

## The Role of Credit Access in Improving Cocoa Production in West African Countries

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### Abstract

This study uses survey data to examine the role of access to credit on cocoa production, in West African cocoa production countries under conditions of agricultural policy liberalization. The study specifies and estimates econometric models to simulate the counterfactual of what cocoa production would be in the absence of credit facilities. The survey results show that about 54% of cocoa farmers have access to credit in Nigeria, and respectively 37% in Cameroon, while in Ghana and Côte d'Ivoire only a few cocoa farmers have access to credit. We find that the cocoa farmer's capacity such as, the cocoa farm size, and the mutuality status of the farmer are more important as a determinants of cocoa farmers access to credit as well as another set of variables like the level of infrastructural development in the village, the lending reputation of the region as more determinant of extent cocoa farmer access to credit. We also find that access to credit by cocoa farmers has a positive spillover effect on cocoa production. The research concludes that there is a need of promoted credit institutions specialized in saving mobilization and credit supply to farmers in general and cocoa farmers specifically. These could include voluntary saving and credit cooperatives, which could pool funds from surplus units for lending to deficit farmers so as to smooth seasonal discrepancies between cocoa farmer income and expenditure.

Keywords: Credit, Cocoa, Farmer, West Africa.

### Introduction

Cocoa is one of the most widely produced agricultural cash crops in the West African countries. It is a vital source of foreign exchange, investment, and economic growth. The cocoa proportion portions of the forest agroecology in Cameroon, Nigeria, Ghana and Cote d'Ivoire now account for over 2 millions tons of cocoa which represents 70% of world supplies. Cocoa production raises over \$2 billion in foreign exchange for the sub region and taxation of the sector generates significant government revenues. With average country yields between 300 and 400kg per hectare (ha), approximately 7 million ha of land is currently in cocoa production in these countries farmed by approximately 2 millions households (Vos et al. 2002; NRI, 2004).

Since the early 1980s, dramatic changes in export commodity markets, and other shocks resulted in a drop in the price of cocoa and other raw material in the world market, the cocoa sub sector had to be reformed with the support of the World Bank and the International Monetary fund. The recommended policy was the retreat of the states from economic life and the

opening up of economic activities to the free play of market forces.

Following the implementation of liberalization policies in West African countries, there has been a decline in the availability of adequate and appropriate rural banking and credit facilities that could help to support future tree crop development such as cocoa (NRI, 2004).

The availability and timely delivery of inputs is probably one of the most effective ways of rising productivity. Access to inputs (e.g. seeds, chemicals and fertilizers) has often become more difficult as input distribution has passed from the public to the private sector and subsidies have been reduced or removed. Shortfalls in input availability have contributed to other on-farm problems, for example, one of the most severe problems faced by cocoa farmers is pest and disease control. Yield losses due to disease are estimated to range between 10% and 80% (Natural Resources Institute, 2004). Chemicals, cultural practices and biological control can all be used to control pest and diseases, but depressed produce prices do not encourage farmers to use inputs or undertake appropriate cultural practices involving

costly labour. Prior to liberalization, many cocoa farmers received free or subsidized pesticides, and many who relied on state-sponsored pest and disease control services have not continued to treat their trees after state systems were withdrawn. This together with other factors, for example limited replanting and lack of access to quality planting material, poor level of technical knowledge and technology transfer, have caused declining yields.

Because of the need for purchased inputs to achieve on-farm yields, and high quality requirements throughout the supply chain to be competitive in world markets, processed product such as cocoa require a great deal of coordination to be produced, processed, and marketed competitively. Unfortunately, the consequent denial of access to affordable credit is probably the major constraint facing the farmers in developing countries in general (Killick, 1999) and specifically, cocoa farmers in West Africa.

It has been a long-held belief among researchers and policymakers that cocoa farmers in West African countries lack adequate access to credit. This lack of adequate access to credit is in turn believed to have significant negative consequences on various aggregate and household level-incomes, including technology adoption, agricultural productivity, and the overall household welfare.

Several studies in the past two decades have substantially increase scientists' understanding of the workings of financial credit institutions in developing countries (Alderman and Paxson, 1992; Besley, 1995; Delgado, 1995; Zeller et al. 1997; Zeller et Sharma, 1998; Diagne and Zeller, 2001). These studies have revealed the complex strategies used by farmers to increase their productive capacity, share risks, and smooth consumption. These strategies generally work through self-enforcing informal contracts among friends, neighbours, and members of extended family, and arranged within networks of informal institutions of diverse natures (Diagne, 1999; Diagne and Zeller, 2001).

These nonmarket informal institutions, the economic rationales of which have long eluded the attention of researchers and policymakers, have often been found to outperform the financial institutions governments have set up to serve rural population. One hypothesis that is often advanced by researchers and policymakers to explain this phenomenon is that government and non government organizations (NGO) supported credit

programs often crowd out the financial services offered by these informal institutions. Hence, understanding how informal credit institutions serve the financial need of cocoa farmers and interact with the cocoa production is important.

Access to credit affects cocoa farmers' outcomes through different pathways. The more prominent is through the alleviation of capital constraints on cocoa production: expenditures on cocoa inputs are incurred during the cocoa husbandry process, whereas returns are received only after the cocoa are harvested and commercialized. Most cocoa farmers show a negative cash flow during the proceeding season. Therefore, to finance the purchase of production inputs, the farmer must either dip into its savings or obtain credit. Access to credit can therefore significantly increase the ability of cocoa farmers with little or no savings to acquire agricultural inputs. Furthermore, easing potential capital constraints through the credit reduces the opportunity costs of capital-intensive assets relative to family labour, thus encouraging the adoption of high-yielding technologies such as Integrated Crop and Pest Management (ICPM) and therefore increasing land and labour productivity, a crucial factor in encouraging development, in particular in many West African cocoa countries. The analysis is based on a data set collected in 2002 and 2003 among cocoa farmer households in Cote d'Ivoire, Ghana, Nigeria and Cameroon.

The paper is organized as follows: section 2 present the methodology of the paper and discusses the conceptual framework between the two regimes of cocoa farmers (those who have access to credit and those who do not have access to credit). Section 3 briefly describes the structure of data collected and used in this paper. Section 4 presents the results of the econometric analysis. Section 5 concludes the paper with some final remarks on the policy implications of the findings of the paper.

### **Methodology**

To allow the most flexible form of interaction between credit and cocoa production activities, we use the methodology performed by de Janvry et al. (2005) by separately considering two cocoa production regimes: households producing cocoa without credit access, regime 0; and households producing cocoa with credit access, regime 1. We start by introducing the notation, used in this section.

Let  $y_{0i}$  be the total production for each individual  $i$  in regime 0. We assume a linear model for its logarithm:

$$\log y_{0i} = E \log y_{0i} + \mu_{0i} = \beta_0 X_i + \gamma_0 \hat{\lambda}_i + \mu_{0i},$$

where  $E \log y_{0i}$  is expected log-production conditional on observed characteristics and regime participation,  $X_i$  are observed characteristics of the farmers/farms,  $\hat{\lambda}_i$  (defined later) is function of observed characteristics and observed regime participation, and  $\mu_{0i}$  accounts for unobserved characteristics. Estimation of this model will give an estimated expected log-production:

$$\hat{E} \log y_{0i} = \hat{\beta}_0 X_i + \hat{\gamma}_0 \hat{\lambda}_i \text{ from which one can derive an estimated expected production } \hat{E} y_{0i} = \exp(\hat{E} \log y_{0i} + 0.5 \hat{\text{var}} \mu_{0i}).$$

Using the estimation results, we also generate a predicted unobserved term  $\hat{\mu}_{0i}$ , and derive the predicted log-production and corresponding production:

$$\log \hat{y}_{0i} = \hat{\beta}_0 X_i + \hat{\gamma}_0 \hat{\lambda}_i + \hat{\mu}_{0i} \text{ and } \hat{y}_{0i} = \exp(\log \hat{y}_{0i}).$$

Similar expressions are defined for cocoa production in regime 1,  $y_{1i}$ .

### **Effect of the credit access on cocoa production and revenue**

To identify the impact of the credit access on cocoa production and revenue, we compare the observed farmer production distribution with a counterfactual production distribution without credit access. We first estimate farmer production equations from observed values; then use the production equations to simulate what farmer production would be if the household produce cocoa without credit; finally we compare the simulated and observed production distributions, and derive the contribution of the credit access to cocoa production.

We are interest in predicting the total production for each individual  $i$  in regime 0,  $y_{0i}$ . For farmer non-having access to credit, this is the observed production; for those who have access to credit, this is the predicted production they would earn if they had not credit facilities. The prediction requires (i) the estimation of the model of cocoa production under regime 0, and (ii) using the estimated conditional mean

and variance of production to generate a counterfactual predicted production  $\hat{y}_{0i}$  for farmer  $i$ .

Estimation for the cocoa production in regime 0 is done with a standard selection model:

$$\begin{cases} P_i^* = \alpha Z_i + \varepsilon_i & P_i = 1 (P_i^* > 0) \\ \log y_{0i} = \beta_0 X_i + \mu_{0i}^*, \text{ observed for } P_i = 0 \end{cases} \quad (1)$$

where  $P_i^*$  is non-observed continuous latent variable and  $P_i$  is an observed binary variable, equal to 1 if the farmer has credit facilities;  $Z_i$  and  $X_i$  are vectors of independent variables of the belonging regime and production equations;  $(\varepsilon_i, \mu_{0i}^*)$  are unobserved terms following a bivariate Normal distribution. This distributional assumption on the unobserved terms implies that, conditional on the belonging regime:

$$\begin{aligned} E(\log y_{0i}|P_i) &= \beta_0 X_i + \gamma_0 \lambda_i, \text{ with} \\ \lambda_i = E(\varepsilon_i|P_i) &= \begin{cases} -\phi(\alpha Z_i)/(1 - \Phi(\alpha Z_i)) & \text{for } P_i = 0. \\ \phi(\alpha Z_i)/\Phi(\alpha Z_i) & \text{for } P_i = 1. \end{cases} \quad (2) \end{aligned}$$

The model is estimated with the two-step Heckman procedure (Heckman, 1979). From the estimated probit equation (1), we compute an estimated value  $\hat{\lambda}_i$  for  $\lambda_i$ , by replacing  $\alpha$  by its estimated value  $\hat{\alpha}$  in equation (2). The log-production in regime 0 is then estimated on the group  $P_i = 0$ :

$$\log y_{0i} = \beta_0 X_i + \gamma_0 \hat{\lambda}_i + \mu_{0i}, \quad (3)$$

with  $E(\mu_{0i}|P_i) = 0$ ,  $\text{var}(\mu_{0i}|P_i) = \sigma_0^2$ . For this sub-sample of observations,  $y_{0i}$  is total farmer production (equal to  $y_i$ ).

Using estimated parameters, we can now predict individual log-production,  $\log \hat{y}_{0i}$ , for all farmers  $i$ .

Equation (3) includes two terms: a conditional expected value,  $E \log y_{0i} = \beta_0 X_i + \gamma_0 \hat{\lambda}_i$ , based on the observable variables and characteristics of the farmer, and unobserved term  $\mu_{0i}$ . a prediction of the conditional expected value of farmer log-production in regime 0 is given by:

$$\hat{E} \log y_{0i} = \hat{\beta}_0 X_i + \hat{\gamma}_0 \hat{\lambda}_i.$$

To generate unobserved terms for group in regime 1, we construct a random value:

$$\hat{\mu}_{0i} = \hat{\sigma}_0 \Phi^{-1}(r)$$

where  $\hat{\sigma}_0$  is the estimated standard error of  $\mu_{0i}$  for the group in regime 0,  $r$  stands for a random number between 0 and 1, and  $\Phi^{-1}$  is the inverse of the cumulative probability function of the standard normal distribution. For the non access to credit farmers, we use the observed residual.

Combining these two terms gives a predicted log-production in regime 0 for all farmers:

$$\log \hat{y}_{0i} = \begin{cases} \log y_i = \hat{\beta}_0 X_i + \hat{\gamma}_0 \hat{\lambda}_i & \text{for } P_i = 0 \\ \hat{\beta}_0 X_i + \hat{\gamma}_0 \hat{\lambda}_i + \hat{\mu}_{0i} & \text{for } P_i = 1 \end{cases} \quad (4)$$

and the corresponding predicted production  $\hat{y}_{0i} = \exp(\log \hat{y}_{0i})$  in regime 0.

In particular, we are interested in assessing whether the farmers that had credit facilities would be better or worse farmers without credit; whether having credit facilities enhance or reduce farmer production; and finally whether the farmers that have credit facilities are those that benefit the most from credit. To answer these questions, we use the expected farmer production in each regime estimated for each farmer.

This method requires an estimation of the expected log-production from farming in each regime ( $\hat{E} \log y_1^a, \hat{E} \log y_0^a$ ) for the two population groups. The predicted of the expected log-production from farming  $\hat{E} \log y_0^a$  in regime 0 was done, since in that regime the total production is:

$$\hat{E} \log y_{0i}^a = \hat{E} \log y_{0i} = \hat{\beta}_0 X_i + \hat{\gamma}_0 \hat{\lambda}_i. \quad (5)$$

Similarly, we estimate an equation for the log-production from farming for the group of farmers in regime 1:

$$\hat{E} \log y_{1i}^a = \beta_1 X_i + \gamma_1 \hat{\lambda}_i + \mu_{1i} \quad (6)$$

from which we can derive the expected log-production from farming in regime 1:

$$\hat{E} \log y_{1i}^a = \hat{\beta}_1 X_i + \hat{\gamma}_1 \hat{\lambda}_i. \quad (7)$$

Using equations (5) and (7) and the estimated variance of  $\mu_{0i}$  and  $\mu_{1i}$ , and the method described previously, we can predict the counterfactual expected cocoa

production of the farmers that have credit facilities based on regime 0,  $\hat{E} y_0^a |_{P=1}$ , and the expected cocoa production of the farmer that haven't credit facilities based on regime 1,  $\hat{E} y_1^a |_{P=0}$ . This allows some interesting comparisons:

a. The difference in expected cocoa production within regime 0 is measured by the difference between the average observed cocoa production  $E y_0^a |_{P=0}$  of the farmers without credit facilities with the average predicted expected cocoa production  $\hat{E} y_0^a |_{P=1}$  for credit facilities' farmers.

b. The impact of credit facilities on cocoa production is obtained by comparing the average observed production  $E y_0^a |_{P=0}$  with the average predicted expected production from farming  $\hat{E} y_1^a |_{P=0}$ , also a measure of the average predicted production  $\hat{y}_1^a |_{P=0}$ , for non-credit facilities' farmers, and similarly by comparing average of  $y_1^a |_{P=1}$  and  $\hat{E} y_0^a |_{P=1}$  credit facilities' farmers.

#### Data

The present study will be based on data collected by the International Institute of Tropical Agriculture (IITA) in 2002 in Côte d'Ivoire, Ghana, Nigeria and Cameroon.

A baseline survey of major cocoa growing regions of West and Central Africa was conducted to provide base parameters of cocoa based systems in the sub-region. In all of the countries indicated, villages and clusters of households were randomly selected and household heads interviewed using structured questionnaires. In Nigeria, 1083 households were visited in 35 villages and towns of Ondo State, which accounts for 40 to 50 percent of annual production in Nigeria. In Cameroon, 1003 households in 83 villages in the Southwest, Center and South Provinces were visited with production from these sites accounting for over 80 percent of national production. In Ghana, the surveys were conducted with 1000 households from 85 villages in the Brong Ahafo, Ashanti, Eastern and Western regions which together account for approximately 90% of national production. In Cote d'Ivoire, a list of farmers obtained from a national

census of cocoa and coffee producers conducted in 1998 allowed the opportunity of selecting households using a random number procedure. 1372 households from 20 sub-division and 134 villages, hamlets and cocoa “camps” across the cocoa belt of Cote d’Ivoire were interviewed.

**Table 1.** Number of villages and farmers surveyed

	Villages	Farmers
Cote d’Ivoire	134	1372
Ghana	85	1000
Nigeria	35	1083
Cameroon	83	1003
Total	337	4458

The main objective of this survey was to understand the general constraints and opportunities of cocoa based systems in the humid forest zone of West and Central Africa, in view to increase the productivity of agricultural land and labor employed by asset-poor households, and thus contribute to alleviation of rural poverty.

Conducted in close consultation with research collaborators in Cameroon, Côte d’Ivoire, Ghana, and Nigeria, data were collected with a questionnaire that was made of six parts:

- Agricultural systems and rural livelihoods (demographics, other enterprise, farm size, capital inventory)
- Rural service provision (input markets, credit markets, market and production information, rural organization)
- Tree stocks by age, replanting, uprooting and new planting
- Agronomic practices and output by plot
- Labour practices
- Post harvest practices and cocoa marketing

#### *Specification of the credit access and production equation*

Two major categories of factors determine a farmer’s liability to have credit facility: first, the factors that affect the relative return of cocoa production; and second, the factors that determine the capacity of the cocoa farmer to negotiate a credit. We can assume that these two set of factors are determined by cocoa farmer’s endowment in physical and human capital and by environment where it is located. In the credit

access equation, we introduce the following independent variables:

- The cocoa land area operated by the farmer. For the cocoa farmer, land is the main form of physical capital.
- The average number of years of schooling of cocoa farmers. Many researchers have shown that farmers with higher education level are more likely to negotiate extra income for agricultural activities (de Janvry *et al.*, 2005).
- The gender of the farmer
- The average yield per hectare.
- The distance of the plot from the main access road.
- The social capital variable measuring if the cocoa farmer is a member of a cocoa farmer organization.

For the production equation, the following variables have been introduced: (i) the number of worker in the cocoa farm, (ii) the productive cocoa area, (iii) the amount of expenditure on pesticides, (iv) the average age of the cocoa farm.

Table 2 presents descriptive statistics from the sample of cocoa farmers. Average cocoa production in the sample was 1453.8kg, or 247.67kg/ha in Cameroon and, 1770kg, or 375 kg/ha in Nigeria. Cocoa farmers that have access to credit in Cameroon significantly have a higher level of production (2307.5 kg or 325.50 kg/ha) than those that do not have access to credit (950kg or 184.5 kg/ha). In Nigeria, the same observation can be made where farmers with credit facilities exhibit a higher level of production (2088.2 kg or 429.67 kg/ha) than their counterparts that do not have access to credit (1406.7 kg or 307.14 kg/ha).

The lower part of table 2 summarizes farmer characteristics. The difference between the two groups is significant in term of human resources, the average number of workers that have access to credit is 5.76 in Cameroon and, 3.29 in Nigeria, higher than that of farmers that do not have access to credit (3.59 and 2.70 in Cameroon and Nigeria respectively).

Also, the average expenditure amount in pesticides (US\$ 343.9 in Cameroon and, US\$ 175.08 in Nigeria) is higher than that of the latter (US\$ 100.9 and US\$ 132.77). In terms of community organization, cocoa farmers that have access to credit are on average more members in farmer organization (39% in Cameroon and, 29 % in Nigeria) than cocoa farmers that do not have access to credit (37% and 19%). However, about the location from the town, the situation is opposite.

**Table 2.** Descriptive statistics

	Cameroon				Nigeria			
	All farmers	Non access to credit	Access to credit	Difference	All farmers	Non access to credit	Access to credit	difference
Total cocoa production (kg)	1453.8	950.2	2307.5	1358*** (9.698)	1770	1406.7	2088.2	681.5*** (4.39)
Total cocoa farm size (ha)	5.87	5.15	7.089	1.94*** (3.69)	4.72	4.58	4.86	0.28 (0.28)
Number of workers (man/day)	4.40	3.59	5.76	2.17*** (6.55)	3.01	2.7	3.28	0.58*** (4.29)
Total expenditure on pesticides used (US\$)	191.19	100.9	343.9	243*** (7.25)	155.3	132.77	175.08	42.31*** (3.91)
Age of the farms (years)	30.24	34.78	22.56	-12.22*** (-10.36)	24.55	24.89	24.26	-0.63 (-0.91)
Age of the farmer (years)	50	51	50	-1 (-0.91)	56	55	56	1 (0.67)
Gender of the farmer (% of men)	97	97	98	1 (0.67)	89	0.9	0.88	-0.02 (-0.86)
Rural organization (%)	37.8	37	39	2 (0.61)	24.11	19	29	8*** (3.67)
Number of years of education	7.58	7.8	7.2	-0.68** (2.475)	1.59	1.65	1.52	-0.13 (-0.96)
Distance between the household and the major urban market centre (km)	18.73	15.05	24.97	9.92*** (7.18)	2.85	2.08	3.52	1.44** (5.68)

t-statistics are in brackets. \*\*\* significant at 1%; \*\* significant at 5%

Cocoa farmers that do not have access to credit are relatively closer to the town (15.05 km in Cameroon and, 2.08 km in Nigeria) than those that have access to credit (24.97 km and 3.52 km). In summary, cocoa farmers acceding to credit are richer in work force, have higher cocoa farms, and invest in pesticides expenditures.

### Results and Discussion

The results of our analysis are presented in two parts. First, we estimate the credit access and production equations. These two equations allow us to (1) identify the determinants of credit access and estimate the cocoa production equation, and (2) simulate the production given the credit status of the cocoa farmer. Second, we compare the level of production between the two groups of farmers.

#### *Estimation of the credit and production equations*

The model used three sets of regressors. The first set includes farmer characteristics: (1) farmer ability as proxied by age of the farmer; education of the farmer measured as number of years of schooling, the gender

of the farmer, and (2) farmer's capacity as proxied by the size of the Cocoa area operated by the farmer; the age of the cocoa farms; the social capital as proxied by the farmer organization. The second set, information variables such as the lending reputation of the region as proxied by the regional dummy variables. Finally, there are other exogenous variables depicting, for example the level of infrastructural development in the village. The former variable is a distance indicating the distance of the village from major urban marketing centres. The estimates for the credit access equation, using the Probit model are reported in table 2, in all countries case several regression were run, but only the most statistically sound one is presented and discussed here, and some regressors were dropped for statistical problems as the case of regional variable in Nigeria. The Chi-square statistic was significant in all regressions, indicating that the models are good. Results show that in Cameroon, the cocoa area operated by the farmer and the lending reputation of the region contribute significantly to the accessibility of credit.

**Table 3.** Estimation of the credit access equation (Probit)

Endogenous variable=1 if the farmer has credit facilities	Cameroon	Nigeria
Constant term	-0.740 (-0.851)	-0.818 (-1.242)
Number of years of education	-0.002 (-0.268)	-0.011 (-0.184)
Cocoa area operated by the farmer	0.184*** (2.673)	0.011 (0.224)
Age of the cocoa farm	0.074 (0.896)	-0.044 (-0.538)
Age of the farmer	-0.137 (-0.709)	0.199 (1.168)
Gender of the farmer	-0.511 (-1.559)	-0.044 (-0.332)
Farmer organization	-0.022 (0.539)	0.339*** (3.440)
Distance	1.935*** (12.636)	0.242*** (5.863)
<i>Regional variable</i>		
South west	0.299 (1.590)	
Mbam	-0.238 (-1.179)	
Lekie		
Chi-square	$\chi^2(9)=382.144$	$\chi^2(8)=55.109$
Percentage of correct prediction	83%	60%
Sample	824	1041

t-statistics are in brackets. \*\*\* significant at 1%; \*\* significant at 5%; \* significant at 10%

This suggests that if households have the capacity to farm cocoa, then the existence of the credit opportunities will raise their loan demand. This positive effect can be attributed to the fact that seasonal agricultural loans come as input packages. In Nigeria, accessibility to credit is positively and significantly responsive to the social capital variable (farmer organization) and the level of infrastructural development in the region, suggesting that both farmer-specific variables and the general level of infrastructural development in the locality are more important determinants of access to credit in Nigeria. Finally, as the regression results show the gender of the farmer, educational level, and age have no significant effect on access to credit. Table 4 shows the estimates of the production equations in each of the two regimes. Except the variable labour in Cameroon, the coefficients of the main exogenous variables have the expected signs. It appears that cocoa farm size, the expenses in pesticide use and some regional variables significantly increase cocoa farmer production in Cameroon and Nigeria, whereas the number of workers significantly increases the cocoa production in Nigeria in the two regimes. It effect is only positive and significant in regime 1 in Cameroon.

The Inverse Mills Ratio (IMR) reflects the correlation between the unobserved terms in the credit and production equations. In table 4, the coefficients of the IMR are negative in general. Since the selection criterion is 'access to credit', the IMR is negative in regime 0 for the cocoa farmer without credit facilities

and positive for the cocoa farmer with credit facilities. The selection effect thus implies that, conditional on observed characteristics, cocoa farmers that have not access to credit have a higher farm production than an average farmer would have in their regime. In other words, there is positive selection in the decision to produce cocoa without credit facilities. By contrast, for cocoa framers that have access to credit, the negative effect of the IMR suggests that these farmers have a lower farm production than their counterparts would if they were in this regime.

The results of this regression are used to predict what the cocoa production of farmers that have access to credit would if they produce cocoa without credit facilities.

#### *Cocoa farm production difference between two groups of farmers.*

Following the methodology presented in section 3.2, we can predict for each farmer with access to credit the cocoa production obtained in regime 0; we can also predict for each farmer without access to credit the cocoa production it would obtained in regime 1. Table 4 shows the results. Comparisons of observed farm cocoa production with their counterfactuals in the other regime allow us to derive two conclusions. The first is that the cocoa production of farmers that have access to credit, had they stayed in the opposite side (2029.47 kg in Cameroon and; 1256.59 kg in Nigeria), would be much more than that of cocoa farmers without credit facilities (950.16 kg) in Cameroon and; less (1406.72kg) in Nigeria. Hence, the farmers that produce cocoa with credit facilities are the best

farmers in Cameroon, and their cocoa production premium is respectively 114% in Cameroon and; -11% in Nigeria. This is also true if they produce cocoa without credit. Implying 123% and, -3% premium in Cameroon and Nigeria respectively.

The second conclusion is that access to credit in cocoa production creates spillover effects on cocoa production. For those who have access to credit, spillovers raise cocoa production from 2029.47 kg to 2307.92 kg in Cameroon and; from 1256.59 kg to 2088.15 kg in Nigeria, a 14 and 40% production gains respectively. If farmers that produce cocoa without access to credit were to benefit in credit facilities, their cocoa production would increase by 9% and 53% in Cameroon and Nigeria respectively, from 950.16kg to 1036.17kg in Cameroon and, 2153.41kg to 1406.72 kg in Nigeria. Hence, access to credit help raise total factor productivity in cocoa production, expectedly by helping relax the constraints on cocoa farming imposed by the pervasive credit and market failures that characterize less developed countries such as Cameroon and Nigeria.

### **Conclusion**

Understanding the socioeconomic factors influencing cocoa farmer access to credit, and how the latter interacts with and affects cocoa production can help in the design of credit programs targeted to the rural household in general and cocoa farmers in particular. This paper used survey data from West African cocoa production countries to examine the role of access to credit in improving cocoa production and then revenue in the study area. There are several conclusions drawn from the analysis.

Our study shows that about 54% of cocoa farmers have access to credit in Nigeria, and 37% in Cameroon, while in Ghana and Côte d'Ivoire, only a few cocoa farmers have access to credit.

Second, we find that the cocoa farmer's capacity such as, the cocoa farm size, and the mutuality status of the farmer are more important as a determinant of cocoa farmers access to credit. We also find that another set of variables such as the level of infrastructural development in the village, the lending reputation of the region as more determinant of extent cocoa farmer access to credit.

Third, we find that access to credit by cocoa farmers has a positive spillover effect on cocoa production. In

West African cocoa countries, the rural credit and insurance markets are seriously deficient. As a consequence, the conflict between cash shortage and cocoa agricultural investment, and between risk-taking and aversion to risk, must be generally solved internally to the household through the strategic use of their own resources. Without doubt, access to credit in cocoa production is a smart alternative in overcoming the major cocoa production constraints. Credit obtained by cocoa farmers helps enhance the investment capacity in cocoa production activities.

An important policy implication of this study concerns the promotion of credit institutions specializing in saving mobilization and credit supply to farmers in general and cocoa farmers specifically. Given the evidence that agriculture as a whole could be net lender, there appears to be a necessity as well as a scope for the promotion of appropriate financial intermediaries. These could include voluntary saving and credit cooperatives, which could pool funds from surplus units for lending to deficit farmers so as to smooth seasonal discrepancies between cocoa farmer income and expenditure. However, considering that the necessary complementary resources and economic environment are not yet in place for access to credit for cocoa countries farmers, and considering the fact that formation of sustainable rural financial institutions is such a difficult task in West African countries rural economies, our study recommend a cautious and gradual strategy for expansion of the rural financial institutions. This strategy will require direct support by government, donors, and NGOs, through an adequate legal and regulatory framework, of institutional innovations and pilot programs such as the Sustainable Tree Crops Program (STCP) in cocoa production areas that may have the potential to reduce costs in providing savings, credit, and insurance services to the rural clientele. This will probably contribute to support government and private efforts to improve the access of cocoa farmers to best production practices and their capacity of professional enterprises for the marketing, and production

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**Table 4.** Estimation of the farm production equation (Probit with the two-step Heckman procedure)

	Cameroon N=824		Nigeria N=1041	
	Regime		Regime	
	0	1	0	1
Constant term	4.42*** (20.25)	4.84*** (3.59)	4.77*** (16.1)	4.81*** (18.8)
Cocoa area operated by the farmer	0.38*** (6.26)	0.32*** (3.68)	0.33*** (7.08)	0.35*** (7.56)
Age of the cocoa farm	0.03 (0.48)	-0.03 (-0.49)	0.10 (1.57)	0.08 (1.29)
Pesticides	0.29*** (11.31)	0.29*** (8.80)	0.29*** (7.88)	0.35*** (10.1)
Labour	-0.00 (-0.24)	0.41*** (6.15)	0.26*** (4.89)	0.26*** (5.01)
Inverse Mills Ratio	0.14 (0.21)	-0.10 (-0.15)	-0.03 (-0.16)	-0.34* (-1.8)
<i>Regional variable</i>				
South west	0.89 (1.29)	0.22 (0.25)		
Mbam	0.56*** (4.67)	0.11 (0.44)		
Lekie	0.36*** (3.88)	0.11 (0.38)		
Idanre/Owena			-	-
Akure/Owo			-0.29*** (-3.44)	0.03 (0.32)
Ile-Oluji/Ondo/Ijesha			-0.25*** (-3.09)	-0.26** (-3.21)
<b>R<sup>2</sup></b>	0.49	0.42	0.42	0.46
Number of observations	518	306	486	555

t-statistics are in brackets. \*\*\* significant at 1%; \*\* significant at 5%; \* significant at 10%.

Table 5. Average farm production of the two groups of cocoa farmers in each regime

Country	Regime	REGION	Cocoa farmers without credit facilities	Cocoa farmers with credit facilities	
			$\overline{(Y_0^\alpha  _{P=0}, \text{observed production in kg})}$	$\overline{(Y_0^\alpha  _{P=1}, \text{simulated production in kg})}$	
Cameroon	Regime 0	Lekie	723.26	860.62	
		Mbam	1008.33	1305.50	
		South	563.46	718.94	
		South West	2216.83	2269.50	
		Total	950.16	2029.47	
		REGION			
	Regime 1	REGION	$\overline{(Y_1^\alpha  _{P=0}, \text{simulated production in kg})}$	$\overline{(Y_1^\alpha  _{P=1}, \text{observed production in kg})}$	
		Lekie	730.78	718.11	
		Mbam	868.00	1068.33	
		South	710.42	1010.81	
		South West	2501.72	2598.52	
		Total	1036.17	2307.92	
	Nigeria	Regime 0	REGION	Cocoa farmers without credit facilities	Cocoa farmers with credit facilities
				$\overline{(Y_0^\alpha  _{P=0}, \text{observed production in kg})}$	$\overline{(Y_0^\alpha  _{P=1}, \text{simulated production in kg})}$
Idanre/Owena			2016.75	1513.18	
Akure/Owo			1007.18	898.83	
Ile-Oluji/Ondo/Ijesha			1121.88	1021.05	
Total		1406.72	1256.59		
Regime 1		REGION	$\overline{(Y_1^\alpha  _{P=0}, \text{simulated production in kg})}$	$\overline{(Y_1^\alpha  _{P=1}, \text{observed production in kg})}$	
		Idanre/Owena	2702.60	2443.51	
		Akure/Owo	1931.12	1947.30	
		Ile-Oluji/Ondo/Ijesha	1793.33	1434.45	
		Total	2153.41	2088.15	