

## DETERMINANTS OF DOMESTIC SUPPLY OF COCOA IN NIGERIA (1980-2019)

**BUSARI Ahmed Olugbenga<sup>1</sup>**

**AGBOOLA Timothy Olusola<sup>2</sup>**

**AKINTUNDE Olaide Kamila<sup>3\*</sup>**

**JIMOH Lateef Olatunbosun<sup>4</sup>**

**SALAM Kabir Olaide<sup>5</sup>**

<sup>1,2,3,4,5</sup>Osun State University, Osun State University, P.M.B. 4494, Ejigbo Campus, Osun State, Nigeria

\*Corresponding Email: hamed.busari@uniosun.edu.ng

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### ABSTRACT

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This study examined the factors influencing the domestic supply of cocoa in Nigeria. Time series data covering the period between 1980 and 2017 were used in the study. Data on the domestic supply of cocoa, domestic and international prices of cocoa, volume of cocoa exports, exchange rate, inflation rate, and agricultural gross domestic product (agGDP) were obtained from reputable secondary sources such as the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS) and Food and Agriculture Organization Statistical databases (FAOSTAT). Data were analysed using Augmented Dickey-Fuller statistics, Johansen's co-integration test, descriptive statistics, trend model, and error correction models at a level of significance  $\alpha = 0.05$ . There was a high fluctuation in the trend of the domestic supply of cocoa over the study period. The average annual percentage change in the domestic supply of cocoa was 8.092 percent. The coefficients of variation revealed a high degree of instability in the domestic supply of cocoa, ranging from a low of 11.510 percent in the 2010-2017 sub-period to the highest of 122.340 percent in the 2000-2009 sub-period. The producer price of cocoa steadily decreases over the study period. The average producer price of cocoa over the study period was ₦1935.80 per tonne. The average annual percentage change in producer price of cocoa over the study period is 4.900 percent. The coefficient of variation ranged from a low 25.130 percent in the 2000-2009 sub-period to the highest 130.370 percent in the 1990-1999 sub-period, showing high instability in the producer price of cocoa over the study period. The contribution of cocoa to agricultural exports is unstable over the study period. The average percentage contribution of cocoa to agricultural export over the study period was 84.300 percent. The results of error correction analysis revealed that the domestic supply of cocoa is negatively influenced by interest rate, inflation rate, and producer price of cocoa. Thus, it can be concluded that cocoa is a significant agricultural export commodity, but there is a need to pay significant policy attention to these macroeconomic variables for an increased domestic supply of cocoa.

**Keywords:** Agricultural exports, Producer price, Agricultural gross domestic product

## INTRODUCTION

Cocoa, a perennial tree crop is widely cultivated in tropical climates across the globe. The crop was initially introduced into the country in 1974 and has since become a major source of agricultural export earnings in Nigeria. However, over 66 percent of cocoa production in the West Africa sub-region is undertaken by smallholder farmers with scattered cocoa farms (Oyedele, 2007; Owoeye and Sekumade, 2016). In the 90s, Nigeria produces 12 percent of the global cocoa production, ranking third behind Cote de Voire and Ghana which is responsible for 35 percent and 13 percent of the global production respectively (Wilcox and Abbot, 2004 and Owoeye and Sekumade, 2016). According to Erelu (2008), in the early 2000s, cocoa production reached a production capacity of about 385,000 metric tonnes per year, with an increase of 215,000 metric tonnes from the year 2000 production level, ranking the country the fourth highest in global production of cocoa behind Cote de Voire, Indonesia and Ghana, giving the country a high comparative advantage in the production of this agricultural export commodity.

However, cocoa production in Nigeria suffered a serious decline in the latter part of the year the 2000s, with a significant fall in the country's production capacity. This can be attributed to myriads of problems; aging farms, low yield, inconsistent production patterns, disease incidence, pest attacks, and use of simple farm tools (Oluyole and Sanusi, 2009 and Owoeye and Sekumade, 2016).

In Nigeria, cocoa is usually cultivated on small scale from fragmented farm holdings, with an average production of roughly 300kg per hectare of cocoa per farmer per season. In terms of production capacity, Ondo State is ranked as the largest cocoa producing state in Nigeria (Oluyole, 2005; Nwachukwu et al, 2010; Afolayan, 2020). Before the discovery oil and its boom era in Nigeria, cocoa, cotton, groundnut, oil palm products and rubber were the major agricultural export crops. However, only cocoa remained of significance in terms of agricultural export after 1975. The federal government of Nigeria through the assistance from the World Bank, restored cocoa production in the late 1970s and 1980s through replanting programs and producer price supports (Nwachukwu et al, 2010 and Afolayan 2020). Although the failure of the marketing boards in the 1990s was disappointing, it facilitated the liberalization of the cocoa market. Nigeria became the first West Africa Cocoa Producer to liberalize (in 1996), with reforms from producer and input level through the marketing chain to exporting the beans (Wilcox and Abbot, 2004 and Nwachukwu et al, 2010).

Cocoa was a major foreign exchange earner for Nigeria in the 1950s and 1960s and in 1970s. The country was the second largest producer in the world, but with country's massive investments in the oil sector in the 1970s and 1980s, Nigeria's share of world output of cocoa declined. In 2010, Cocoa production accounted for only 0.3% of agricultural gross domestic product (agGDP). Average cocoa beans production in Nigeria between 2000 and 2010 was estimated at 389,272 tonnes per year rising from 170,000 tonnes produced in 1999 (Oyedele, 2007 and Afolayan, 2020).

Historically Nigeria's cocoa production was marketed through a monopsony by

marketing boards created by the government. In the 1980s the World Bank and the International Monetary Fund advised Nigeria to liberalize the sector because the marketing boards were ineffective. In 1986, Nigeria dissolved the marketing boards and liberalized cocoa marketing and trade. However, this reform has not yielded the anticipated results, as cocoa production has become stagnant. Currently, farmers sell their products indirectly through a cooperative or a licensed buying agent who in turn sells them to exporting firms (Nkang et al, 2006 and Afolayan, 2020).

The continuous fall in crude oil prices in the world market signifies impending doom for the Nigerian economy. There is thus an urgent need to forestall this situation. This can be achieved through the diversification of the foreign exchange earnings base of the country away from crude oil exportation. Agricultural exports provide a viable option in this regard. Agricultural export commodities such as cocoa, rubber, palm oil, cotton, and groundnut, which accounted for about 90 percent of the total exports and 70 percent of government revenue in the 1960s have suffered a serious decline. (Olomola et al; 1993, Akanji, 1992; MAFAP, 2013). However, the potential of these crops for domestic industrial use as well as for generating higher export earnings has been expanding while the supply has continued to decline. (Oni, 2000).

In spite of a clear direction in agricultural strategy in Nigeria, the agricultural export sector has manifested a slow growth rate of output, and expansion in output is achieved through the expansion of area under cultivation. The root of the problem was that while oil export was growing, non-oil exports were ignored making the power of oil exports more pervading (Osuntogun et al, 1998). This aggravated the transformation of Nigeria from a net exporter of agricultural products to a large-scale importer of food commodities which was particularly marked during the period from 1973 to 1982 (Oyejide, 1986; Afolayan, 2020).

Gbetnkom and Khan (2002) identified two factors affecting the production and export supply of agricultural commodities in developing countries; the micro (internal factors) such as domestic agricultural policies, domestic prices, interest rate, and inflation rate, and the macro (external factors) such as slow volume of growth of world primary commodity markets, international prices, exchange rate and deteriorating terms of trade.

There is thus, the need to examine the determinants of the domestic supply of cocoa; one of the major agricultural export commodities in Nigeria. This study examined determinants of the domestic supply of cocoa in Nigeria. Specifically, the objectives of the study are to examine the trend in the domestic supply of cocoa, domestic and international prices of cocoa, the contribution of cocoa to Nigeria's agricultural exports, and determine the factors influencing the domestic supply of cocoa in Nigeria

## **METHODOLOGY**

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### **Study area**

The study area is Nigeria. Nigeria, a republic in western Africa, with a coast along the

Atlantic Ocean on the Gulf of Guinea Nigeria is by far the most populated of Africa's countries, with more than one-seventh of the continent's people. The people belong to many different ethnic groups.

Nigeria lies between 40 and 140 North of the equator and between longitudes 30 and 150 east of Greenwich. Nigeria has a total land area of 923,768.622 km or about 98.3 million hectares, and population of 149,229,090140 million people (National Population Commission (NPC), 2009). At its greatest expanse, it measures about 1,200 km (about 750 mi) from east to west and about 1,050 km (about 650 mi) from north to south. Nigeria has a highly diversified agroecological condition, which makes possible the production of a wide range of agricultural products.

### Source of Data and Method of Data Collection

This study utilised secondary data for empirical analysis. These data were obtained from statistical publications of relevant agencies such as the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS) domestic supply of cocoa, domestic and international prices of cocoa, the volume of cocoa exports, exchange rate, inflation rate and agricultural gross domestic product (agGDP). The analysis covered the period between 1980 and 2019.

### Analytical Technique

The study applied appropriate analytical methods to each objective of the study. These include; means, standard deviation, coefficients of variation, percentages, and average growth rate. These were used to describe trends in the domestic supply of cocoa, domestic and international prices, and volume of agricultural exports.

The Augmented Dickey-Fuller statistics were used to examine the stationarity of time series data. Johansen's method was used to verify the co-integration among the variables of the model. The error correction mechanism (ECM) was used to isolate the determinants of the domestic supply of cocoa in Nigeria.

The empirical model employed in the study is given as:

$$\text{DOMSUP} = f(\text{EXRATE}, \text{INTRATE}, \text{INFRATE}, \text{PP}, \text{AGDP} \text{ and } \text{ECMt})$$

Where

DOMSUP is the domestic supply of cocoa (tonnes)

EXRATE is the exchange rate in terms of units of foreign currencies (₦/United States Dollar).

INTRATE is the interest rate in the economy (percentage)

INFRATE is the inflation rate in the economy (percentage)

PP is the producer price of cocoa in (United States Dollars)

AGDP is agricultural gross domestic product (agGDP) in billions of naira

ECMt is the error correction factor.

### Apriori Expectation

Improved exchange rate (EXCRATE) is expected to cause an increase in the domestic supply of cocoa (DOMSUP)

Similarly, the increased producer price of cocoa (PP) and the value of the agricultural gross domestic product (agGDP) are expected to stimulate an increased domestic supply of cocoa (DOMSUP).

However, the increased interest rate in the economy (INTRATE) and inflation rate in the economy (INFRATE) is expected to decrease the domestic supply of cocoa (DOMSUP).

## RESULTS AND DISCUSSION

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### Trends in domestic supply of cocoa (tonnes) in Nigeria (1980-2019)

As shown in Table 1 Figure 1, the average domestic supply of cocoa steadily increase from 175.080 tonnes in the 1980-1989 sub-period to 385.410 tonnes in the 2000-2009 sub-period and decreases to 279.842 tonnes in the 2010-2019 sub-period. The average domestic supply of cocoa ranged from a low of 175.080 tonnes in the 1980-1989 sub-period and highest of 385.410 tonnes in the 2000-2009 sub-period. The average domestic supply of cocoa over the study period was 296.716 tonnes. The intra-sub-period annual percentage change in domestic supply of cocoa was +2.881 percent, +7.328 percent, +8.738 percent, and +11.801 percent per year in the 1980-1989 sub-period, 1990-1999 sub-period, 2000-2009 sub-period, and 2010-2019 sub-period respectively. The annual percentage change range from the highest 11.801 percent in cocoa supply in the 2010-2019 sub-period to the lowest of 2.881 percent in cocoa supply was recorded in the 1980-1989 sub-period as it range across sub-period following the Structural Adjustment Programme (SAP) era. The average annual percentage change of cocoa supply over the study period was 8.902 percent.

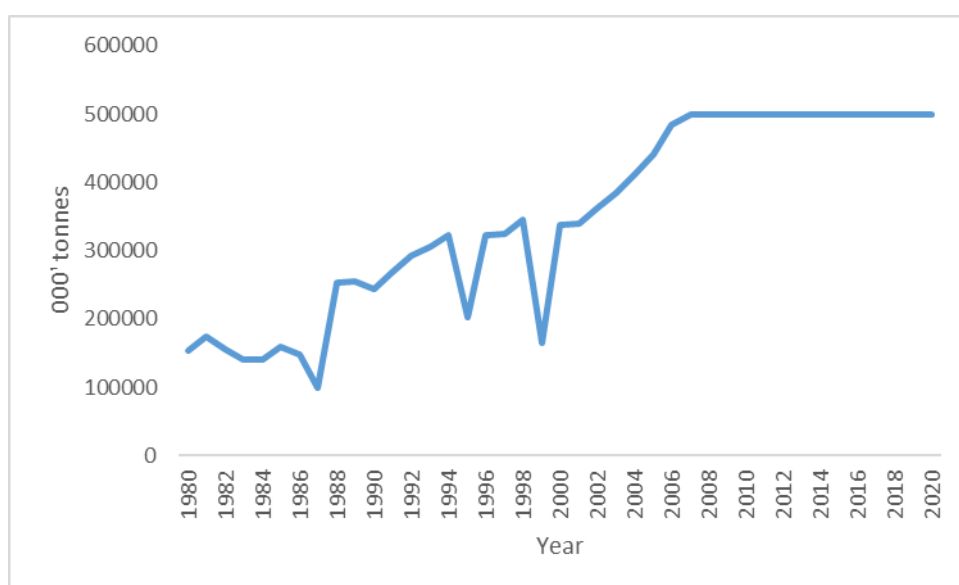
The coefficient of variation in the domestic supply of cocoa as it ranges from 24.450 percent in the 1980-1989 sub-period to 11.510 percent in the 2010 -2019 sub-period. The average coefficient of variation over the study period was 31.4309 percent; this shows a high degree of instability in the domestic supply of cocoa in Nigeria. The trend in the coefficients of variation shows high instability in the domestic supply of cocoa.

These results can be attributed to the fact that the production of cocoa in Nigeria has suffered a reduction in recent years owing to a series of factors. Some of these factors are low yield, inconsistent production patterns, disease incidence, pest attacks, and aging cocoa trees (Villalobos, 1989; Oluyole and Sanusi, 2009, Afolayan, 2020).

**Table 1: Trends in domestic supply of cocoa (tonnes) in Nigeria (1980-2019)**

Sub-period	Average quantity (tonnes) per annum	Annual change	Percent of variation
1980-89	175.080	2.881	24.450
1990-99	287.200	7.328	17.960
2000-09	385.410	8.738	122.340
2010-19	279.842	11.801	11.510
<b>All Period</b>	<b>296.719</b>	<b>8.092</b>	<b>31.430</b>

Source: Computed from CBN and FAOSTAT, 2021



**Fig 1: Trend in Domestic Supply of Cocoa in Nigeria (1980-2019)**

**Trends in producer price of cocoa in Nigeria (1980-2019)**

As shown in Table 1 and Figure 2, the average producer price of cocoa decreases from ₦4050, 000 per tonne in the 1980-1989 sub-period to ₦586,190 per tonne in the 2010-2019 sub-period. The average producer price of cocoa ranged from the highest of ₦4050, 000 per tonne in the 1980-1989 sub-period and a low of ₦586,190 per tonne in the 2010-2019 sub-period. The average producer price of cocoa over the study period was ₦1935, 80 per tonne. The intra-sub-period annual percentage change in producer price of cocoa was -19.300 percent, 15.700 percent, +6.710 percent, and +13.65 percent per year in the 1980-1989 sub-period, 1990-1999 sub-period, 2000-2009 sub-period,

and 2010-2019 sub-period respectively. The annual percentage change in the producer price range from the highest of 15.700 percent in the 1990-1999 sub-period and a low of -19.300 percent in the 1980-1989 sub-period was recorded. The average annual growth rate of the producer price of cocoa over the study period was 4.900 percent.

There is high instability in the coefficient of variation of producer price of cocoa across sub-period, the coefficient of variation in producer price range from low 25.130 percent in the 2000-2009 sub-period to highest (130.370%) in the 1990-1999 sub-period. The average coefficient of variation in the producer price of cocoa over the period of the study was 136.640 percent.

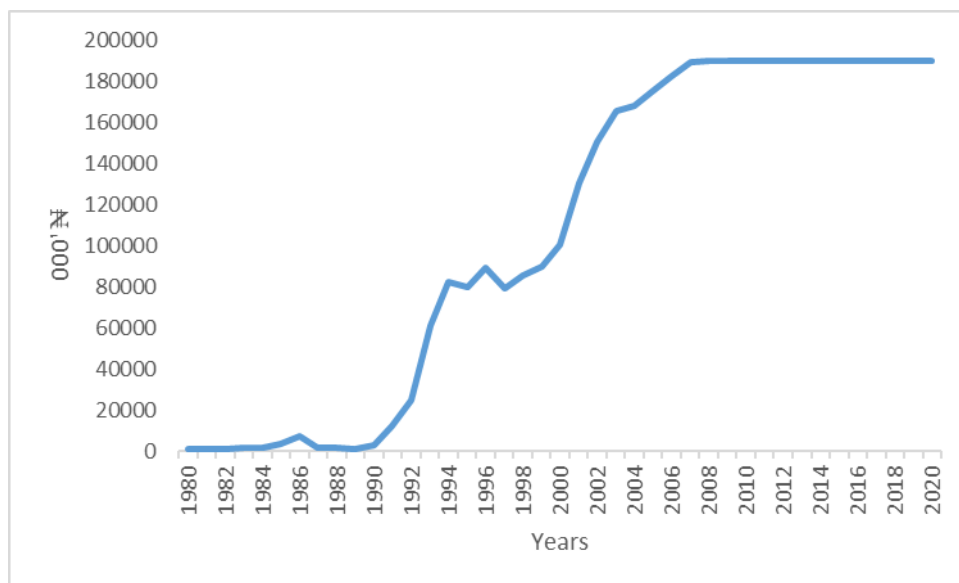
According to Verter and Bečvářová (2014), one of the constraints to increased output of cocoa was low producer prices (set through administrative fiat by marketing boards) and it was a disincentive to the farmers.

Additionally, Ogunkola et al. (2006) reported that ineffective agricultural trade policies, especially the marketing boards that reduced the farmer incomes (farmers received low prices relative to international prices) discourage production. This eventually led to a drop in the supply of agricultural exports.

**Table 2: Trends in producer price of cocoa (naira) in Nigeria (1980-2019)**

Sub-period	Average price (₦'000) per annum	Annual change	Percent	Coefficient of variation
1980-89	4050.000	-19.300		97.148
1990-99	1814.940	15.700		130.370
2000-09	1022.140	6.710		25.130
2010-19	586.190	13.65		48.120
<b>All Period</b>	<b>1935.80</b>	<b>4.900</b>		<b>136.640</b>

Source: Computed from CBN and FAOSTAT, 2021



**Fig 2: Trend in Producer Price (PP) of Cocoa in Nigeria (1980-2019)**

**Trend in the contribution of cocoa to agricultural export in Nigeria (1980-2019)**

As shown in Table 3, the contribution of cocoa to agricultural exports is unstable over the study period. The contribution of cocoa to agricultural export increases from 69.370 percent in the 1980-1989 sub-period to 94.930 percent in the 2000-2009 sub-period but decreases to 68.700 percent in 2010-2019 sub-period. The average percentage contribution of cocoa to agricultural export over the study period was 84.300 percent. This result revealed that cocoa is the most significant agricultural export commodity over the study period. This result is in line with that of (Oyejide (1986), Okunmadewa et al, (2015), and MAFAP, (2013) that cocoa is the highest non-oil foreign exchange earner in Nigeria.

**Table 3: Trends in contribution of cocoa to agricultural exports (tonnes) in Nigeria (1980-2019)**

Sub-period	Average quantity of cocoa (tonnes) per annum	Average quantity of agricultural exports (tonnes) per annum	Percentage contribution of cocoa to agricultural exports
1980-89	175.080	252.380	69.370
1990-99	287.200	353.330	81.280
2000-09	385.410	405.980	94.930
2010-19	279.842	407.350	68.700
<b>All Period</b>	<b>296.719</b>	<b>351.990</b>	<b>84.300</b>

Source: Computed from CBN and FAOSTAT, 2021.



## Result of Time Series Analysis

### Unit Root Test

The results of the ADF unit roots test in Table 4 reveal that 5 variables (domestic supply of cocoa (DOMSUP), exchange rate (EXRATE), interest rate (INTRATE), inflation rate (INFRATE) and producer price of cocoa (PP)) are stationary at the first difference, and agricultural gross domestic product (AGDP) is stationary at the second difference. If ADF value is greater than Mackinnon critical values, either at 1, 5 and 10 percent significant level, the null hypothesis of series having unit root is rejected.

**Table 4: Results of unit root test**

Variables	ADF value	Mackinnon critical values			Decision
		1%	5%	10%	
DOMSUP	-5.0421	-3.6289	-2.9472	-2.6116	I(1)
EXRATE	-4.267224	-3.6289	-2.9472	-2.6118	I(1)
INTRATE	-6.0026	-3.6289	-2.9472	-2.6118	I(1)
INFRATE	-4.552003	-3.6289	-2.9472	-2.6118	I(1)
PP	-3.6426	-3.6289	-2.9472	-2.6118	I(1)
AGDP	-3.6426	-3.6289	-2.9472	-2.6118	I(2)

Source: Author Computation 2021.

### Co-integration Test

The results of the co-integration analysis in Table 5 indicate 3 co-integrating equations. The co-integrating variables are the domestic supply of cocoa (DOMSUP), the exchange rate (EXRATE), the interest rate (INTRATE), the inflation rate (INFRATE) and the producer price of cocoa (PP), and agricultural gross domestic product (AGDP). Thus, the results revealed that the series are co-integrated.

**Table 5: Result of Co-integration Analysis of Variable for Regression Equation**

Eigen Hypothesized Value Variab	Likelihood Co-integrating Ratio	5 Percent		1 Percent
		Critical Value	Critical Value	No. of CE(s)
0.876998	169.3757	94.15		103.18
None **	DOMSUP			
0.674710	93.93583	68.52		76.07
At most 1 **	EXCRATE			

0.550279	53.50647	47.21	54.46
At most 2 *	INTRATE		
0.330137	24.73785	29.68	35.65
At most 3	INFRATE		
0.172656	10.31327	15.41	20.04
At most 4	PP		
0.092394	3.490020	3.76	6.65
At most 5	AGDP		

**CE(s) mean Co-integration(s)**

**\*(\*\*) denote rejection of the hypothesis at 5%(1%) significance level**

**L.R test indicate 3 co-integrating equation(s) at 5% significant level.**

**Source: Author Computation 2021.**

**Result of Error Correction Analysis**

Table 6 presents the result of the ECM analysis. The coefficient of multiple determinants (R2) is 0.555. The F-value is statistically significant at a 1 percent level.

The error correction coefficient is negative and it is statically significant at a 1 percent level. The significance of error term cointegration suggests the existence of long-run equilibrium and steady-state equilibrium between the domestic supply of cocoa and its selected determinants specified in the model. The coefficient of ECM indicates that the speed of adjustment from disequilibrium to long-run equilibrium is .25.500 percent.

Table 6 also reveals the coefficients of interest rate lagged by two years (INTRATE-2), inflation rate lagged by one year (INFRATE-1) and producer price (PP) lagged by two years are negative and statistically significant at 1 percent level, 1 percent, and 10 percent respectively. These results show that there is an inverse relationship between these variables and the domestic supply of cocoa.

In summary, the domestic supply of cocoa is negatively influenced by the interest rate, inflation rate, and producer price of cocoa.

**Table 6: Result of Error Correction Analysis**

**Dependent Variable = ΔLn DOMSUP(-1)**

Variable	Coefficient	Standard Error	T-value		
ECM			-0.255	0.026	-9.663
ΔLn DOMSUP(-1)	-0.245	0.260	-0.942		
ΔLn DOMSUP(-2)	0.032	0.179	0.182		

$\Delta \ln$ EXCRATE(-1)	70.248	1153.780	0.061
$\Delta \ln$ EXCRATE(-2)	-438.593	1621.330	-0.270
$\Delta \ln$ INTRATE(-1)	1994.802	2500.990	0.798
$\Delta \ln$ INTRATE(-2)	5957.594	2248.590	2.649*
$\Delta \ln$ INFRATE(-1)	-247.457	63.128	-3.919*
$\Delta \ln$ INFRATE(-2)	-774.187	553.380	-1.399
$\Delta \ln$ PP(-1)	-1.695	6.693	-0.253
$\Delta \ln$ PP(-2)	-13.053	12.800	-1.519**
$\Delta \ln$ AGDP(-1)	0.004	0.015	0.257
$\Delta \ln$ AGDP(-2)	-0.0135	0.015	-0.885
C	10183.030	14105.200	0.722

<b>R<sup>2</sup></b>	<b>0.555</b>
<b>Adj R-square</b>	<b>0.479</b>
<b>Sum sq.resids</b>	<b>4.56E+03</b>
<b>S.E equation</b>	<b>46604.130</b>
<b>F-statistic</b>	<b>2.015</b>
<b>Log likelihood</b>	<b>-416.954</b>
<b>Akaike A/C</b>	<b>24.626</b>
<b>Schwarz Sc</b>	<b>25.281</b>
<b>Mean dependent</b>	<b>4921.800</b>
<b>S.D dependent</b>	<b>54910.160</b>
<b>Determinant Residual</b>	<b>2.10E+03</b>
<b>Covariance</b>	
<b>Log likelihood</b>	<b>-1519.847</b>
<b>Akaike information criteria</b>	<b>91.992</b>
<b>Schwarz criteria</b>	<b>95.991</b>

Source: Author Computation, 2021.

## CONCLUSION

Conclusively, findings from the study showed that, although cocoa contributed significantly to the volume of agricultural exports, there is a need to pay significant policy attention to producer price and other variables such as inflation rate and interest rate which adversely affect the domestic supply of cocoa. Thus, there is a need for effective and efficient fiscal and monetary policy, especially on the interest rate and inflation rate in the economy. This would go a long way in improving the domestic supply of cocoa thereby improving agricultural export earnings.

Also, there should be a regulated policy on the producer price of the agricultural export commodities which will ensure that agents buy at government recommended price from farmers thus encouraging sustainable production of agricultural export commodities.

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