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Response of vegetable oil production to monetary policy in Nigeria

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ABSTRACT

Monetary policy is one of the macroeconomic variables that control economy. This is why the study evaluated the response of vegetable oil production to monetary policy in Nigeria. Annual time series that spanned for 39 years were obtained from the database of Central Bank of Nigeria and Food and Agriculture Organisation. Data obtained were analysed using descriptive statistics, quadratic trend model and ARDL model. The result indicated that the coefficient of beta 2 (B_2) for vegetable oil production (9.15E-05) is positively signed at P-value > 0.1. The implication is that vegetable oil production in Nigeria experienced stagnated growth. The result showed that monetary policy determinants such as inflation rate and broad money supply made significant negative impact on vegetable oil production in Nigeria. Therefore the study strongly recommended that the monetary authorities should make available commercial loan for industries involved in the production of vegetable oil at the single-digit prime lending rate to encourage them to grow and expand their vegetable oil agribusiness.

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1.0 Introduction

Vegetable oil is an important agricultural value added product that is produced from the edible part of plant matters such as fruits of oil palm, seed of groundnut, soybean, cotton, sunflower, melon, moringa (*Moringa oleifera),* cashew, beniseed and so many other crops that contain extractable oil. Vegetable oil is produced for household and industrial uses. When the vegetable oil is refined or bleached, it serves as cooking oil for the households' uses and other industrial uses (Matthaus, 2007). When the vegetable oil is in the crude form, it serves for an intermediate product used by industries to produce refined or bleached vegetable oil. In Nigeria, groundnut is the second -largest source of domestic vegetable oil after palm fruit. Among the world sources of vegetable oil, soybean oil (31%) ranked the number one position, followed by palm oil (26%) while groundnut oil (7%) ranked the fifth position (Freeman *et al*., 1999). Moreover, Nwalieji *et al*. (2018) opined that vegetable oil production in Nigeria is characterized by low productivity at the production and processing level. This is caused by factors affecting agribusiness such as lack of storage and marketing facilities, supply of inputs, low quality of output, inefficient processing method, lack of infrastructures like good road,

epileptic power supply and inefficient distribution (Gourichon, 2013 and Olagunju, 2008). However, Olagunju, (2008) reported that Nigeria has the potential to become the world number one in vegetable oil production.

Central Bank of Nigeria (2011) described that the Vegetable Oil Development Programme (VODEP) that was initiated in 2002 helped the country to achieve a lot in vegetable oils production. The programme recorded an increase in palm oil production from 1.3 million tonnes in 2000 to 3.5 million tonnes of palm oil in 2007 at 177 per cent increase. Though, this increase in production has not been able to meet target aggregate for vegetable oils production of about 7.93 million tonnes per annum. According to Nwankwo (2000), monetary policy is a conscious action taken by the monetary authorities to control the availability of money, the quantity and cost of money in an economy in order to attain economic goals. The importance of monetary policy to an economy was discovered by Milton Friedman where he stated that money matters in an economy and as such, it is a more stabilizing tool for an economy. Apansile and Saibu (2013) used Mundel-Flemming model to study the interaction between the domestic and international macroeconomic policy variables. The level of stationarity of the time series variables was first tested using a combination of Augmented Dickey-Fuller and Philip Perron unit root test before the Autoregressive Distributed Lag (ARDL) analytical technique was adopted to estimate the model. The parameter estimates were also gotten to determine the effectiveness of each of the policies. The result showed that external shocks had hindered the effectiveness of domestic policy overtime. The result further showed that monetary policy is more effective than the fiscal policy but proper coordination of monetary and fiscal policy would be more effective. The specific objectives of the study include to: compare the vegetable oil production and import volume to domestic consumption (1980 – 2018), ascertain the trend of vegetable oil production with respect to acceleration, deceleration, and stagnation; analyse the growth rate with respect to instantaneous growth rate, compound growth rate, double decline; and determine the impact of monetary policy determinants on vegetable oil production.

2.0 Materials and method

2.1 Research design

Ex-post-facto research design was used in this study. According to Ogar *et al.* (2014), this research design is adopted when the researcher does not have direct control of the variables when engaging in empirical research of facts that had already existed. However, this study was limited to the period within 1980 to 2018 which guarantee the availability of data on vegetable oil production and monetary policy within that political dispensation.

2.2 Study Area

The study was carried out in Nigeria. According to International Monetary Fund in Mgbanya *et al*. (2018), Nigeria is located in West Africa and lies between latitude $4^0$and 14^0N of the equator and longitude $3^0$and 15^0E of the Greenwich. It is a democratic country that is made up of 36 States. Nigeria has six geopolitical zones; namely South-East, South-South, South-West, North-East, North-Central and North-West. The country has boundary with the Republic of Benin and Niger at the west; on the east with Republic of Cameroon; on the south with Gulf of Guinea and on the north with Niger and Republic of Chad (National Bureau of Statistics, 2013). Nigeria occupies 923,769 Km^2 areas of land (National Bureau of Statistics, 2011). Major crops that are grown in Nigeria include; millet, guinea corn, sorghum, groundnut, beans, yam, cotton, maize, cassava, rice, melon, and cocoyam. Some of the fruit-bearing tree crops found in Nigeria include; palm, mango, cashew, orange, guava, etc.

2.3 Data Source

Data for this study were sourced from secondary sources. Data on taxation, interest rate, exchange rate, money supply were sourced from the database of Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) while the quantity of vegetable oil produced was sourced from the Food and Agriculture Organisation (FAO) Statistics. Data collected were subjected to unit root test using Ng-Perron. Bound test was carried out to detect if there is long run relationship between the variables. Ordinary Least Square approach to ARDL model was used to estimate the long and short run parameter. Toda and Yamamoto granger causality test was performed to determine the variables causing the impact. However, diagnostic test and stability test were also performed. The ARDL short and long run model is specified below:

ARDL Short and Long Run Model for Vegetable Oil Production Response to Monetary Policy:

lnY_t= $F(lnVOP,INFL,PLR,EXCH,lnMS,lnLA,MPR)$

Implicit form…1

Ln

ln

$$\Delta Y_t = \gamma_{0i} + \sum_{i=1}^{p} \delta_{ij} \ln\Delta DY_{t-i} + \sum_{i=0}^{q} \delta_{ik} \ln\Delta DX_{t-i} + \delta_n ECT_{t-1} + \beta_{ij} \ln Y_{t-i} + \beta_{ik} \ln X_{t-i} + \varepsilon_{it}$$

Where:

Y_t = Vector (*lnVOP* as response variable)

F= Function

D = short run opeartors

Δ = First difference operator

Y_{t-i}= lagged response variables

X_{t-i}= lagged covariate variables (*lnVOP, INFL, PLR, EXCH, lnMS, lnLA, MPR*)

ln= Natural log form (standardized form)

i =1,…k

β_{ij} - β_{ik} = Coefficients correspond to the long run relationship

δ_{ij}- δ_{ik} = Coefficients correspond to the short run dynamic

γ_{oi} = Constant for each of the model

p, q =Optimal lag orders for the response and covariate variables respectively = Vector of the stochastic term (unobservable zero-mean white noise vector process)

ECT = Error correction term for short run estimate

VOP = Quantity of vegetable oil produced (metric tonnes per annum)

PLR = Prime lending interest rate on loan (percentage per annum)

EXCH = Annual exchange rate of Naira to US Dollars (Naira per annum)

LA = Commercial loan and advances to manufacturing industries (Billion Naira per annum)

MS = Broad money supply (Billion Naira per annum)

MPR = Monetary policy rate (% per annum)
INFL = Inflation rate (% per annum)
The Toda and Yamamoto causality between two variables are shown below

$$X_t = \beta_1 + \sum_{i=1}^{h+d} \beta_{1i} X_{t-i} + \sum_{j=1}^{l+d} \alpha_{1j} Y_{t-j} + \varepsilon_{1t}$$

... Explicit form…3

$$Y_t = \beta_1 + \sum_{i=1}^{h+d} \beta_{2i} X_{t-i} + \sum_{j=1}^{l+d} \alpha_{2j} Y_{t-j} + \varepsilon_{2t}$$

… Explicit form… 4
Where
d = maximum order of integration
h and d = optimal lag length
ε = the error terms which are assumed to be white noise
Y and X are the variables
β and α = parameters

3.0 Results and Discussions

3.1 Comparison between vegetable oil productions and import to domestic consumption

Table 1: Percentage distribution of Nigeria vegetable oil production and import to vegetable oil domestic consumption in metric tons (1980 – 2018)

Year	Vegetable Oil Production (%)	Vegetable Oil Import (%)	Domestic Consumption	Total %
1980 - 1984	2960000(81)	771264(21)	3669000	102
1985 - 1989	3204000(93)	308919(9)	3444000	102
1990 - 1994	3299000(88)	106604(3)	3760000	91
1995 - 1999	4012000(86)	423659(9)	4658000	95
2000 - 2004	5063000(81)	945320(15)	6265000	96
2005 - 2009	5511000(73)	2715021(36)	7511000	109
2010 - 2014	6278000(74)	5388331(64)	8477000	138
2015 - 2018	5436000(82)	3176300(48)	6627000	130

Source: FAOSTAT (2018) & USDA (2019)

From Table 1, the result shows the highest (93%) vegetable oil production volume was between the years 1985 and 1989, yet the domestic consumption could not be satisfied without importation of (9%). This implies that vegetable oil production volume could not meet the demand for vegetable oil domestic consumption within the reference period. Therefore vegetable oil importation became necessary for meeting the remaining volume of vegetable oil domestic consumption in Nigeria. The percentage volume of vegetable oil import in Nigeria from 1980 – 2018 showed that the highest importation volume of 64% occurred within 2010 – 2014 categorization, indicating production deficit. This is consistent with Nzeka (2014) that Nigeria vegetable oil production (the case of palm oil) responds to production deficit and as a result, palm oil is imported to meet the local demand.

The result also showed that the highest (138%) volume of vegetable oil production and import that met the domestic consumption occurred between 2010 and 2014. This implies that the combination of the volume of vegetable oil production and vegetable oil import in Nigeria was used to meet domestic consumption of vegetable oil in Nigeria. However, the extra percentage (38%) volume of vegetable oil production and import helped in re-export of vegetable oil from Nigeria to other countries. The result further showed that the least (91%) volume of the combination of vegetable oil production and import to meet the domestic consumption took place between 1990 and 1994. This implies that importation of vegetable oil to supplement the local production of vegetable oil could not meet total domestic consumption in Nigeria; this could imply that smuggling of vegetable oil within that period was high and proper documentation of vegetable oil either imported or produced was not properly accounted for. This is why Nzeka, (2014) reported that the domestic production of vegetable oil (soybean and palm oil) have not met the increasing demand from local consumers and the Office of Agricultural Affairs may be contracted to identify true importers of vegetable oil in Nigeria.

The result also showed that the highest (93%) volume of vegetable oil was produced between 1985 – 1989 while the lowest (73%) volume of vegetable oil was produced between 2005 – 2009 while the highest (64%) volume of vegetable oil was imported between 2010 – 2014; while the lowest (3%) volume was imported between 1990 and 1994. This implies that for Nigeria to have produced 93% volume of domestic demand for vegetable oil between 1985 – 1989 indicates that the country has the capacity to meet domestic demand for vegetable oil and for Nigeria to have imported 3% of the domestic demand for vegetable oil between 1990 – 1994 implies that if the country boost its domestic production of vegetable oil, Nigeria can do without vegetable oil importation. This is why Olagunju, (2008) reported that Nigeria has the potential to become the world number one in vegetable oil production.

Trend of Vegetable Oil Production in Nigeria (1980 – 2018)

Quadratic trend analysis was used to analyse the trend of vegetable oil production in Nigeria (1980 – 2018) to know if they are accelerating, decelerating or stagnated. The result in Table 2 was used to calculate the instantaneous, compound growth rate and the doubling time of vegetable oil production within the reference period in Nigeria. The result of the analysis is presented in Table 2.

Table 2: Quadratic Trend Analysis of Vegetable Oil Production in Nigeria (1980 – 2018)

Dependent Variable	B_0	B_1	B_2	R^2	Adj. R^2	F-Ratio
Vegetable oil production	13.21***	0.02***	9.15E-05^{ns}	0.92	0.91	212.7***

Source: Authors Computation Using Eviews 10 (2019); *** = statistically significant at 1% level of significance, * = statistically significant at 10 % level of significance, ns = non-significant
R^2 = Multiple coefficient of determination, Adj. R^2 = adjusted coefficient of multiple determinations.

Table 2 showed that the coefficient of beta 2 (B_2) for vegetable oil production (9.15E-05) is positively signed at non-significant level (P-value > 0.1). The implication is that vegetable oil production in Nigeria experienced stagnated growth. Onyenweaku (2004) reported a stagnated growth in agricultural production in Nigeria from 1970-2000. The coefficient of multiple determination (R^2) for vegetable oil production is 0.92. This implies that 92% change in the stagnated growth of vegetable oil production is explained by the time period under study. The F-ratio of vegetable oil production is 212.7 at P-value < 0.05. This implies that growth in vegetable oil production is highly time-dependent.

3.2 Growth rate of vegetable oil production, export and import in Nigeria (1980 – 2018)

Table 3 showed the computed instantaneous, compound growth rate and doubling time of vegetable oil production in Nigeria from 1980 – 2018. The instantaneous growth rate for the variables is computed as thus with this formula: growth rate = $\beta^2 * 100$. The compound growth rate for the variables is computed as thus with this formula: growth rate = $(e^{\beta} - 1) \times 100$ while e = Euler's constant (2.71828) while the doubling time is calculated with 69/r, where r is the compound growth rate.

Table 3 showed that the instantaneous growth rate of 0.00915% for vegetable oil production implies that from 1980 to 2018, the production vegetable oil in Nigeria stagnated because the rate of growth at a point in time is very low.

The compound growth rate of 0.0091504% for vegetable oil production implies that from 1980 to 2018, the production vegetable oil in Nigeria stagnated because the rate of growth over the period is very slow.

The result showed that the doubling time computed for the compound growth rates in years were 7540.6 years for vegetable oil production. This implies that given the current trend, it would take vegetable oil production 7540.6 years to double the stagnated rate of growth towards accelerating the rate of growth. The approach has been applied by various scholars in estimating the trend of various agricultural production such as rice and sugarcane production in Nigeria (Tanko, Jirgi & Igwe, 2010; Ibrahim, Mohammed, Nmadu, Yakubu & Ibrahim, 2010 and Maikasuwa *et al.,* 2013).

Unit root test results

We tested the stationarity of the annual time series data used for the analysis. The stationarity test was conducted using Ng -Perron test. The Ng-perron test was conducted at 5% and 10% level of significance in order not to accept a false null hypothesis. The result is presented in Table 4.

Table 3: Instantaneous and compound growth rate for the quantity of vegetable oil produced, exported and imported in Nigeria (1980 -2018)

Variable	B^2	IGR (%)	CGR (%)	Doubling Time(Years)
Vegetable Oil Production	9.15E-05^{ns}	0.00915	0.0091504	7540.6

Source: Authors computation using Eviews 10 (2019). IGR = instantaneous growth rate, CGR = compound growth rate, ns = non-significant

Table 4: Unit root test for vegetable oil production and monetary policy indicators

	Ng-Perron I(0)				Ng-Perron 1(1)			
	MZa	MZt	MSB	MPT	MZa	MZt	MSB	MPT
C.V. 5%	-8.100	-1.980	0.233	3.170	-8.100	-1.980	0.233	3.170
C.V. 10%	-5.700	-1.620	0.275	4.450	-5.700	-1.620	0.275	4.450
LNVOP	-	-	-	-	-17.333	-2.943	0.169	1.417
MPR	-	-	-	-	-25.181	-3.545	0.141	0.973
LNLA	-6573.6	-57.324	0.009	0.005	-	-	-	-
LNMS	-	-	-	-	-8.079	-2.001	0.249	3.033
PLR	-	-	-	-	-11.513	-2.397	0.208	2.136
EXCH	-	-	-	-	-16.253	-2.848	0.175	1.517
INFL	-10.675	-2.308	0.216	2.301	-	-	-	-

Source: Authors Computation Using Eviews 10 (2019) Note: C.V: asymptotic critical value, LNVOP = log of vegetable oil production, MPR = monetary policy rate, LNLA = log of commercial loan extended to manufacturing industries, LNMS = log of money supply, PLR = prime lending rate, EXCH = exchange rate, INFL = inflation.

The result in Table 4 showed that log form of vegetable oil production, the monetary policy rate, log form of money supply, prime lending rate and exchange rate were stationary at their first difference since their Ng-perron MSB statistics values were less than the critical values of MSB at 5% level of significance (0.233) and 10% level of significance (0.275). While the log form of the commercial loan extended to manufacturing industries and inflation rate were stationary at their ordinary level since their Ng-perron MSB statistics values were less than the critical values of MSB at 5% level of significance (0.233) and 10% level of significance (0.275). This implies that the series have mixed order of integration. Therefore, it becomes appropriate to use Autoregressive Distributed Lag Model (ARDL) to estimate the series. However, Bhargava in Muller and Elliott (2002) stated that Ng-Perron uses four test statistics that are based on detrended data y_t^d which are modified forms of PP Za and Zt statistics, the R1 statistics and the ERS point optimal test. The three test statistics that are commonly used are Mza, MZt and MSB, where MZt = MZa x MSB. In addition, Pesaran, Smith and Shin (2001), stated that ARDL is used for testing the presence of co-integration relationship among the variables. This is because ARDL test the existence of a long-run relationship between the regressand and regressor variables irrespective of the level of the order of

Table 5: Bound test for co-integration

Function	F-Stat.	I(O)	I(1)	Decision
F(LNVOP/LNVOP,MPR,PLR,LNMS,LNLA,INFR,EXCH)	11.06***	2.6	3.86	Presence of Co-integration

Source: Authors Computation Using Eviews 10 (2019)

integration of the variables whether purely I(0), I(1) or fractionally integrated. Therefore we performed bound test for co integration on the model.

The result of the bound test using ARDL approach as presented in Table 5 showed that the F-statistics (11.0648) of the response of vegetable oil production to monetary policy is greater than the lower (2.618) and upper bound (3.86) at 5% level of significance. This implies that the long-run relationship of the response of vegetable oil production to monetary policy exists; therefore ARDL long run and ECM short run should be estimated using the OLS approach.

3.3 Response of vegetable oil production to monetary policy (1980 – 2018)

Multiple regression analysis using Ordinary Least Square approach to Autoregressive Distributed Lag Model to estimate the responses of vegetable oil production to the monetary policy is presented below.

Table 6: ARDL short run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

Variables	Coefficients	St. Error	T-Statistics
Constant	0.0106	0.0113	0.9353^{ns}
D(LNVOP(-1))	0.5401	0.1270	4.2503***
D(EXCH)	-0.0001	0.0002	-0.5730^{ns}
D(INFR)	-0.0013	0.0003	-3.8876***
D(INFR(-1))	-0.0025	0.0003	-6.6110***
D(LNLA)	0.0897	0.0410	2.1890**
D(LNLA(-1))	-0.0545	0.0379	-1.4374^{ns}
D(LNMS)	-0.2440	0.0638	-3.8241***
D(LNMS(-1))	0.2211	0.0565	3.9077***
D(PLR)	0.0014	0.0014	0.9997^{ns}
D(PLR(-1))	0.0037	0.0015	2.4644**
D(MPR)	-0.0008	0.0017	-0.5113^{ns}
ECM(-1)	-1.2476	0.1958	-6.3704***
R^2	0.8683		
Adjusted R^2	0.8025		
F-statistics	13.19***		

Source: Authors Computation Using Eviews 10 (2019) ***, **, * implies 1%, 5% and 10% significance levels respectively, ns implies non significance.

From Table 6, the result of the data analysis shows the coefficient of multiple determinations is 0.8683 and the adjusted coefficient of multiple determinations is 0.8025. This implies that 80.25% variation in vegetable oil production is explained by the monetary policy determinants in Nigeria.

The coefficients that had a positive significant impact on vegetable oil production in the past include: 1st lag of vegetable oil production, commercial loan extended to manufacturing industry, broad money supply at 1st lag period and prime lending rate at 1st lag. This implies that a unit increase in vegetable oil production, commercial loan extended to manufacturing industry, 1st lag of broad money supply and 1st lag of prime lending rate made significant positive impact on vegetable oil production at the past. However, Osakwe *et al,* (2019) reported that unit rise in money supply leads to about 9% increase in the output from the manufacturing sector of Nigeria economy.

The coefficients that had negative significant impact on vegetable oil production in Nigeria at the past were current inflation rate, 1st lag of inflation rate and current broad money supply. This implies that inflation rate, and broad money supply made a negative impact on vegetable oil production currently. Since the exchange rate has no significant effect on the production of vegetable oil in Nigeria in the short run, the IS-LM model shows consistency with the short-run relationship between the interest rate and production. This is why Apansile and Saibu (2013) stated that the IS-LM model is the model that describes the relationship between the interest rate and production for a closed economy. Moreover, Aroriode and Ogunbadejo (2014) studied the impact of macroeconomic policy on agricultural growth in Nigeria. The result showed that money supply (0.22), credit loan to agriculture (-0.09), agricultural output (0.98) and exchange rates (-0007) have significant effect on agricultural gross domestic product while the interest rate (-0.004) has no significant effect on gross domestic product of agriculture with error correction term value of -0.77.

The error correction term value is -1.2476 at a probability value of 5% level of significance. The negative sign indicates long-run convergence and the speed of adjustment, in the long run, is 124.76%. This is consistent with Nkoro and Uko (2016) assertion that if the error correction term coefficient magnitude is zero (0), it shows no long-run relationship between the variables because there is no presence of speed of adjustment, but if it is greater than zero (0) but less than or equal to one (1), it shows that there is long-run relationship among the variables because there is presence of speed of adjustment

The return to scale parameter which is obtained from the total coefficient values of the significant variables (0.6068) at short run is less than 1. This implies that monetary policy lead to a decreasing rate of return on vegetable oil production in the short run. This approach has been applied by Mgbanya *et al* (2018), where they stated that the rate of return to scale is obtained from the total values of the significant coefficients.

3.4 Diagnosis test of the short run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

Table 7: Diagnosis test of the short run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

Residual Diagnosis	F-Stat.	Q-Statistics	Jarque-B Stat	Decision
Breusch-Godfrey LM test	0.0065^{ns}	-	-	No Serial Correlation
Breusch-Pagan-Godfrey test	0.2952^{ns}	-	-	Homoskedasticity
Correlogram test	-	0.0041^{ns}	-	No Autocorrelation
Normality test	-	-	139.9***	Not normally distributed

Source: Authors Computation Using Eviews 10 (2019)

To determine if the model meets the assumption of the classical linear regression model, residual diagnosis test was conducted to test their various null hypotheses of no serial correlation, heteroskedasticity, autocorrelation and normality. The result is presented in Table 7.

From Table 7, the diagnosis test of values of 0.0065, 0.2952, 0.0041 and 139.9 for no serial correlation, absence of heteroskedasticity and no autocorrelation met the assumption of the classical linear regression model since their various probability values is greater than 0.05 level of significance. The implication is that there is absence of serial correlation, the variance of the error term in the model is constant in each period, and the value that the error term assumes in one period is uncorrelated with the value it may assume in any other period. However, the variables are correctly aggregated and the model rightly specified.

3.5 Stability tests of the short run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

To test the stability of the short-run parameters included in the model of the response of vegetable oil production to monetary policy in Nigeria, cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) test were performed as proposed by Borensztein, Gregorio and Lee (1998). The result is presented in Figure 1 and 2

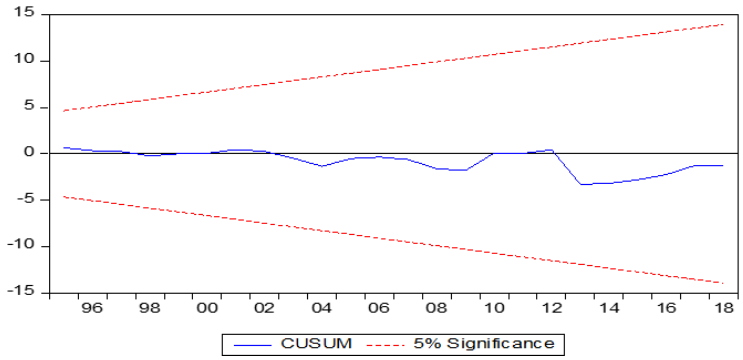

Figure 1 Stability Test of the short run response of vegetable oil production on monetary policy in Nigeria (1980 – 2018) Using CUSUM Test

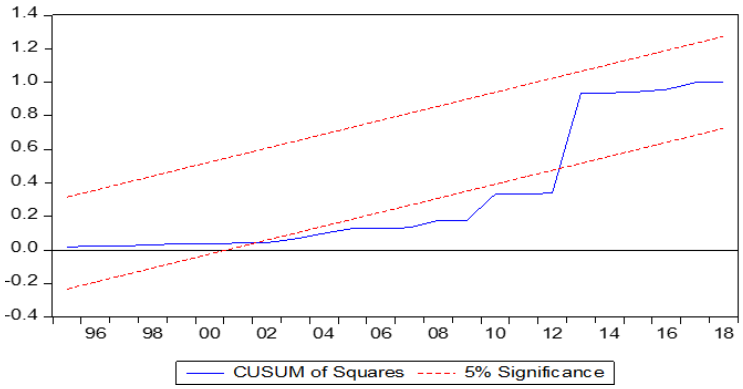

Figure 2 Stability Test of the short run response of vegetable oil production on monetary policy in Nigeria (1980 – 2018) Using CUSUM of Squares Test

The results show that the plotted line lies within and outside the dotted lines at 5% level of significance for CUSUM and CUSUMSQ respectively. This implies that the CUSUM short-run coefficients of the model are stable and the

Table 8: ARDL long run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

Variables	Coefficients	St. Error	T-Statistics
Constant	9.1772	1.5690	5.8489***
LNVOP(-1)	0.3126	0.1206	2.5912***
EXCH	0.0001	0.0001	0.9264ns
INFR	-0.0012	0.0004	-2.6561***
INFR(-1)	-0.0028	0.0006	-4.7138***
LNLA	0.0480	0.0530	0.9056ns
LNLA(-1)	0.0615	0.0504	1.2193ns
LNMS	-0.1618	0.0780	-2.0745**
LNMS(-1)	0.1266	0.0690	1.8345*
PLR	0.0010	0.0016	0.6466ns
PLR(-1)	0.0030	0.0020	1.4619ns
MPR	0.0002	0.0023	0.0947ns
R^2	0.9924		
Adjusted R^2	0.9892		
F-statistics	311.32***		

Source: Authors Computation using Eviews 10 (2019) ***, **, * implies 1%, 5% and 10% significance levels respectively, ns implies non significance.

CUSUMSQ short-run coefficient is instable. This has been applied by Mohsen and Ng (2002) to test the stability of the long-run estimates. From table 8, the result of the data analysis shows the model is fit since the coefficient of multiple determinations is 0.9924 and the adjusted coefficient of multiple determinations is 0.9892. This implies that 98.9% variation in vegetable oil production is accounted for by the monetary policy determinants in Nigeria.

The coefficients of 1st lag of vegetable oil production and broad money supply made significant positive impact. This implies that past vegetable oil production and broad money supply lead to increase in vegetable oil production for long time.

The coefficients of current inflation rate, 1st lag inflation rate and current broad money supply made a negative significant impact on vegetable oil production for long time. Moreover, the negative nature of inflation on vegetable oil production showed that for inflation rate to increases, the production cost had increased which will lead to decrease in vegetable oil production in the long run. However, broad money supply of the previous year's led to dynamic impact on vegetable oil production for long time. This is as the result of the continuous change in broad money supply. Keynesian economics maintain that change in money supply leads to higher prices of goods and services in the economy. This is why monetary policy is a veritable policy tool used by government or monetary authorities such as Central Bank of Nigeria to regulate money supply and interest rate in the view to grow and stabilize the economy (Nwankwo, 2000; Chigbu and Njoku, 2013 and Ogar *et al*., 2014). However, Orphanides and Wieland (2008) opined that the expansionary policy increases the money supply or cuts interest rate while contraction policy reduces the quantity of money supply or increases the interest rate.

The return to scale parameter which is obtained from the total coefficient values of the significant variables (0.2734) at the long run is less than 1. This implies that monetary policy of Nigeria within 1980 to 2018 lead to a decreasing rate of return to vegetable oil production for long time. This approach has been applied by Mgbanya *et al.* (2018), where they stated that the rate of return to scale is obtained from the total values of the significant coefficients.

3.6 Diagnosis test of long run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

To determine if the model meets the assumption of the classical linear regression model, residual diagnosis test was conducted in other to test their various null hypotheses of no serial correlation, heteroskedasticity, autocorrelation and normality. The result is presented in Table 9.

Table 9: Diagnosis test of the estimate of long run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

Residual Diagnosis	F-Stat.	Q-Statistics	Jarque-B Stat.	Decision
Breusch-Godfrey LM test	0.4104^{ns}	-	-	No Serial Correlation
Breusch-Pagan-Godfrey test	1.3594^{ns}	-	-	Homoskedasticity
Correlogram test	-	0.4558^{ns}	-	No Autocorrelation
Normality test	-	-	3.3668^{ns}	Normally distributed

Source: Authors Computation Using Eviews 10 (2019)

In Table 9, the diagnosis test of values of 0.4104, 1.3594, 0.4558 and 3.3668 for no serial correlation, absence of heteroskedasticity, no autocorrelation and normal distribution met the assumption of the classical linear regression model since their various probability values is greater than 0.05 level of significance. The implication is that there is absence of serial correlation, the variance of the error term in the model is constant in each period, the value that the error term assumes in one period is uncorrelated with the value it may assume in any other period and that the values of the error term for each variable have a bell shape. However, the variables are correctly aggregated and the model rightly specified. This is consistent with Osakwe, Ibenta and Ezeabasili (2019) who deduced the normality test; serial correlation test and heteroscedasticity tested using Jarque-Berra statistics, F-statistics of Breusch-Godfrey Serial correlation test and F-statistics of Breusch-Pagan-Godfrey test respectively at 5% level of significance.

3.7 Stability tests of long run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

To test the stability of the long-run parameters included in the

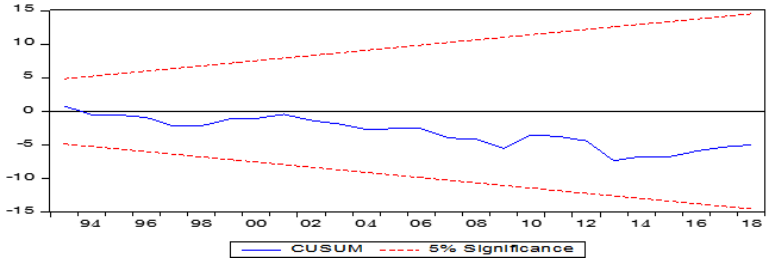

Figure 3: Stability Test of the long run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018) using CUSUM Test

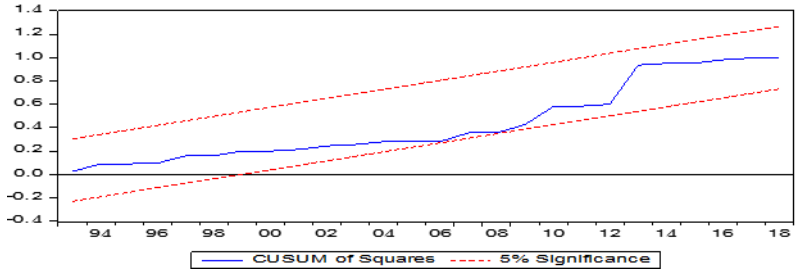

Figure 4: Stability Test of the long run response of vegetable oil production to monetary policy in Nigeria (1980 – 2018) using CUSUMSQ Test

model of the response of vegetable oil production to monetary policy in Nigeria, cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) test were performed as proposed by Borensztein, Gregorio and Lee (1998). The result is presented in Figure 3 and 4

The result shows that the plotted line lies within the dotted lines at 5% level of significance. This implies that the long-run coefficients of the model are stable. This has been applied by Mohsen and Ng (2002) and Suleiman (2005) to test the stability of the long-run estimate.

Hypothesis testing: Response of vegetable oil production to monetary policy in Nigeria (1980 – 2018)

The null hypothesis that vegetable oil production do not significantly respond to monetary policy was tested using the F-statistics at P-value <.0.05. The result of the F-statistics;

Table 10: Toda-Yamamoto causality (Modified Wald) impact test of hypotheses

Null Hypothesis	Chi-sq	Granger Causality	
Long run: EXCH does not Granger cause VOP	0.8583^{ns}	No causality	
Short-run: EXCH does not Granger cause VOP	0.3284^{ns}	No causality	
Long run: INFL does not Granger cause VOP	47.6810***	INFL	VOP
Short-run: INFL does not Granger cause VOP	58.3627***	INFL	VOP
Long run: LA does not Granger cause VOP	11.3733***	LA	VOP
Short-run: LA does not Granger cause VOP	6.0854**	LA	VOP
Long run: BMS does not Granger cause VOP	4.3064^{ns}	No causality	
Short-run: BMS does not Granger cause VOP	21.2325***	BMS	VOP
Long run: PLR does not Granger cause VOP	2.8989^{ns}	No causality	
Short-run: PLR does not Granger cause VOP	6.1035**	PLR	VOP
Long run: MPR does not Grander cause VOP	0.0089^{ns}	No causality	
Short-run: MPR does not Granger cause VOP	0.2615^{ns}	No causality	

Source: Authors Computation using Eviews 10 (2019)

311.32 (at the long run) and 13.19 (at the short run) has P-value that is less than 0.05. This implies that the null hypothesis should be rejected and the alternative should be accepted. Therefore, monetary policy determinants had significant impact on vegetable oil production in Nigeria.

Table 10 showed that inflation rate and commercial loan extended to manufacturing industries strongly causes vegetable oil production while broad money supply and prime lending rate cause vegetable oil production. In other words, monetary policy determinants such as inflation rate, a commercial loan extended to manufacturing industries, broad money supply and prime lending rate are the variables capable of causing either increase or decrease in vegetable oil production in Nigeria.

4.0 Conclusion

The evaluation of the response of vegetable oil production to monetary policy in Nigeria revealed that monetary policy has a significant impact on vegetable oil production in Nigeria.

However, monetary policy of Nigeria within those period lead to decreasing rate of return on vegetable oil production. The study strongly recommends that monetary authorities should make available commercial loan at all times for industries involved in the production of vegetable oil at the single-digit prime lending rate in other to encourage them to grow and expand their vegetable oil agribusiness. This is because commercial loan has a positive impact on vegetable oil production. Also, the increase in vegetable oil production will lead to a reduction in inflation rate and growth in the cost of capital. Moreover, the monetary authorities and the government should monitor, control and maintain stable broad money supply, commercial loan extended to vegetable oil producers, prime lending rate, inflation rate, and ensure that they are not adversely over or underutilized by the vegetable oil producers.

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