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MONETARY POLICY TRADE AND CARBON EMISSION INVESTIGATION IN NIGERIA

Osemwenkhae, O. Department of Banking and Finance, Faculty of Management Sciences, University of Benin, Benin City Nigeria.

Uwubanmwen, A. E. Department of Banking and Finance, Faculty of Management Sciences, University of Benin, Benin City Nigeria.

Abstract

The effect of monetary policy trade on carbon emission investigation in Nigeria is empirically examined in this study for the period 1981 to 2021 using descriptive statistics, correlation analysis, and Auto Regressive Distributed Lag (ARDL) technique. The various analyses were used to investigate the connection between monetary policy and carbon emission in Nigeria. The empirical findings showed that monetary policy variables (monetary policy rate, cash reserve ratio and money supply) as well as the control variables (exchange rate, inflation rate and energy consumption) had a no substantial impact on carbon emission in Nigeria. Based on these findings, the study recommends that monetary authorities should consider the environment when implementing monetary policy in Nigeria. For example, the Central Bank of Nigeria may incentivize investments in energy-efficient equipment by tailoring its monetary instruments towards activities that encourages low-carbon emission. Also, the government should come out with a clear policy to solving the climate related issue in Nigeria, coming up with such policy will encourage private businesses to do more in reducing carbon emission in Nigeria.

Keywords: Auto Regressive Distributed Lag Method, Carbon Emission, Cash Reserve Ratio, Climate Change, Monetary Policy Rate

1. Introduction

Climate change which is caused by carbon emission is increasingly affecting our societies and economies. Adapting to it, and mitigating its consequences, requires a rapid transition to a low-carbon economy. The primary responsibility for this shift rests with governments. They are legitimised and have a broad spectrum of policy levers at their disposal, such as setting the necessary price of carbon emissions, defining a regulatory framework to reduce emissions, and undertaking needed sustainable investments. A global policy response is embodied in the 2015 Paris Agreement (Gianluigi, Francesco, Mongelli, 2022).

Yet, government action alone is not enough to address the complexity and scale of the transformation required achieving climate goals, and there is a growing consensus that a comprehensive policy package would be more effective in tackling the multiple market failures at the roots of the climate challenge. Such a comprehensive policy package requires a mix of fiscal, regulatory, and structural measures as well as financial policy instruments and monetary policy measures (ECB, 2021; Weder di Mauro, 2021; and Pisu, D'Arcangelo, Levin & Johansson, 2022). Monetary authorities execute financial policies via spending and levy to manage changes in prices of goods and services, joblessness, and a steady sustainable GDP increase. In this case, green finance has emerged as an important strategy for the financial sector and a point of reference for government policies in the face of environmental issues such as climate change and biodiversity loss. Green finance arose from the ashes of the 2008 global financial crisis and is rooted in private financial sector strategies (Siddhartha, 2022).

The literature on the policy options available to central banks to respond to climate change is rapidly developing but still fragmented. A key factor shaping central banks' response to the climate challenge is the mandate that is assigned to them. For central banks with an explicit 'green mandate', the case for action is clear. But even in the absence of such a mandate, taking no action is not a viable option. There are several measures that central banks can and should consider, both to ensure that their policy frameworks remain resilient to emerging climate risks, and in terms of contributing to the decarbonisation objectives set by the relevant political authorities, supporting climate policies, and harnessing green finance (Dikau & Volz, 2021)

The central bank could aim to set the desired monetary policy stance in a 'green way'. Moreover, by reducing the transition costs for firms that invest to cut emissions, monetary policy may ease the path towards carbon neutrality, thereby generating some long-lasting effects. Greening monetary policy could distort financial markets, especially given the current scarcity of green assets. The transmission of monetary policy could be hampered if, for example, certain institutions are excluded from accessing central bank facilities. Moreover, in the absence of a clear taxonomy and accepted market standards of what is 'green' and what is polluting investment, and without implementable guidelines, central banks lack an objective definition and possibly a legal underpinning to ground their green policies. Given these constraints and trade-offs, central banks need to carefully balance the costs and benefits of any green action (Schoenmaker, 2019; Gianluigi, et al., 2022).

Despite the numerous factors that influence carbon emission that has been studied in the extant literature, this study takes a different angle by considering monetary policy as a novel factor and evaluates its effect on carbon emission. A cursory look at the empirical literature reveals that the nexus between monetary policy and carbon emission has been examined in other climes, for instance, Siddhartha (2022) and Vishal, Sana, Qamar and Yogendra (2023) focus on Indian, Wenji, Hayot, Wasim and Muhammad (2022) did a study for European Union, Hence, to the best of the researchers knowledge, this is one of the few studies that have investigated this subject matter in Nigeria. Hence, this paper seeks to investigate the effects of monetary policy (monetary policy rate, cash reserve ratio and money supply) on carbon dioxide emissions level in Nigeria.

2. Literature Review

2.1 Empirical Review

Siddhartha (2022) investigates the impact of monetary policy on CO_2 emissions while controlling for income, trade, foreign direct investment (FDI) and accounting for structural breaks using annual data from 1971 to 2014. By utilizing the extended environmental Kuznets curve (EKC) framework and dynamic ARDL simulations, the results reveal that the Kuznets curve is a long-run phenomenon for India, not a short run. Moreover, interest rates are identified to possess a significantly positive relation with emissions in the short as well as long run. Additionally, trade is found to be inelastic and weakly beneficial for the environment, while FDI is elastic and significantly detrimental. The latter evidence supports Pollution Haven Hypothesis. Further, following Itkonen (Itkonen, Energy, 2012) arguments, the study demonstrates that inclusion of the energy-used term as a determinant of CO_2 emissions for India, which underestimates the turning point of the long-run Kuznets curve and the total effect of income on emissions. Consequently, such a model yields incorrect estimates.

Wenji, Hayot, Wasim and Muhammad (2022) examine the links among macroeconomic policies, total national expenditure per person, traditional energy use, renewable energy use, and CO_2 emissions levels in EU countries from 1990 to 2016. The study utilizes the second generation cross-sectional-autoregressive-distributed lag (CS-ARDL) panel data method. According to the study's findings, the monetary instruments of growth exacerbated the adverse effects of CO_2 emissions, and by tightening monetary policy, the harmful effects of CO_2 emissions levels have been reduced. Further, the Granger causality test indicates a bidirectional causality between monetary policy and CO_2 emissions levels, and unidirectional causality from the policy assessment for energy use. The finding confirms that the assessment policy recommendations on energy consumption have future effects on ecological value.

Vishal, Sana, Qamar and Yogendra (2023) examines the role of fiscal policy and monetary policy instruments along with selected macroeconomic variables on carbon emission in India over the period 1971–2019 in the non-linear framework. The outcome of the study reveals that the impact of fiscal and monetary policy instruments on carbon emission is asymmetric in nature. In addition, the positive and negative shocks in fiscal and monetary policy instruments have a positive and negative impact on carbon emissions, respectively. Based on the coefficients' magnitude, the role of fiscal policy instruments has a more prominent effect on carbon emissions than monetary policy instruments.

In a bid to actualize the research of objective, the data was collected from secondary source which consist of statistical bulletin derived from central bank of Nigeria (CBN, 2022) and World Bank – World Development Indicator (WDI, 2022) from 1981 -2021. To estimate data in this research, descriptive and inferential statistics approaches are used. Descriptive statistics are used to investigate the qualities of variables and present them in a more concise manner. The Pearson correlation analysis is used to demonstrate the direction and intensity of the association between variables. It also allows the study to verify for the presence of multi-co-linearity among variables in the model. It is critical in time series analysis to ensure the stationarity of all variables included in the model since time series data is always related with the problem of non-stationarity, which can reduce the validity of forecasts based on such data. To address this issue, this study used standard Augmented Dickey-Fuller (ADF) unit root tests to assess the stationarity or otherwise of the data in this study and to confirm that none is I (2) or above, in which case the ARDL limits test cannot be applied to co-integration. When this requirement was met, this study used the ARDL bound test to co-integration, which may deal with whether all variables are I(0), I(1), or a mixture of both. Finally, the Breusch-Godfrey high order correlation post regression test is utilised to validate the model's lack of serial correlation.

3. Methodology

3.1 Model Specification

The model used is a modification of Siddhartha (2022) model. The model is stated in a functional form in equation (1):

$CO_2 = f$ (MPR, CRR, M2, EXR, INF, ENC) ……… (1)

The econometric form of the model is stated as:

$CO2_t = \alpha_0 + \alpha_1 MPR_t + \alpha_2 CRR_t + \alpha_3 M2_t + \alpha_4 EXR_t + \alpha_5 INF_t + \alpha_6 ENC_t + \varepsilon_t$ ……… (2)

The estimated short and long run Autoregressive Distributed Lag (ARDL) model is stated as:

$\Delta CO2_t = \alpha_0 + \sum_i^n = 0 \ \alpha_1 \Delta MPR_{t-1} + \sum_i^n = 0 \ \alpha_2 \Delta CRR_{t-1} + \sum_i^n = 0 \ \alpha_3 \Delta M2_{t-1} + \sum_i^n = 0 \ \alpha_4 \Delta EXR_{t-1} + \sum_i^n = 0 \ \alpha_5 \Delta INF_{t-1} + \sum_i^n = 0 \ \alpha_6 \Delta ENC_{t-1} + \alpha_7 ECM_{t-1} + \varepsilon_t$ …… (3)

Equation (3) is the short run model while Equation (2) is the long run model.

Where:

CO_2 = Carbon Emission

CO_{2t-1} = Value of the lagged Carbon Emission

MPR = Monetary policy rate

CRR = Cash reserve ratio

M2 = Money supply

EXR = Exchange rate

INF = Inflation rate

ENC = Energy Consumption

= changes

ECM ($_{-1}$) = Error correction term and negative coefficient is expected.

= lag values of variables

A priori expectation;

, > 0;, , < 0

3.2 Variables Measurement

Table 1 defines the variables used as well as the *a priori* expectation.

Table 1: Variables Measurement

S/N	Variables	Type	Measurement	Sign
1.	Carbon Footprint (CO2)	Dependent	Measure as CO2 emissions(metric tons per capita)	
2	Monetary Policy Rate (MPR)	Independent	As set by the Nigerian Monetary Authority (CBN)	-
3	Cash Reserve Ratio (CRR)	Independent	Calculated as a percentage of net demand and time liabilities	-
4.	Money Supply (M2)	Independent	Measure as broad money supply (M2) - measure of the quantity of money consisting of M1, plus savings & small time deposits, overnight commercial bank deposits, plus non-institutional money market accounts	+
5	Exchange Rate (EXR)	Independent	Measure as the exchange rate of naira to Dollar	-
6	Inflation Rate (INF)	Independent	measured as the annual change in the CPI; (CPIt – CPIt-1) / CPIt-1	-
7.	Energy Consumption (ENC)	Independent	Total e energy consumption	+

Source: Researcher's Compilation (2024).

4. Results and Discussion

4.1 Descriptive Statistics

To summarise the data, the basic characterization of the datasets is conducted using descriptive statistics. Table 2 shows the annualised summary data for all variables in the research for the period 1980 to 2021.

Table 2: Descriptive Statistics

	CO2	MPR	CRR	M2	EXR	INFR	ENC
Mean	0.689195	13.09756	6.060976	9847.270	107.1640	19.48829	729.1620
Median	0.667000	13.50000	1.300000	1599.490	111.9433	13.09000	721.8140
Maximum	0.874000	26.00000	22.50000	113303.5	358.8012	72.81000	803.4300
Minimum	0.457000	6.000000	0.000000	16.16000	0.610000	4.670000	671.9070
Std. Dev.	0.102038	3.945281	8.452807	19236.74	107.3382	17.14936	42.59893
Skewness	0.108465	0.669847	1.187882	3.978962	0.886773	1.679200	0.297525
Kurtosis	2.555896	4.535167	2.707056	21.57204	2.883152	4.668060	1.681209
Jarque-Bera	0.417323	7.092179	9.788879	697.4257	5.396826	24.02135	3.576043
Probability	0.811670	0.028837	0.007488	0.000000	0.067312	0.000006	0.167291
Sum	28.25700	537.0000	248.5000	403738.1	4393.726	799.0200	29895.64
Sum Sq. Dev.	0.416472	622.6098	2857.998	1.48E+10	460859.9	11764.03	72586.76
Observations	41	41	41	41	41	41	41

Source: Researcher's Computation (2024) Using E-views 9.0 Software.

The descriptive statistics result in Table 2 revealed that the ratio between mean and median for most of the variables is approximately one. The mean value of CO_2 emission is lower than that of the values of the monetary policy variables. This implies the average values of the monetary policy variables exceeded the CO_2 emission that is associated with these variables. There is a meaningful difference and changes between the maximum and minimum values. The Jaque-Bera statistics that considers the Skewness and Kurtosis values in its computation shows that CO_2 emission, exchange rate and energy consumption were normally distributed while the other variables are not normally distributed because their corresponding probability value is < 0.05. Hence, normalizing the deviation of these variables from their mean becomes imperative by ascertaining their stationarity status.

4.2 Correlation Analysis

It is critical to investigate the degree and direction of link between the variables in the study in advance. These investigations are carried out using correlation analysis. Table 3 shows the results of the correlation tests.

Table 3: Correlation Matrix

Correlation Probability	CO2	MPR	CRR	M2	EXR	INFR	ENC
CO2	1.000000						

MPR	0.008770	1.000000					
	0.9566	-----					
CRR	-0.379117	0.061851	1.000000				
	0.0145	0.7009	-----				
M2	-0.334921	-0.094965	0.507578	1.000000			
	0.0323	0.5548	0.0007	-----			
EXR	-0.569049	-0.018651	0.861093	0.536811	1.000000		
	0.0001	0.9079	0.0000	0.0003	-----		
INFR	0.295982	0.322631	-0.255148	-0.198526	-0.352790	1.000000	
	0.0603	0.0397	0.1074	0.2134	0.0237	-----	
ENC	-0.548367	-0.020110	0.776480	0.591892	0.874589	-0.359151	1.000000
	0.0002	0.9007	0.0000	0.0000	0.0000	0.0211	-----

Source: Researcher's Computation (2024) Using E-views 9.0 Software.

The correlation result in table 3 show that CRR, M2, EXR and ENC have significant negative relationship with CO_2. This implies that increase in these variables significantly reduced CO_2 during the studied period as indicated by their corresponding negative coefficients. However, MPR and INFR has a non-significant positive relationship with CO_2. This implies that increase in INFR insignificantly increased CO_2 emission during the studied period as indicated by their corresponding positive coefficients. The relationship between the independent variables follow similar pattern. Furthermore, table 3 also revealed the absence of multi co-linearity problem among explanatory variables since no correlation coefficient between explanatory variables is > 0.90 as suggested by Gujarati (2008).

4.3 Unit Root Testing

Time series data are always associated with the problem of non-stationarity. This could decrease the validity of forecast based on such data. In order to overcome this problem, this study used the standard Augmented Dickey-Fuller (ADF) test to examine the stationarity or otherwise of the data in this study. Consequently, the results of the estimated Augmented Dickey-Fuller (ADF) tests shown in the above table clearly indicate that data on the variables such as CRR, EXR and ENC were not stationary in their level form. However, carbon emission (CO_2), MPR, M2 and INFR were stationary at level. At the first difference, only credit to private all the variables were stationary. This implies that the data employed for the econometric analysis in this research are the combination of I(0) and I(1). As a consequence of the test results indicating that the variables are integrated of 1(0) and I(1) and that none of the variables are integrated of I(2) or higher, we proceed with the ARDL co-integration technique since it can cope with whether all variables are I(0), all are I(1), or a mixture of both. This implies performing a co-integration test utilising the ARDL co-integration bounds test approach proposed by Pesaran, Shin, and Smith (2001).

Table 4: Unit Root Test Result

	Augmented Dickey–Fuller (ADF) Test		
Variables	**At level**	**1st Difference**	**Order of Integration**
CO_2	-3.3965*	-9.7241*	I[0]
MPR	-3.3547*	-8.8093	I[0]
CRR	-0.1619	-7.1591*	I[1]
M2	-4.3881*	-7.278*	I[0]
EXR	1.7373	-4.8726*	I[1]
INFR	-3.2414**	-6.1285*	I[0]
ENC	-0.9345	-5.819*	I[1]

Note: * and ** indicate significance at 1 and 5 percent levels.
Source: Author's computations, (2024) using Eviews 9.0.

4.4 Bounds Tests for Co-integration

The criterion for the co-integration bounds test involves comparing F-statistics to critical values. The ARDL result in Table 5 indicates that the Null hypothesis of no long run relationship could not be rejected owing to the value in the upper and lower Critical Bounds at 10%, 5%, 2.5%, and 1% level of significance which is greater than the value of F-Statistic. As a result, the findings in Table 4 support none existence of a long-run link between carbon emission and the explanatory variables (MPR, CRR, M2, EXR, INF ENC). Thus, there is an absence of co-integrating relationship among the variables in the model. This outcome necessitates the estimation of only short run relationship among these variables.

Table 5: ARDL Bounds Test for Co-integration [ARDL(2, 0, 0, 0, 1, 2, 0)]

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	1.447388	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Author's computations, (2024) using Eviews 9.0.

4.5 ARDL Analysis (Short-Run Estimation)

Table 5 presents the ARDL results of the relationship between the monetary policy and carbon emission in Nigeria. It should be noted that MPR, CRR and INFR that did not follow aprori expectation among all the explanatory variables. The estimated results showed a non-significant positive value of the first and second lagged of dependent variable, CO_2(-1) and CO_2(-2). The implication of this result is that previous year carbon emissions increase the level of CO_2 in the current year. Meanwhile, it could be established that CO_2 and monetary policy rate have a direct relationship which is not significant at 1%, 2% and 5% level of significance. In the same vein, cash reserve ratio (CRR) and CO_2 inflows have a positive relationship which is not significant at 1%, 2% and 5% level of significance. A unit change in CRR brings about a rise in the level of CO_2 by 0.0007% in the country. However, Money supply (M2) has an insignificant positive relationship with CO_2. Similarly, inflation rate (INFR) and energy consumption (ENC) has an insignificant positive relationship with CO_2 while exchange rate (EXR), first and second lagged of EXR, EXR(-1) and EXR(-2) has an insignificant inverse relationship with CO_2. Hence, a unit change INFR and ENC increases CO_2 while a unit change in EXR, EXR(-1) and EXR(-2) reduces CO_2

level in the country. The result shows a R^2 of 0.558903 which indicates that about 55% of total variation in in the dependent variable (CO_2) is accounted for by the explanatory variables (i.e., MPR, CRR, M2, EXR, INF ENC). This result remains not too robust after adjusting for the degrees of freedom (df) as indicated by the value of adjusted R^2 , which is 0.379197 (i.e., approximately 37%). Thus, the regression does not have a very strong fit. The F-statistic, which is a test of explanatory power of the model is 3.11 with a corresponding probability value of 0.007947, is statistically significant at 1% level. This implies that the six explanatory variables (MPR, CRR, M2, EXR, INF ENC) have joint significant effect on the level of carbon emission in Nigeria. The Durbin-Watson statistic of 1.744126 indicates that we can completely rule out autocorrelation.

Table 6: Short-Run Error Correction Model Results

Short-Run Parameters			
Variables	Coeff.	t-stat	Prob.
CO2(-1)	0.250290	1.432978	0.1633
CO2(-2)	0.318475	1.618487	0.1172
MPR	0.005473	1.410383	0.1698
CRR	0.000714	0.215554	0.8310
M2	4.62E-07	0.554579	0.5837
EXR	-0.001323	-1.663613	0.1078
EXR(-1)	0.001160	1.490899	0.1476
INFR	0.000739	0.728382	0.4727
INFR(-1)	-0.001810	-1.637085	0.1132
INFR(-2)	0.001908	1.872509	0.0720
ENC	0.000208	0.292477	0.7722
C	0.065490	0.108789	0.9142
R-squared	0.558903		
Adjusted R-squared	0.379197		
F-statistic	3.110097		
Prob(F-statistic)	0.007947		
Durbin-Watson stat	1.744162		

Source: Author's computation, (2024) using E-views 9.0. Note: * indicate significance at 5% and 1% level, respectively.

4.6 Diagnostic and Stability Test

The following tests were performed to ensure the robustness, reliability, and validity of the ARDL results acquired from the empirical analysis: Jarque-Bera normalcy test, Ramsey RESET stability test, Breusch-Godfrey Serial Correlation LM test, and Breusch-Pagan-Godfrey heteroskedasticity test. The test results are shown in Table 6. The result in Table 6 shows that the probability values (0.2122) are greater than 0.05 ($p. > 0.05$); implying that the F-statistics value is not significant at 5% confidence level; this implies the absence of autocorrelation in the model. Similarly, Breusch-Godfrey Serial Correlation LM test results in in Table 6 shows that the probability values (0.3448) is greater than 0.05 ($p. > 0.05$) level of significance which imply that the F-statistics value is not significant at 5% confidence level; this implies that the model has no serial correlation problem (That is, there is no serial correlation between the independent variables and disturbance term). Also, Ramsey RESET test shows that the models are free of specification errors since both the probability of the t-statistic and F-statistic of the Ramsey RESET test in Tables 7 is greater than 0.05 ($p > 0.05$), hence, relevant variables were not omitted, the model was correctly specified in its linear form.

Table 7: Result of the diagnostic test for ARDL (2, 0, 0, 0, 1, 2, 0**)**

Diagnostic Tests (Test Statistics)	Test	Coefficient	P-value	Decision
Breusch-Pagan-Godfrey	Heteroskedasticity	1.8833	0.2122	No Heteroskedasticity problem
Breusch-Godfrey LM (F-Stat.)	Serial Correlation	1.0232	0.3156	No Serial correlation
Ramsey RESET Test	Model Specification Error:			Equation is correctly specified
	t-stat.	1.0232	0.3156	
	F-Stat.	1.0471	0.3156	

Source: Author's computation, (2024) using Eviews 9.0.

A stability test of the long run and short run coefficients using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) was performed. Accordingly, the parametric stability can be tested using cumulative of the recursive residuals (CUSUM) as well as the cumulative sum of squares of recursive residual (CUSUMQ) (Figures 1 and 2). CUSUM and CUSUMQ statistics are plotted against the critical bound of 5 per cent significance and if the plot of these statistics remains within the critical bound of 5 per cent significance level, the null hypothesis, which states that all coefficients in the error correction model are stable, cannot be rejected. In other words, if the blue line crosses redline which is critical line and never returns back between two critical line, we accept the null hypothesis of the parameter instability whereas the cumulative sum goes inside the area (can returns back) between the two critical lines, then there is parameter stability in the short-run and long-run. The null hypothesis is that the coefficient vector is the same in every period. As shown in the graphs, the plots of CUSUM and CUSUMQ residuals are within the boundaries. Thus, the plots of CUSUM and CUSUM SQURE test statistics rests neatly within the boundaries at 5% significant level. This implies that the parameters of the models have remained stable within its critical bounds. Hence, we can conclude that long-run estimates are stable and there is no structural break.

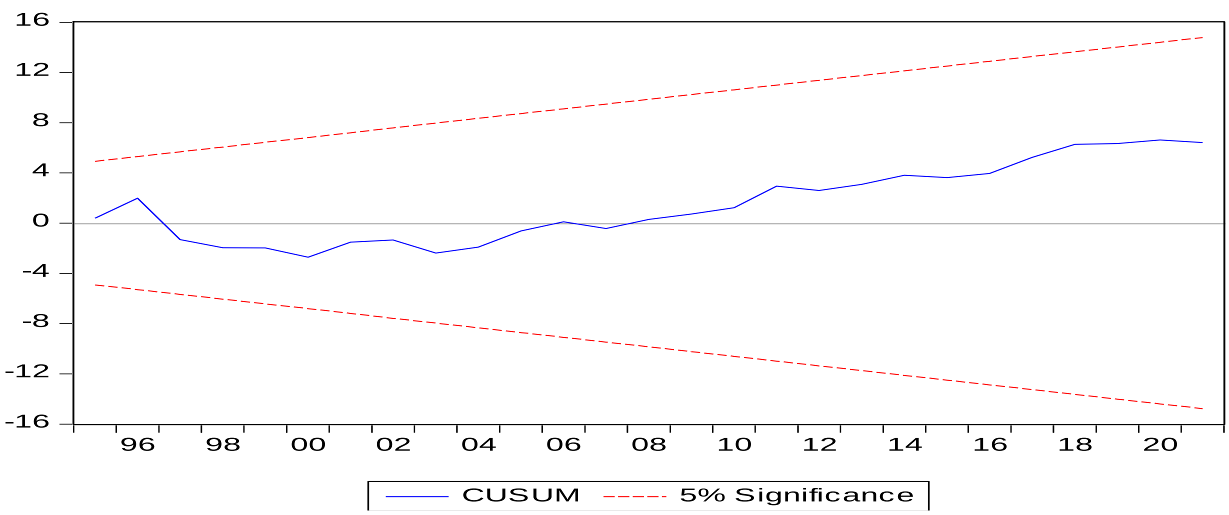

Figure 1: Plot of Cumulative Sum of Recursive Residuals - CUSUM
Source: Author's computation, (2024) using Eviews 9.0

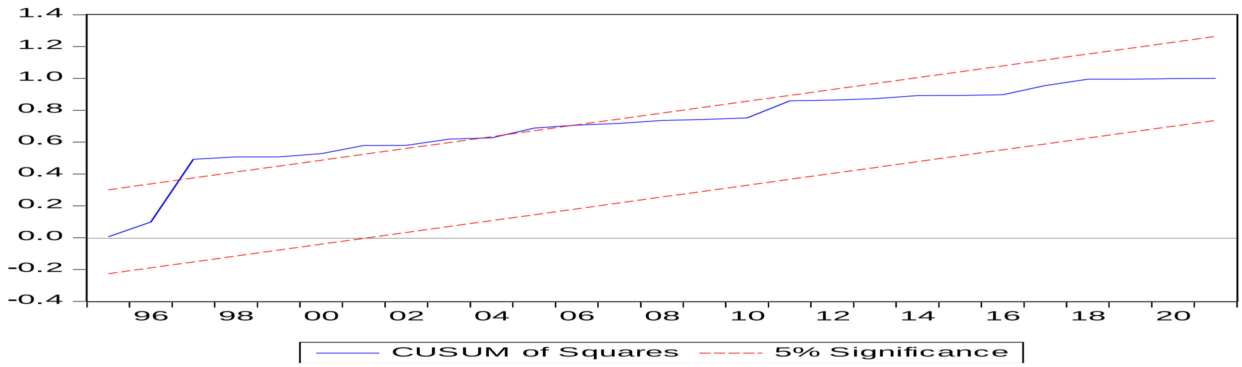

Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals - CUSUM SQUARE
Source: Author's computation, (2024) using Eviews 9.0.

4.7 Discussion of Findings

The effect of all the independent variables on carbon emission (CO_2) is insignificant, although in different magnitude. Monetary policy rate (MPR) has insignificant direct impact on carbon emission. Hence, the variable did no conform *to a priori* expectation. This implies that a unit increase in MPR lead to 0.005473 insignificant increases in CO_2 in Nigeria. Hence, monetary policy rate is not a key variable that influences CO_2 in Nigeria within the studied period. This is because of the insignificant relationship between the two variables. This result could not be validated by the submission of Siddhartha (2022) who attributed the level of CO_2 to interest rate. In the same vein, cash reserve ratio (CRR) and CO_2 inflows have a positive relationship which is not significant at 1%, 2% and 5% level of significance. A unit change in CRR brings about a rise in the level of CO_2 by 0.0007% in the country. This contradicts the finding of Vishal, et al., (2023) who reported a significant relationship between reserves and carbon emission. However, Money supply (M2) has an insignificant positive relationship with CO_2. The result is contrary to that of Wenji, et al., (2023) who reported a significant and direct link between Money supply and carbon emission. Similarly, inflation rate (INFR) and energy consumption (ENC) has an insignificant positive relationship with CO_2 while exchange rate (EXR), first and second lagged of EXR, EXR(-1) and EXR(-2) has an insignificant inverse relationship with CO_2. Hence, a unit change INFR and ENC increases CO_2 while a unit change in EXR, EXR(-1) and EXR(-2) reduces CO_2 level in the country. The implication of this finding is that these variables are not critical factors that influence carbon emission in Nigeria within the period under consideration.

5. Conclusion and Recommendations

In this study, the effect of monetary policy on carbon emission in Nigeria was examined. Carbon emission was represented as the CO_2 emissions (metric tons per capita) on annual basis, while monetary policy was proxied with monetary policy rate; cash reserve ratio and money supply. Exchange rate, inflation rate and energy consumption were considered as control variables. The autoregressive distributed lags (ARDL) technique was employed on annual data covering the period of 1981 to 2021. Finding reveals that monetary policy (monetary policy rate, cash reserve ration and money supply) as well as the control variables (exchange rate, inflation rate and energy consumption) exerts insignificant impact on carbon emission, hence they are not key variables that stimulate CO_2 emission in both the short and long run period. From the findings, this study concludes that monetary policy has no significant influence on carbon emission in Nigeria.

Recommendations

From the findings, the following policy recommendations are made:

1. Monetary authorities should consider the environment when implementing monetary policy in Nigeria. For example, the Central Bank of Nigeria may incentivize investments in energy-efficient equipment by tailoring its monetary instruments towards activities that encourages low-

carbon emission. Hence, environmental impacts should be incorporated into the central bank's framework. Examples include developing central banks' own climate risk assessments, and ensuring that climate risks are appropriately reflected in central banks' collateral frameworks and asset portfolios.

2. The government should come out with a clear policy to solving the climate related issue in Nigeria, coming up with such policy will encourage private businesses to do more in reducing carbon emission in Nigeria.

3. Also, Nigerian government is required to implement green monetary policy. Use monetary policy to implement a 'green lending programme' for commercial via the central bank.

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