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Inflation Threshold and Demand for Money Function in West Africa Monetary Zone (WAMZ) Countries: Implication for Inflation Targeting

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Abstract: Two macroeconomic policy options toward achieving a sustainable inflation threshold as well as a stable demand for money function which are capable of fostering pragmatic effort of achieving other macroeconomic goals within the West Africa Monetary Zone (WAMZ) countries, but not much has been achieved. This study examines inflation threshold and demand for money function in the West Africa monetary zone countries, providing insight into attaining the threshold level of inflation that is considered optimally reasonable for maintaining a stable demand for money function. The study employs a quantitative data analysis technique. Data used for this study are annual time series data spanning from 1980-2023 covering the West Africa monetary zone countries. The study employed the autoregressive distributed lag (ARDL) bound testing model to test for time series properties of the relevant data and the vector autoregressive (VAR) model to estimate the threshold level of inflation. Furthermore, error correction modeling (ECM) approach was explored to identify both the short-run and long-run impact of inflation threshold among other major determinants of demand for money function in selected countries in the West African monetary zone. The findings indicate that the expected specified demand for money function was stable and well behaved in the West African Monetary Zones countries. The result further showed that monetary expansion can be both inflationary and deflationary, depending on the country's economic structure and policy environment.

Keywords: Demand for Money, Inflation Threshold, WAMZ.

I. Introduction

Inflation threshold as a concept has become a common practice around the world, notably in the African continent. Inflation threshold is a framework for monetary policy, characterized by public announcement of official quantitative target(s) for the inflation rate over one or more times periods. Inflation threshold framework is the identification of a framework of a forward - looking and quantifiable inflation target upon which policy decisions are based. Since economic units often develop future expectations which influence their economic rationality, inflation threshold offers a more realistic guide to the desired path of economic development to central bankers. This derives from the major features of the inflation threshold framework, including the announcement of the set goals to the public, thereby eliciting a reasonable measure of commitments from monetary authorities. Central bankers are aware that public knowledge about the set target constitutes a bench mark by which the effectiveness of the policy is judge.

The demand for money function on the other hand refers to the relationship between the quantity of money that people wish to hold and various factors that influence their decision. According to Keynes, the theoretical relationship between demand for money and inflation threshold stems out of the decision for holding financial assets in the form of cash and bonds which is linked to the level of output rather than growth. Specific to the West African Monetary Zone (WAMZ), consideration given to adopting the inflation threshold framework needs thorough assessment given the region's macroeconomic quagmire and most importantly the readiness of the Central Banks to achieve agreed threshold, which invariably is critical to ascertaining confidence in the domestic economy. In this regard, transitioning from the current monetary aggregate regime (with price stability being the main objective and supported by a suite of forecast models) to something new will require an accurate and robust assessment of the wider implications of such a policy shift across the different sectors of the economy (Jackson, 2021).

Statement of the Problem

The implementation of inflation threshold in Africa especially within the West Africa Monetary Zone (WAMZ) countries has resulted in some increase in the inflation rate and, in some cases, achieving the target threshold in the WAMZ countries had coursed an increase in the inflation rate from 19.25% in 2009 to 22.49%, 23.37%, 23.92%, 24.21%, 25.12%, 25.72%, and 28.97% in 2014, 2016, 2017, 2018, 2019, 2020, and 2021 respectively.(World Bank,2023). However, the issue of attaining a sustainable inflation rate within the threshold level of 3% and 10% still remain a problem. Countries in WAMZ as import dependent economies where exchange rate movement have some potential influence on the inflation rate, established direct exchange rate pass through (ERPT) to domestic prices. Given the current monetary policy stance of the Central Banks, where commitment is made to price stabilization using the policy rate while allowing the exchange rate to float, continued currency depreciation tend to have negative impacts on domestic prices and inflation. The abysmal performance of the WAMZ countries currencies against the

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major trading currencies (US Dollar, Euro, and the British Pound) has generated debate among economist. In addition, governments fiscal operations policies especially inflationary financing of large budgetary deficits by the Central Banks in the selected countries posed serious challenges to monetary management. With exception of surplus of 2.92% recorded between 2001 and 2004, all other periods witnessed negative budget deficit. These fiscal deficits were occasioned by credits through ways and means advances from the Central Banks. The consequences of deficit financing have reflected in rapid growth of liquidity in these economies. For instance, both the growth of M1 and M2 became heightened between 2015 to date with 45.5% and 48.2% respectively while budget deficit average -12.90% being the highest of all periods of negative percents.

Despite the above policy interventions, most developing economies particularly countries from the West Africa region have been eluded by low and stable inflation targeting threshold for a very long time. In Nigeria, Ghana, Sierra Leone, Guinea, Senegal and Ivory Coast, for instance, inflation has continued and still posing a challenging treat to the realization of other crucial economic policy objectives given their oscillating behavior for over three decades. Further, it has been considered as a drag on the countries progress in the attainment of primary convergence criteria set by the West Africa Monetary Zone (WAMZ) for inflation threshold and stability of the demand for money. Thus, if inflation is a major obstacle in stabilizing the demand for money, then it readily follows that policy makers should aim at a low rate of inflation. At this juncture, the pertinent issues are: if inflation constitutes an unavoidable evil in the economy, how then can it be minimized? What level of inflation threshold is commensurate with stable demand for money? Attempt at solving the above raised issues largely depends on each country's initial conditions, policy environment as well as a host of other intervening factors which vary from one economy to another.

Although, a number of studies have been conducted on inflation threshold and demand for money function in the African region, for instance, Rangarajan, (2022) specifically examined the inflation threshold and demand for money in some selected Africa countries, but the study did not indicates the effects of inflation below a threshold level. Fielding, (2019), looked at inflation volatility and demand for money in Sub-Saharan Africa, but the study did not imply the effect of inflation on productivity, since demand for goods and services are meet by the supply. Adi & Riti (2014) examined the demand for real balances in six countries in the West Africa Monetary Zone (WAMZ), but the result of their study showed that real income and interest rate are not significant in explaining the threshold level of inflation. Faboya & Ajilore, (2018) who examined the existence of threshold effects in inflation and demand for money relationship using data for WAMZ for the period 1970 – 2010, but the study did not conclude on non-linearity of the inflation growth and stability of income. This study seeks to address the lacuna in the previous studies employing time series data spanning from 1980 to 2023 by examining the effect of inflation on economic growth, the stability of demand for money function on the inflation threshold and also analyzing the significance of real income and interest rate in explaining the threshold level of inflation.

While this study is similar to this latter strand of evidences, our study however charts a distinct path on a number of fronts. First, none of the studies on inflation thresholds conducted for WAMZ countries tested for time series properties of the variables used since most macroeconomic time series data are known to plagued by unit root problem. Thus, this paper expresses skepticism about the validity of the empirical results of most of these earlier studies. This skepticism is based upon the fact that it is now an agreed consensus that it is inappropriate to apply conventional econometric techniques to non stationary time series to estimate a regression with this type of data at best ignores important information about the underlying (statistic and economic) process of generating the data and at worst leads to spurious results. (Harris, 2018). Secondly this study analyzes the impact of inflation threshold on the stability of demand for money function in selected countries in the West Africa Monetary Zone (WAMZ) augmented with some growth determining variables like interest rate, exchange rate, foreign interest rate, government expenditure, nominal exchange rate and broad money which earlier studies conducted for WAMZ took for granted. Furthermore, this paper employed autoregressive distributed lag (ARDL) model and the vector auto regressive (VAR) model to test for Six WAMZ counties by carrying out individual country's specific test and also carried out structural break test for inflation threshold and the behavior of demand for money function in the WAMZ countries.

The broad objective of this study is to estimate inflation threshold and demand for money function in the West African Monetary Zone (WAMZ) countries. However, The following specific objectives would also be : achieved

1. To examine the determinant of demand for money function in the West African Monetary Zone (WAMZ) countries.
2. To ascertain the stability of demand for money function in the West African Monetary Zone (WAMZ) countries.
3. To examine the implication of demand for money function in determining the inflation threshold in the West African Monetary Zone (WAMZ) countries.

Having identified issues bordering on the subject matter under investigation, the study seeks to provide answers to the following basic research questions;

1. What are the determinants of demand for money function in the West African Monetary Zone (WAMZ) countries?
2. How stable is the demand for money function in the West African Monetary Zone (WAMZ) countries?
3. What implication does the demand for money function have on the determination of inflation threshold in the West African Monetary Zone (WAMZ) countries?

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II. Review of Related Literature

Conceptual Framework

Inflation threshold is a central banking policy that revolves around adjusting monetary policy to achieve a specified annual rate of inflation (CBN, 2014). This is known as the target rate which is normally set at around 2% to 10%. The principle of inflation threshold is based on the belief that long-term economic growth and financial stability is best achieved by maintaining stable prices which is achieved by controlling inflation.

Inflation threshold can be compared with other central bank operating targets, such price level targeting and nominal gross domestic product (GDP) targeting. Inflation threshold is a central bank strategy of specifying an inflation threshold as a goal and adjusting monetary policy to achieving that threshold (Robert, 2016).

The demand for money function on the other hand refers to the relationship between the quantity of money that people wish to hold and various factors that influence their decision. According to Black (2012), demand for money refers to the amount of money people wish to hold or the function determining this. In other words, it is referred to as the desire to hold cash. Omanukwe (2013) defined demand for money as the desire of holding of financial assets in the form of money that is, cash or bank deposits rather than investments. This definition implies that demand for money is not limited to cash holdings (as suggested by Black, 2003) but includes bank deposits in current and savings accounts that are not held for investment purposes.

Theoretical Review

Theories of Inflation Threshold

a. Keynesian Theory.

The Keynesian theory provides an explanation on a possible link between inflation and economic growth through aggregate demand and supply framework. According to this model, in the short run, the aggregate supply curve is characterized by upward sloping trend rather than vertical. But if the aggregate supply curve were to assume a vertical line, it then means that any changes on the demand side will only result into price changes. However, if it is upward sloping, changes in aggregate demand affect both prices and output, (Dornbusch, et al, 1996). This is made possible because many factors drive the inflation rate and the level of output in the short-run. These include changes in: expectations; labour force; prices of other factors of production, fiscal and/or monetary policy.

b. Neo-classical Theory.

The earliest neo-classical models was championed by Solow (1956) and Swan (1956). The variants of these models produce different conclusions on the nature of relationship between inflation-growth nexus. One such variants was articulated by Mundell (1963) who stated that an increase in inflation or inflation expectations immediately reduces people‘s wealth arising from a fall in the rate of return on individual‘s real money balances. Greater savings means greater capital accumulation and thus faster output growth. Tobin (1965) is another neoclassical economist, whose framework shows that a higher inflation rate permanently raises output level but the effect on output growth is temporary.

Theories of Demand for Money

a. Fisher’s Quantity Theory

Fisher’s quantity theory was proposed by Fisher (1911). According to Schmitt (2003), Fisher’s quantity theory of money states that there is a direct relationship between the quantity of money in an economy and the level of prices of goods and services. The mathematical relationship between money stock and price is popularly called the equation of exchange in Fisher’s theory.

Fisher’s analysis on the transactions velocity of circulation of money, which refers to the rate at which money passes from one hand to another, begins with a simple identity. There are always two parties to each transaction, represented by a seller and a buyer. This implies that the value of receipts for the aggregate economy must equal the value of sales.

b. Cambridge Cash Balance Version

A different approach to the theory of demand for money was developed by Cambridge economists such as Pigou (1917), Marshall (1920) and Keynes (1923). Keynes contribution to the cash balance version was through his 1923 tract on Monetary Reform (this treatise was written before the 1936 general theory that gave birth to Keynesians liquidity preference). The Cambridge economists advocated a quantity theory of money that paid more attention to money demand that the supply-oriented classical version. The Cambridge economists argued that a certain portion of money supply will not be used for transactions; instead, it will be held for the convenience and security of having cash in hand. In others words, the Cambridge cash balance emphasizes that money acts both as a store of wealth and a medium of exchange.

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Empirical Literature

2.2.1. Empirical Literature Review on Inflation Threshold.

Christofferson (2016) investigated the nonlinear relationship between inflation and growth for 22 transitional countries over the period from 1990 to 2010, using Sarrel's (1990) approach to modeling the kinked interaction between inflation level and economic growth. As a result, the study found that threshold level of inflation is 13%.The study did not find any evidence that output will rapidly increased by high inflation for countries that keep inflation below this threshold level. The result showed that policy makers should keep inflation at some specific threshold level where the favouable impact of inflation on growth performance is the highest.

Fischer et al (2018) investigated the link between inflation and growth in time – series, cross section and panel data set for a large numbers of African countries. The main result of these works is that there is a negative impact of inflation on growth. The study utilized domestic exchange rate, per capita income, consumer price index and terms of trade as explanatory variables. The result obtained shows that a negative relationship exists only when high inflation data were included in the sample. He further submitted through his estimation that 10% threshold of inflation reduces real GDP per capita by 0.2% per year.

Sarrel (2019) explored the relationship between inflation threshold and demand for money in Southern African countries using the Engel Gremger and JML technologies for the period 1980-2010. The study found the evidence of structural break in interaction between inflation and growth. The result shows that the estimated threshold level equals to 8 percent, exceeding which leads to negative, powerful and robust impact on inflation growth.

Kremer et al (2020) using time series data provides new evidence on the effect of inflation on long-run demand for money for a panel 63 industrial and non industrial countries. The empirical evidence show that inflation impedes growth if it exceed threshold of 2% for non-industrial and 12% for industrial countries respectively. The study however, indicates that below these thresholds, the effect of inflation on growth are positively significant.

Farin (2022) investigated the relationship between inflation and output for the economy of Tunisia where permanent inflationary shock has been observed for the last three decade 1990 to 2010. Using a bivariate vector auto-regressive composed of output growth and the change in inflation in order to test the hypothesis that inflation has long run impact on output. He also use the data for the same period to estimate the short run relationship between inflation and real output. The findings verify sidrauski's superneutrality of money which can be defined as inflation has no real effect on output in the short run.

Using the Ordinary Least Square (OLS) estimation method, Sriran (2013) investigated the demand for broad money function in the Gambia, utilizing monthly data from 1988 to 2007, using an error correction model. The dependent variable is real money balance, while the independent variables included real GDP, interest rates on deposits at the commercial banks, yields on the Treasury bill and expected inflation. The cointegration analysis showed that there is a long-run relationship between real money balance and its determinants. However, the result showed that variables such as foreign interest rates and expected depreciation were not significant determinants of real money demand in Gambia.

Tanu (2014) using quarterly data for the period 1978 to 2010 estimated the demand for money for real broad money (M3) in New Guinea with the aim of establishing its determinant and the functional stability. As most time series data non-stationary, which potentially may lead to the spurious regression problem, individual data series were tested for unit root using the Augmented Dickey Fulls (ADF) and Kwiatkowski-Philips-Schmidt-Shin (KPSS) tests. Showed that variables defined in levels are non-stationary but are stationary in first differences i.e. integrated of order.

Adi and Riti (2014) examined the demand for real money balances in the West Africa Monetary Zone (WAMZ) from 1985 to 2014, using panel cointegration technique. The result of the estimation showed that real income and inflation rate positively influenced broad money demand in the long-run. Further analysis showed that income elasticity was greater than unity in the long term and less than unity in the short-run. The result further showed that both the currency substitution and capital mobility hypothesis were confirmed for the long-run, but only the capital mobility hypothesis held in the short-run. The authors recommended that monetary aggregate should grow more slowly than economic growth so as to maintain price stability. Also, there is need for countries to maintain stable exchange rate and ensure a market driven interest rate policy.

Nehora and Adama (2022) examined the demand for broad money and its stability in Ghana. The study covered the period of 1990 to 2020, with annual time series M1, M2, GDP and interest rate, Johansen's cointegration approach and error correction mechanism were employed. The study estimated the results using two set of variables for real demand for money: M1 and M2. This was done given the assumption that the demand for money was equal to the supply of money. The results show that, GDP affects the level of demand for money in the long-run while the interest rate affects it in the short-run. The error correction term in each of the cases shows that 18% of the deviations in the real demand for money are corrected annually. The CUSUM tests of parameters stability showed that, the money demand functions was stable over the period and the chow test indicated that there was no structural breaks.

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Identified Research Gap

Having sourced empirical literature on the subject matter, it was discovered that there was a paucity of empirical works on inflation threshold and demand for money function across the globe. Thus, the few that were available were reviewed. However, none of these empirical works covered the West Africa Monetary Zone (WAMZ) countries. The majority were done for the euro zone, while some were carried out in some regions of Africa and Asia. The most recent empirical work on inflation threshold in the West Africa Monetary Zone (WAMZ) countries did not examine the existence of threshold effect in inflation and demand for money relationship, and did not conclude on non-linearity of the inflation growth and stability of money. This study seeks to address the lacuna in the previous studies by employing time series data spinning from 1980 to 2023 and examined the effect of inflation on growth, the stability for demand for money function on the inflation threshold and also analyzing the significance of real income and interest rate in explaining the threshold level of inflation.

III. Research Methodology

Given the type of data used in this study-cross-sational and time series-panel data analysis was used since it made if possible to address issues with autocorrelation and heteroskhedasticy that arise with pure time series analysis. Additionally, the techniques employed are of the three variations of panel analysis, which comprises fixed, random effect, or pooled Ordinary Least Squares; the selection which is based on diagnostic test such as the Huasman and Wald redundant tests.

Theoretical Framework

The theoretical framework for this study is anchored on the model quantity theory of demand for money. The monetarist demand theory advanced by Friedman (1956) has been viewed as a restatement of the classical quantity theory. As noted by Jhingan (2004), these classical economists did not explicitly formulate demand for money theory but they emphasized the transactions demand for money in terms of the velocity of circulation of money. This according to the classical economists, is because money acts as the medium of exchange and facilitates the exchange of goods and services. This views were expressed in the Fisher's equation of exchange.

$MV = PQ$

Where:

M= the quantity of money, V= its velocity of circulation, P= price level and Q= total output.

Here, MV= money supply, while PQ represents the demand for money.

At equilibrium, money demand (PQ) equals money supply (MV), Jhingan (2004) further noted that the underlying assumption in the equation of exchange is that people hold money for transactionary purposes and does not explain other motives for holding money. Friedman (1956) faulting the classical theory argued that money is held for purposes other than transactions purposes. According to Friedman (1956), investors can hold their wealth in the form of money, bonds, equity shares and commodities. He concludes that demand for money depends on rates of returns of the four assets and upon income.

Model Specification

Demand for Money Function Model

The model used in this study is an adopted form of the model specified in Friedman modern quantity theory (1956). The model is adopted for this as it embodies a number of variables similar to the variables of interest in this study and indicate some fundamental theoretical determinants of demand for real balances. Equation 3.1 is augmented to accommodate variables of demand for real balances and some other control variables so as to capture their impact on demand for money and its stability. The functional form of the model is given as;

$$M2 = F(RGDP, INFR, INTR, EXCH, FISDEF, GEXP) \quad 3.1$$

Where

M2 = real broad money, RGDP = real gross domestic product, INFR = Inflation rate, INTR = interest rate, EXCH = Exchange rate, FISDEF = Fiscal deficit, GEXP = Government expenditure, which typifies as a measure of fiscal dominance.

Mathematically, the model is specified as;

$$M2 = \beta_0 + \beta_1 RGDP + \beta_2 INFR + \beta_3 INTR + \beta_4 EXCH + \beta_5 FISDEF + \beta_6 GEXP \quad 3.2$$

The model can be restated in a stochastic form as:

$$M2 = \beta_0 + \beta_1 RGDP + \beta_2 INFR + \beta_3 INTR + \beta_4 EXCH + \beta_5 FISDEF + \beta_6 GEXP \quad 3.3$$

Where β_0 is the constant term or parameter intersect and β_1, β_2, β_3, β_4, β_5, β_6 are parameter estimates of real gross domestic product, inflation, interest rate, exchange rate, foreign interest rate and government expenditure respectively

Taking the natural logarithm for the model we have.

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$LnM2 = M2 = \beta_0 + \beta_1 LNRGDP + \beta_2 LNINFR + \beta_3 LNINTR + \beta_4 LNEXCH + \beta_5 LNFISDEF$

$+ \beta_6 LNGEXP$ 3.4

Inflation Threshold Model

From the demand for money function model, the money demand variables are treated as significant determinants of the inflation threshold model using the function of function rule. The model specification for this study is based on the popularized version of the DOLS procedure by Sims (1986; 1980), which is expressed in Equation 3.5. According to Brooks (2008), a dynamic ordinary least square is a systems regression model that comprises both univariate time series and simultaneous equations models in which all variables are treated as endogenous.

$INF\ GAP = F(MD) + EXCHR + GEXP + NEXCHR + M2 + YP(Y - Y) + FISDEF)$ 3.5

Where:

INF GAP= Inflation Gap (Difference between CPI and the targeted rate)(-)

MD = Money Demand Variables

EXCHR = Exchange Rate

GEXP = Government Expenditure

NEXCHR = Nominal Exchange Rate

M2 = Broad Money

YP (Y- Y_t) = Output Gap (Difference between trend from the composite index of economic activity and actual CIEA)

FISDEF = Fiscal Deficit

Mathematically, the model is specified as

$INF - GAP = F(MD) + EXCH + GEXP\ NEXCH + M2 + YP\ (Y - Y_t) + FISDEF$ 3.6

The model can be restated in a stochastic form as

$INF - GAP = \beta_0 + \beta_{1EXCHR} + \beta_{2GEXP} + \beta_{3NEXCHR} + \beta_{3M2} + \beta_{5YP} + \beta_{6FISDEF} + U$ 3.7

Where β_0 is the constant term or parameter intercept and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ are parameter estimates of exchange rate, government expenditure, nominal exchange rate, broad money, output gap and fiscal deficit respectively.

Taking the natural logarithm for the model we have

$LnINF = DD = \beta_0 + \beta_{1EXCHR} + \beta_{2GEXP} + \beta_{3NEXCHR} + \beta_{4M2} + \beta_{5YP} + \beta_{6FISDEF} + U$ 3.8

Where Ln = Natural Logarithm

The Logarithm is taken in order to allow for easy interpretation of their coefficient as elasticity

Presentation and Interpretation of Results

This section presents a comprehensive econometric analysis and an in-depth discussion of the study's findings. It is organized into two major premises. The first premise delves into the various factors that determine the demand for money, exploring how these variables interact within the economic framework. The second premise shifts focus to the determinants of inflation threshold, analyzing the key variables and conditions that influence the effectiveness of inflation- threshold policies among the selected countries under study

IV. Result Presentation and Analysis

Test Results of Demand for Money Function Determinants

This section presents the results of the demand for money function model for six African countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. the section presents the results of the, Descriptive Statistics, Correlation Matrix, Augmented Dickey-Fuller (ADF) test to examine the stationarity of the time series data. Following this, the section details the estimations from the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration, which identifies the presence and extent of a long-run equilibrium relationship between the variables. The discussion includes both the long-run and short-run dynamics derived from the model. Furthermore, the chapter evaluates the robustness and validity of the model through post-estimation diagnostic tests, including tests for heteroskedasticity, multicollinearity, and normality. These tests ensure the model's efficiency and reliability. Lastly, the stability of the econometric model is assessed using stability tests to verify the consistency of the results over time.

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Descriptive statistics

Table 4.2 provides a detailed overview of the economic performance of six West African countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. It presents descriptive statistics for key economic indicators, including broad money (M2), which is a proxy for demand for money, real GDP (RGDP), inflation rate (INFR), exchange rate (EXCH), fiscal deficit rate (FISD), and government expenditure as a percentage of GDP (GEXP) over period from 1980 to 2023. This table offers a snapshot of each country's economic landscape, highlighting both areas of strength and potential vulnerabilities.

Table 4.1: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Nigeria					
M2	44	17.27	6.32	9.10	28.60
RGDP(‘bn)	44	278.97	152.26	114.54	550.65
INFR	44	18.87	16.15	5.39	72.80
EXCH	44	17.02	4.88	8.40	31.60
FISD	44	126.08	144.01	0.55	638.70
GEXP	44	-1.45	3.25	-6.10	8.76
Ghana					
M2	44	23.60	6.57	11.30	34.10
RGDP	44	29.14	19.17	9.12	70.51
INFR	44	26.66	24.42	4.90	122.90
EXCH	44	16.47	7.19	8.89	35.76
FISD	44	1.65	2.46	0.00	11.02
GEXP	44	-4.65	3.21	-15.29	0.00
Sierra Leone					
M2	44	14.15227	8.647691	0	29.4
RGDP	44	3.056364	1.264231	1.72	5.58
INFR	44	30.94795	35.80175	-0.92	178.7
EXCH	44	0.1927273	17.06889	-51.62	27.15
FISD	44	3.353409	4.312431	0	21.3
GEXP	44	3.663636	9.271856	-8.9	20.08
Guinea					
M2	44	14.15	8.65	0.00	29.40
RGDP	44	3.06	1.26	1.72	5.58
INFR	44	30.95	35.80	-0.92	178.70
EXCH	44	0.19	17.07	-51.62	27.15
FISD	44	3.35	4.31	0.00	21.30
GEXP	44	3.66	9.27	-8.90	20.08
Gambia					
M2	44	25.17	10.59	15.10	52.20
RGDP	44	12.56	5.83	5.92	26.23
INFR	44	3.84	6.33	-4.10	32.30

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EXCH	44	9.81	2.02	5.80	13.00
FISD	44	482.24	133.00	211.28	732.40
GEXP	44	-3.22	2.94	-8.70	5.90

Liberia

M2	44	24.69	7.08	13.10	38.60
RGDP	44	33.59	14.08	20.54	71.99
INFR	44	4.23	4.79	-1.10	26.10
EXCH	44	10.86	5.41	2.50	16.80
FISD	44	482.24	133.00	211.28	732.40
GEXP	44	-4.26	2.02	-8.38	0.56

Note: M2= Demand for Money, EXCH=Exchange Rate, FISD= Fiscal Deficit Rate, GEXP=Government Expenditure, INFR= Inflation Rate, INTR=Interest Rate, RGDP=Real GDP

The statistics for Nigeria reveal a mixed economic performance. The average real GDP (RGDP) of $278.97 billion indicates a relatively large and growing economy, though with significant variability (standard deviation of $152.26 billion), reflecting periods of both rapid growth and slowdowns. The demand for money (M2) averages 17.27%, indicating moderate liquidity in the economy. However, Nigeria faces substantial inflationary pressures, with an average inflation rate (INFR) of 18.87%, and this has fluctuated widely, reaching as high as 72.80%. The exchange rate (EXCH) is moderately stable, with an average of 17.02 units, but the fiscal deficit rate (FISD) is concerning, averaging 126.08%. This high fiscal deficit, coupled with an average government expenditure (GEXP) slightly in deficit at -1.45% of GDP, suggests ongoing challenges in fiscal management and economic stability.

Ghana's economy, with an average RGDP of $29.14 billion, is smaller but shows substantial variability, indicating uneven growth. The demand for money (M2) is relatively high at 23.60%, which may reflect efforts to stimulate economic activity. However, Ghana experiences significant inflation, with an average rate of 26.66%, and extreme cases reaching as high as 122.90%. The exchange rate (EXCH) averages 16.47 units and shows more volatility than Nigeria's, reflecting currency instability. The fiscal deficit rate (FISD) is low at 1.65%, suggesting relatively better fiscal discipline. However, government expenditure (GEXP) is consistently in deficit, averaging -4.65% of GDP, indicating challenges in managing public finances effectively.

Sierra Leone's statistics indicate a small and vulnerable economy, with an average RGDP of just $3.06 billion. The demand for money (M2) is relatively low at 14.15%, but the inflation rate (INFR) is extremely high and volatile, averaging 30.95% and reaching as high as 178.70%, indicating severe inflationary pressures. The exchange rate (EXCH) data shows extreme volatility, with a mean of just 0.19 units but a standard deviation of 17.07, suggesting potential data issues or extreme currency instability. The fiscal deficit rate (FISD) is moderate at 3.35%, but government expenditure (GEXP) is more positive, averaging 3.66% of GDP, which could indicate efforts to stimulate the economy despite fiscal challenges.

Guinea’s economic profile is similar to Sierra Leone’s, with a small average RGDP of $3.06 billion. The demand for money (M2) is also low at 14.15%, but the inflation rate (INFR) is equally high and volatile, averaging 30.95% and peaking at 178.70%. The exchange rate (EXCH) is highly volatile, mirroring Sierra Leone’s situation, which may indicate significant currency instability. The fiscal deficit rate (FISD) is moderate at 3.35%, while government expenditure (GEXP) averages 3.66% of GDP, suggesting that the government is spending more than it earns, likely to address economic needs despite fiscal constraints.

Gambia displays a relatively higher demand for money, with M2 averaging 25.17%, reflecting greater liquidity in the economy. The average RGDP of $12.56 billion indicates a moderate-sized economy with some growth potential. Inflation (INFR) is relatively low, averaging 3.84%, but shows significant variability, indicating that inflation is generally under control but can fluctuate. The exchange rate (EXCH) is stable, averaging 9.81 units. However, Gambia fiscal deficit rate (FISD) is alarmingly high at 482.24%, suggesting severe fiscal imbalances. Despite this, government expenditure (GEXP) is in deficit, averaging -3.22% of GDP, highlighting the challenges the country faces in managing its public finances.

Liberia has a relatively large economy with an average RGDP of $33.59 billion. The demand for money (M2) is also relatively high at 24.69%, indicating a liquid financial environment. Inflation (INFR) is low and stable, averaging 4.23%, which is a positive sign of price stability. The exchange rate (EXCH) is moderately variable, with an average of 10.86 units. However, like Gambia, Liberia faces a severe fiscal deficit, with an average FISD of 482.24%, indicating major fiscal challenges. Government expenditure (GEXP) is consistently in deficit, averaging -4.26% of GDP, which could be contributing to the high fiscal deficit and pointing to difficulties in achieving fiscal sustainability.

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Each country displays unique economic challenges and strengths. Nigeria and Ghana, while having larger economies, face significant inflation and fiscal challenges. Sierra Leone and Guinea, with smaller economies, are more vulnerable to economic instability, particularly high inflation and volatile exchange rates. Gambia and Liberia, despite relatively stable inflation, struggle with severe fiscal deficits, indicating ongoing fiscal management issues. Overall, the data suggests that while some countries have achieved moderate economic growth, they all face substantial challenges in maintaining fiscal discipline and economic stability.

Correlation Matrix

Table 4.2 presents the correlation matrix for six West African countries—Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia—highlighting the relationships between key economic variables. The table examines the interplay between demand for money(M2), exchange rate (EXCH), fiscal deficit (FISD), government expenditure (GEXP), inflation rate (INFR), interest rate (INTR), and real GDP (RGDP). Understanding these correlations provides valuable insights into the economic dynamics within each country, revealing how fluctuations in one variable may influence others. This analysis is essential for identifying patterns and potential interdependencies that could impact monetary policy and economic stability across the region.

Table 4.2: Correlation Matrix

Nigeria	M2	EXCH	FISD	GEXP	INFR	INTR	RGDP
M2	1.00						
EXCH	0.71	1.00					
FISD	-0.44	-0.43	1.00				
GEXP	0.85	0.40	-0.38	1.00			
INFR	-0.26	-0.19	-0.17	-0.35	1.00		
INTR	-0.21	-0.14	-0.01	-0.29	0.38	1.00	
RGDP	0.84	0.39	-0.40	0.36	-0.28	-0.13	1.00
Ghana	M2	EXCH	FISD	GEXP	INFR	INTR	RGDP
M2	1.00						
EXCH	0.53	1.00					
FISD	-0.49	-0.61	1.00				
GEXP	-0.76	-0.31	0.33	1.00			
INFR	-0.43	-0.21	0.41	0.33	1.00		
INTR	-0.12	-0.37	0.18	-0.03	0.11	1.00	
RGDP	0.64	0.32	-0.75	-0.47	-0.39	-0.41	1.00
Sierra Leone	M2	EXCH	FISD	GEXP	INFR	INTR	RGDP
M2	1.00						
EXCH	-0.70	1.00					
FISD	0.34	-0.58	1.00				
GEXP	0.27	-0.49	0.40	1.00			
INFR	0.26	-0.27	0.41	0.47	1.00		
INTR	-0.18	0.16	-0.19	-0.44	-0.79	1.00	
RGDP	-0.73	0.41	-0.70	-0.39	-0.40	0.29	1.00
Guinea	M2	EXCH	FISD	GEXP	INFR	INTR	RGDP
M2	1.00						
EXCH	0.76	1.00					
FISD	0.21	0.33	1.00				
GEXP	0.52	0.04	-0.04	1.00			
INFR	-0.29	-0.49	-0.26	0.32	1.00		
INTR	-0.48	-0.01	0.00	-0.61	0.12	1.00	
RGDP	0.89	0.28	0.25	0.44	-0.42	-0.42	1.00

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Gambia	M2	EXCH	FISD	GEXP	INFR	INTR	RGDP
M2	1.00						
EXCH	0.38	1.00					
FISD	-0.36	0.44	1.00				
GEXP	0.96	0.25	-0.19	1.00			
INFR	-0.06	0.00	0.06	-0.11	1.00		
INTR	-0.91	-0.24	0.36	-0.84	0.04	1.00	
RGDP	0.96	0.36	-0.17	0.29	-0.16	-0.83	1.00
Liberia	M2	EXCH	FISD	GEXP	INFR	INTR	RGDP
M2	1.00						
EXCH	-0.33	1.00					
FISD	-0.47	0.02	1.00				
GEXP	0.37	0.39	-0.08	1.00			
INFR	0.12	-0.20	0.00	-0.32	1.00		
INTR	-0.25	-0.27	-0.01	-0.73	0.34	1.00	
RGDP	0.45	0.34	-0.14	0.27	-0.31	-0.69	1.00

Note: M2= Demand for Money, EXCH=Exchange Rate, FISD= Fiscal Deficit, GEXP

Government Expenditure, INFR= Inflation Rate, INTR=Interest Rate, RGDP=Real GDP

In Nigeria, there is a moderate negative correlation between the exchange rate and the fiscal deficit, while the exchange rate has a moderate positive correlation with government expenditure and a weak negative correlation with inflation and interest rates, Furthermore, the exchange rate shows a moderate positive correlation with real GDP. The fiscal deficit is moderately negatively correlated with both government expenditure and real GDP and shows a weak negative correlation with inflation, which is not significant. Government expenditure has a moderate negative correlation with inflation and a weak negative correlation with the interest rate, along with a moderate positive correlation with real GDP. Inflation shows a moderate positive correlation with the interest rate and a weak negative correlation with real GDP. Finally, there is a weak negative correlation between the interest rate and real GDP.

ADF Unit Root Test.

Although the bounds test for cointegration does not require all variables to be integrated of order 1 [I(1)], it is crucial to conduct stationarity tests to ensure that none of the variables are integrated of order 2 [I(2)]. If variables were I(2), the F-test would produce spurious results because the critical values for the F-statistics, as computed by Pesaran et al. (2001) and Narayan (2005), are based on the assumption that the variables are either I(0) or I(1).

To determine the order of integration of each variable, unit root tests were performed on both the original series and their first differences using the Augmented Dickey-Fuller (ADF) test. The ADF test was applied to both the levels of the variables and their first differences, examining the stationarity of the series under the assumptions of both a constant and a constant with trend. The null hypothesis in these tests posits that the series contains a unit root, while the alternative hypothesis suggests that the variable is stationary.

Table 4.3: ADF Unit Root Test Result

NIGERIA							
At Level			With Constant				
Variables	M2	RGDP	INFR	INTR	EXCH	FISD	GEXP
t-Statistic	-2.0922	0.6619	-2.6041	-2.6367	2.7783	-1.6695	-0.1844
Prob.	*0.2487*	*0.9898*	*0.1004*	*0.0942*	*1.0000*	*0.4390*	*0.9326*
	n0	*n0*	*n0*		*n0*	*n0*	*n0*
With Constant & Trend							
t-Statistic	-2.4029	-2.1941	-2.5783	-2.5691	2.6160	-1.9398	-2.9516

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Prob.	*0.3729*	*0.4775*	*0.2917*	*0.2957*	*1.0000*	*0.6162*	*0.1576*
	n0	*n0*	*n0*	*n0*	*n0*	*n0*	*n0*
At First Difference		With Constant					
Variables	d(M2)	d(RGDP)	d(INFR)	d(INTR)	d(EXCH)	d(FISD)	d(GEXP)
t-Statistic	-4.9542	-3.6100	-3.0658	-5.5108	-3.5084	-13.6286	-4.6309
Prob.	*0.0002*	*0.0097*	*0.0381*	*0.0000*	*0.0390*	*0.0000*	*0.0005*
	***	***	**	***	**	***	***
		With Constant & Trend					
t-Statistic	-4.9681	-3.8267	-3.0373	-5.8380	-0.7888	-13.5081	-4.6618
Prob.	*0.0013*	*0.0248*	*0.0362*	*0.0001*	*0.0382*	*0.0000*	*0.0029*
	***	**	**	***	**	***	***
GHANA							
At Level			With Constant				
Variables	M2	RGDP	INFR	INTR	EXCH	FISD	GEXP
t-Statistic	-1.2770	2.3812	-5.0289	-1.7762	3.0019	-0.6872	-1.5067
Prob.	*0.6317*	*0.9999*	*0.0002*	*0.3870*	*1.0000*	*0.8380*	*0.5207*
	n0	*n0*	*n0*		*n0*	*n0*	*n0*
With Constant & Trend							
t-Statistic	-2.4814	-0.8055	-4.0115	-2.0725	3.0184	-4.9319	-1.8086
Prob.	*0.3353*	*0.9569*	*0.0158*	*0.5459*	*1.0000*	*0.0014*	*0.6832*
	n0	n0	**	n0	n0	***	n0
At First Difference		With Constant					
Variables	d(M2)	d(RGDP)	d(INFR)	d(INTR)	d(EXCH)	d(FISD)	d(GEXP)
t-Statistic	-6.8896	-3.0341	-5.0498	-6.5798	3.5123	-4.9344	-6.4912
Prob.	*0.0000*	*0.0398*	*0.0002*	*0.0000*	*0.0000*	*0.0003*	*0.0000*
	***	**	***	***	***	***	***
		With Constant & Trend					
t-Statistic	-6.8639	-3.1066	-5.1683	-6.6615	-5.2419	-4.6694	-6.5564
Prob.	*0.0000*	*0.0305*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	***	**	***	***	***	***	***
SIERRA LEONE							
At Level			With Constant				
Variables	M2	RGDP	INFR	INTR	EXCH	FISD	GEXP
t-Statistic	-1.3138	2.3812	-1.6008	-4.1094	-1.1723	-2.2006	-1.3878
Prob.	*0.6147*	*0.9999*	*0.4731*	*0.0028*	*0.6757*	*0.2090*	*0.5794*
	n0	n0	n0	***	n0	n0	n0
With Constant & Trend							
t-Statistic	-2.2249	-0.8055	-2.3960	-1.8529	2.2032	-3.3347	-1.8847
Prob.	*0.4643*	*0.9569*	*0.3761*	*0.6594*	*1.0000*	*0.0743*	*0.6451*
	n0	n0	n0	n0	n0	*	n0

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At First Difference		With Constant					
Variables	d(M2)	d(RGDP)	d(INFR)	d(INTR)	d(EXCH)	d(FISD)	d(GEXP)
t-Statistic	-7.3422	-3.0341	-2.5271	-6.8498	-5.7068	-8.8126	-6.2903
Prob.	*0.0000*	*0.0398*	*0.0384*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
	***	**	**	***	***	***	***
		With Constant & Trend					
t-Statistic	-7.2943	-4.7123	-5.5177	-3.5847	-4.9068	-8.7015	-6.2146
Prob.	*0.0000*	*0.0025*	*0.0004*	*0.0443*	*0.0000*	*0.0000*	*0.0000*
	***	***	***	**	***	***	***
GUINEA							
At Level			With Constant				
Variables	M2	RGDP	INFR	INTR	EXCH	FISD	GEXP
t-Statistic	0.3608	4.1293	-2.9404	-2.3425	-2.7132	-4.7269	-1.9452
Prob.	*0.9786*	*1.0000*	*0.0490*	*0.1639*	*0.0805*	*0.0004*	*0.3092*
	n0	n0	**	n0		***	n0
With Constant & Trend							
t-Statistic	-2.5732	2.4601	-3.3557	-2.2779	-2.2883	-4.8309	-2.3494
Prob.	*0.2939*	*1.0000*	*0.0711*	*0.4362*	*0.4306*	*0.0018*	*0.3995*
	n0	n0	*	n0	n0	***	n0
At First Difference		With Constant					
Variables	d(M2)	d(RGDP)	d(INFR)	d(INTR)	d(EXCH)	d(FISD)	d(GEXP)
t-Statistic	-6.0757	-4.2524	-8.9784	-7.8708	-4.5247	-4.7847	-6.5439
Prob.	*0.0000*	*0.0325*	*0.0000*	*0.0000*	*0.0008*	*0.0004*	*0.0000*
	***	**	***	***	***	***	***
		With Constant & Trend					
t-Statistic	-6.1953	-3.2972	-8.8849	-7.8415	-5.0388	-4.8084	-6.5791
Prob.	*0.0000*	*0.0807*	*0.0000*	*0.0000*	*0.0010*	*0.0022*	*0.0000*
	***		***	***	***	***	***
GAMBIA							
At Level			With Constant				
Variables	M2	RGDP	INFR	INTR	EXCH	FISD	GEXP
t-Statistic	3.1371	6.9850	-4.5003	-1.0565	-2.1404	-2.4641	4.5271
Prob.	*1.0000*	*1.0000*	*0.0008*	*0.7231*	*0.2305*	*0.1311*	*1.0000*
	n0	n0	***	n0	n0	n0	n0
With Constant & Trend							
t-Statistic	0.0722	1.6505	-4.5714	-3.6512	-2.2475	-2.4187	3.1041
Prob.	*0.9960*	*1.0000*	*0.0036*	*0.0373*	*0.4524*	*0.3652*	*1.0000*
	n0	n0	***	**	n0	n0	n0
At First Difference		With Constant					
Variables	d(M2)	d(RGDP)	d(INFR)	d(INTR)	d(EXCH)	d(FISD)	d(GEXP)

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t-Statistic	-4.9275	-1.5046	-6.4727	-3.9504	-6.0062	-8.2058	1.7744
Prob.	*0.0002*	*0.5213*	*0.0000*	*0.0279*	*0.0000*	*0.0000*	*0.9996*
.	***	n0	***	**	***	***	n0
		With Constant & Trend					
t-Statistic	-6.2418	-5.8668	-6.5189	-3.8780	-5.9552	-8.2095	-6.0361
Prob.	*0.0000*	*0.0001*	*0.0000*	*0.0372*	*0.0001*	*0.0000*	*0.0001*
	***	***	***	**	***	***	***
LIBERIA							
At Level			With Constant				
Variables	M2	RGDP	INFR	INTR	EXCH	FISD	GEXP
t-Statistic	-2.0408	6.0654	-4.7258	-0.8897	-2.1404	-2.9539	6.6882
Prob.	*0.2689*	*1.0000*	*0.0004*	*0.7821*	*0.2305*	*0.0477*	*1.0000*
	n0	n0	***	n0	n0	**	n0
With Constant & Trend							
t-Statistic	-0.5991	1.0119	-4.9630	-1.8831	-2.2475	-2.9305	2.5400
Prob.	*0.9740*	*0.9998*	*0.0012*	*0.6459*	*0.4524*	*0.1637*	*1.0000*
	n0	n0	***	n0	n0	n0	n0
At First Difference		With Constant					
Variables	d(M2)	d(RGDP)	d(INFR)	d(INTR)	d(EXCH)	d(FISD)	d(GEXP)
t-Statistic	-5.7749	-3.3256	-6.6859	-5.7107	-6.0062	-6.0715	-3.1386
Prob.	*0.0000*	*0.0304*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0313*
	***	**	***	***	***	***	**
		With Constant & Trend					
t-Statistic	-5.8128	0.4752	-6.7657	-5.7011	-5.9919	-6.1482	-3.2835
Prob.	*0.0000*	*-3.8122*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.5777*
	***	**	***	***	***	***	**

Notes: Null Hypothesis: the variable has a unit root

a: (**) Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on AIC

c: Probability based on MacKinnon (1996) one-sided p-values.

The results, presented in Tables 4.3, indicate that stationarity could not be achieved for the variables at their levels. However, after differencing the variables once, all the variables were found to be stationary at the 5% significance level for all the countries under study. The ADF tests applied to the first differences of the data series rejected the null hypothesis of non-stationarity for all variables. Therefore, it can be concluded that none of the variables used in this study are I(2).

Lag Selection Criteria

Before estimating the Autoregressive Distributed Lag (ARDL) model, it is crucial to determine the appropriate number of lags to include in the regression. The optimal number of lags can be selected using the lag length criteria presented in Table 4. As a general rule, the model with the lowest value for these criteria is considered the most suitable.

Table 4.4: Optimal Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
NIGERIA						

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0	-98.88505	NA	8.659153	4.994526	5.242765	5.085515
1	-87.30570	19.29891*	5.238366*	4.490748*	4.780359*	4.596902*
2	-86.69276	0.992390	5.344200	4.509179	4.840164	4.630498
GHANA						
0	-131.0626	NA	40.08031	6.526795	6.775033	6.617784
1	-97.33425	56.21406*	8.444873*	4.968298*	5.257909*	5.074452*
2	-96.97528	0.581185	8.720321	4.998823	5.329808	5.120142
SIERRA LEONE						
0	-150.7177	NA	102.1905	7.462748	7.710986	7.553737
1	-113.8533	61.44059*	18.54469*	5.754921*	6.044533*	5.861076*
2	-113.2515	0.974312	18.92942	5.773884	6.104869	5.895203
GUINEA						
0	-108.8856	NA	13.94102	5.470745	5.718983	5.561734
1	-81.6861	45.33243*	4.708484*	4.223151*	4.512763*	4.329305*
2	-81.4639	0.359813	4.166268	4.260188	4.591172	4.381507
GAMBIA						
0	-76.8333	NA	3.029920	3.944445	4.192684	4.035435
1	-67.4486	15.64192*	3.734834*	3.545152*	3.834764*	3.651306*
2	-67.4426	0.008966	2.136867	3.592508	3.923492	3.713827
LIBERIA						
0	-103.7647	NA	10.92422	5.226891	5.475130	5.317881
1	-87.0009	27.93961*	5.162896*	4.476236*	4.765847*	4.582390*
2	-86.8800	0.195757	5.392076	4.518097	4.849082	4.639416
	* indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion					

Table 4.4 presents the lag length selection criteria, which indicate different optimal lag lengths. The LR test statistic (LR), final prediction error (FPE), Akaike information criterion (AIC), and Schwarz information criterion (SC) all identify lag one as the optimal lag across the six countries analyzed. These criteria are essential for selecting the best lag length to ensure model accuracy and reliability. More also, Ogbokor (2015) noted that optimal lag selection is crucial for determining the number of lag periods to include in a time series model. McCamel (2017) further supports this approach by noting that a lower AIC value signifies a better model. Consequently, the study adopts AIC lag one as the optimal lag.

ARDL Bound Test for Cointegration

After identifying the order of integration and selecting the optimal lag length using relevant criteria, the study utilizes the ARDL approach to cointegration. This method is employed to thoroughly analyze and determine the long-term equilibrium relationships among the variables, providing insights into how they are interconnected over an extended period. The results of the ARDL bound test for the countries under study are presented in table 4.5

Result of ARDL F-Bound Test

Nigeria				
Test Statistic	Value	Signif.	I(0)	I(1)

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F-statistic	4.472022	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Ghana

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.036543	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Sierra Leone

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.916857	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Guinea

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.283021	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Gambia

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.021261	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Liberia

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.461970	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

At the 5% significance level, the ARDL F-Bound Test results in Table 4.5 reveal the existence of a long-run equilibrium relationship among the economic variables in Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. The F-statistics for each country exceed the critical upper bound value of 3.28, indicating that these economies exhibit cointegration among key macroeconomic indicators. This implies that variables such as demand for money, exchange rates, fiscal deficits, government

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expenditures, inflation rates, and real GDP are interconnected in a way that they move together over the long term. The rejection of the null hypothesis of no cointegration underscores the presence of a stable, long-run relationship, which is essential for understanding the dynamics of economic policy and for modeling the error correction mechanism to adjust short-term disequilibria.

Model Estimation and Evaluation

This section provides an econometric analysis using the ARDL model to assess both the long-run and short-run dynamics of key economic variables for the six countries under study: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. By exploring these effects, the analysis captures how these economies respond to changes in fundamental indicators over time, offering insights into both their immediate and sustained impacts

ARDL Model of Long-run Effect

Table 4.6 presents the results from the ARDL (Autoregressive Distributed Lag) model estimation, highlighting the long-run effects of various macroeconomic variables on the demand for money (M2) across the WAMZ countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. The variables considered include Real GDP (RGDP), Inflation Rate (INFR), Interest Rate (INTR), Exchange Rate (EXCH), Fiscal Deficit (FISD), and Government Expenditure (GEXP).

Table 4.6: Result of ARDL Model Estimation for Longrun Effect

Dependent Variable: M2				
Nigeria				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	0.022731	0.011298	2.011881	0.0460
INFR	-0.039445	0.009979	-3.952739	0.0001
INTR	-0.285074	0.118923	-2.397131	0.0171
EXCH	-0.004952	-0.002118	2.338541	0.0201
FISD	0.091595	0.244667	0.374366	0.7082
GEXP	0.029449	0.012685	2.321503	0.0213
Ghana				
RGDP	0.025098	0.217696	-3.115290	0.0019
INFR	-0.167991	0.150293	-1.117759	0.2639
INTR	-0.394314	0.444552	0.886991	0.3753
EXCH	-1.543164	4.055120	3.380547	0.0008
FISD	0.810932	1.315803	2.616302	0.0090
GEXP	0.450028	-0.372355	-3.208601	0.0014
Sierra Leone				
RGDP	0.334495	0.114991	2.908882	0.0037
INFR	-0.247593	0.100048	-2.474733	0.0135
INTR	0.345732	0.146471	2.360406	0.0184
EXCH	0.191210	0.255103	0.749539	0.4537
FISD	0.230748	1.308511	0.176344	0.8601
GEXP	0.682290	0.200127	3.409285	0.0007
Guinea				
RGDP	0.122446	0.028186	4.344160	0.0000

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INFR	-0.114852	0.332964	-0.344938	0.7301
INTR	-0.439445	0.123232	-3.566001	0.0004
EXCH	-0.828917	0.241507	-3.432266	0.0006
FISD	0.302259	0.101509	2.977661	0.0029
GEXP	0.283611	0.131568	2.155620	0.0311
Gambia				
RGDP	0.952686	0.323593	2.944086	0.0032
INFR	-0.411272	0.132791	-3.097138	0.0020
INTR	-0.134610	0.058716	-2.292561	0.0219
EXCH	-0.019054	0.012180	-1.564375	0.1178
FISD	0.040375	0.385637	0.104697	0.9166
GEXP	0.167199	0.080442	2.078510	0.0377
Liberia				
RGDP	0.123739	0.035435	3.491969	0.0174
INFR	-0.207658	0.058467	-3.551737	0.0164
INTR	-0.240033	0.524131	-0.457964	0.6662
EXCH	-0.043046	0.013346	-3.225468	0.0233
FISD	0.067657	0.019996	3.383492	0.0196
GEXP	0.132717	0.038421	3.454244	0.0182

Note: M2= Demand for Money, EXCH=Exchange Rate, FISD= Fiscal Deficit, GEXP

Government Expenditure, INFR= Inflation Rate, INTR=Interest Rate, RGDP=Real GDP

The summary of the ARDL long-run result as presented in table 4.6 revealed that in Nigeria, the coefficient for Real GDP (RGDP) is 0.022731, indicating that a 1% increase in RGDP leads to a 0.02% increase in the demand for money (M2). The coefficient for the inflation rate (INFR) is -0.039445, meaning a 1% rise in inflation decreases the demand for money by 0.04%. For the interest rate (INTR), the coefficient is -0.285074, showing that a 1% increase in the interest rate results in a 0.29% decrease in M2. The exchange rate (EXCH) has a coefficient of -0.004952, which implies a 0.005% decrease in M2 for a 1% increase in the exchange rate. Government expenditure (GEXP) has a positive coefficient of 0.029449, indicating a 0.03% increase in M2 for a 1% rise in government spending. The fiscal deficit (FISD) has a coefficient of 0.091595, but it is not statistically significant.

ARDL Model of Short-run Effect

The ARDL model estimation results in Table 4.7 present valuable insights into how various macroeconomic variables influence the short-run dynamics of Money Demand (M2) in Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. Key variables analyzed include Real GDP (RGDP), Inflation Rate (INFR), Interest Rate (INTR), Exchange Rate (EXCH), Fiscal Deficit (FISD), and Government Expenditure (GEXP). The error correction term, denoted as CointEq(-1), captures the speed at which deviations from the long-run equilibrium are corrected.

Table 4.7: Result of ARDL Model Estimation for Short-run Effect

Dependent Variable: D(M2)				
Nigeria				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP)	0.267808	0.110963	2.413479	0.0160
D(INFR)	-0.015159	-0.022850	0.663419	0.5072
D(INTR)	-0.125460	-0.061468	2.041077	0.0415

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D(EXCH)	-0.050215	-0.024790	2.025616	0.0431
D(FISD)	-0.193282	0.094396	-2.047564	0.0409
D(GEXP)	0.016807	0.006601	2.546078	0.0110
CointEq(-1)*	-0.784362	0.098993	-7.923403	0.0000
R-squared	0.703775	F-stat.	32.47931	
Adjusted R-squared	0.694404	Prob(Fstat.)	0.000000	
Durbin-Watson stat	2.264268			

Ghana

D(RGDP)	0.176270	0.013787	2.874457	0.0041
D(INFR)	-0.042159	0.105249	-3.057990	0.0023
D(INTR)	-0.005689	0.773290	-0.054053	0.9569
D(EXCH)	0.179258	-0.027234	0.231812	0.8167
D(FISD)	0.065559	-0.010037	-2.407266	0.0163
D(GEXP)	0.021800	0.147021	-2.172032	0.0301
CointEq(-1)*	-0.551385	0.067029	-3.750387	0.0008
R-squared	0.653429	F-stat.	32.97698	
Adjusted R-squared	0.645667	Prob (Fstat.)	0.000000	
Durbin-Watson stat	2.003614			

Sierra Leone

D(RGDP)	0.211130	0.085883	2.458333	0.0141
D(INFR)	-0.020259	0.019730	-1.026822	0.3048
D(INTR)	-0.088745	0.036106	-2.457916	0.0141
D(EXCH)	-0.547844	0.507146	-1.080249	0.2803
D(FISD)	0.043827	0.090921	0.482034	0.6299
D(GEXP)	0.061595	0.018413	3.345254	0.0009
CointEq(-1)*	-0.526538	0.033269	-3.803452	0.0007
R-squared	0.665190	F-stat.	20.92997	
Adjusted R-squared	0.659389	Prob (Fstat.)	0.000000	
Durbin-Watson stat	2.460675			

Guinea

D(RGDP)	0.627107	0.137850	4.549198	0.0001
D(INFR)	-0.111643	0.029335	-3.805837	0.0007
D(INTR)	-0.162310	0.052554	-3.088427	0.0044
D(EXCH)	-0.443108	0.827386	-0.535552	0.5964
D(FISD)	0.252192	0.036579	6.894502	0.0000
D(GEXP)	0.492521	0.207789	2.370291	0.0246
CointEq(-1)*	-0.619371	0.018190	-6.562496	0.0000
R-squared	0.701243	F-stat.	137.0457	
Adjusted R-squared	0.691451	Prob (Fstat.)	0.000000	
Durbin-Watson stat	2.564446			

Gambia

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D(RGDP)	0.963399	0.447215	2.154217	0.0312
D(INFR)	-0.040745	0.013360	-3.049847	0.0023
D(INTR)	-0.691677	0.320028	-2.161304	0.0307
D(EXCH)	-0.000916	0.003983	-0.229969	0.8181
D(FISD)	0.053520	0.115468	0.463506	0.6431
D(GEXP)	0.395675	0.130892	3.022907	0.0025
CointEq(-1)*	-0.534622	0.100440	-5.322808	0.0000
R-squared	0.585325	F-stat.	381.0632	
Adjusted R-squared	0.511212	Prob (Fstat.)	0.000000	
Durbin-Watson stat	1.971800			

Liberia

D(RGDP)	0.812623	0.236062	3.442416	0.0006
D(INFR)	-0.102032	0.056846	-1.794881	0.0727
D(INTR)	-0.229108	0.066294	-3.455954	0.0006
D(EXCH)	-0.005439	0.005594	-0.972285	0.3309
D(FISD)	0.145043	0.038854	3.732993	0.0002
D(GEXP)	0.745993	0.169126	4.410864	0.0001
CointEq(-1)*	-0.571658	0.012418	-5.770569	0.0000
R-squared	0.569552	F-stat.	43.53466	
Adjusted R-squared	0.557810	Prob (Fstat.)	0.000000	
Durbin-Watson stat	2.350027			

Note: M2= Demand for Money, EXCH=Exchange Rate, FISD= Fiscal Deficit, GEXP

Government Expenditure, INFR= Inflation Rate, INTR=Interest Rate, RGDP=Real GDP

Post Estimation Test

This section details the residual diagnostic tests conducted on the econometric models for Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. These diagnostic tests are crucial for assessing the robustness and reliability of the models. They include the Breusch-Godfrey Serial Correlation LM Test to check for serial correlation, the Breusch-Pagan-Godfrey test to evaluate heteroscedasticity, and the Jarque-Bera test to ensure the normality of residuals.

Table 4.8: Residual Diagnostic Test

Test	**F-statistics**	**Obs* R-squared**	**Probability**
Nigeria			
Serial Correlation	0.158360	0.581875	0.7476
Heteroscedasticity	1.902338	22.92420	0.3988
Normality Test(Jarque-Bera)	0.709869	*******	0.7012
Ghana			
Serial Correlation	2.733824	7.241327	0.4268
Heteroscedasticity	0.575445	8.817616	0.7866
Normality Test(Jarque-Bera)	25.2302	*******	0.2684
Sierra Leone			
Serial Correlation	0.278392	0.952281	0.6212
Heteroscedasticity	1.499255	19.47935	0.1928

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Normality Test(Jarque-Bera)	2.388461	*******	0.3029
Guinea			
Serial Correlation	0.195152	0.502633	0.7778
Heteroscedasticity	0.676768	10.00883	0.6932
Normality Test(Jarque-Bera)	0.439406	*******	0.8027
Gambia			
Serial Correlation	1.619883	4.606845	0.2999
Heteroscedasticity	0.942916	12.77549	0.4653
Normality Test(Jarque-Bera)	6.45432	*******	0.0796
Liberia			
Serial Correlation	1.472638	4.229278	0.1207
Heteroscedasticity	1.037674	13.65175	0.3988
Normality Test(Jarque-Bera)	0.020504	*******	0.9898

The residual diagnostic tests as presented in table 4.8 for Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia indicate that the econometric models used are generally well-specified, with no significant issues related to serial correlation, heteroscedasticity, or non-normality of residuals.

Model Stability Test

The stability test was conducted to determine whether the parameters of the model are consistent across the different data samples used in the study. The Cumulative Sum (CUSUM) test and the Cumulative Sum of Squares (CUSUM Squares) test, as proposed by Brown et al. (1975), were applied. Figure 4.1 shows the results of these tests for the six countries under study: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia.

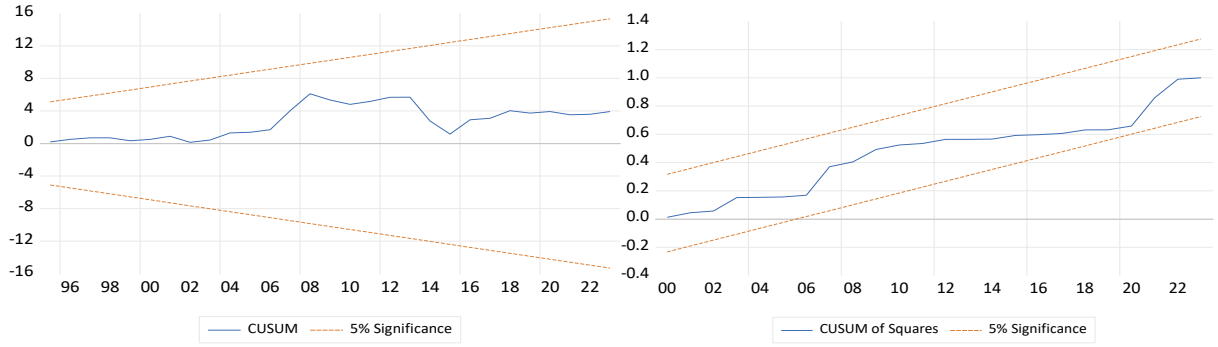

Figure 4.1(i) Cusum and Cusum of Squares Plot for Nigeria

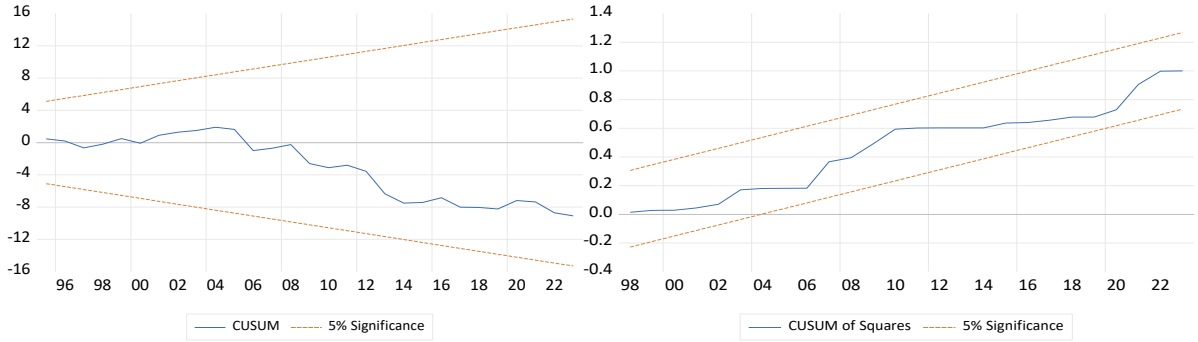

Figure 4.1(ii) Cusum and Cusum of Squares Plot for Ghana

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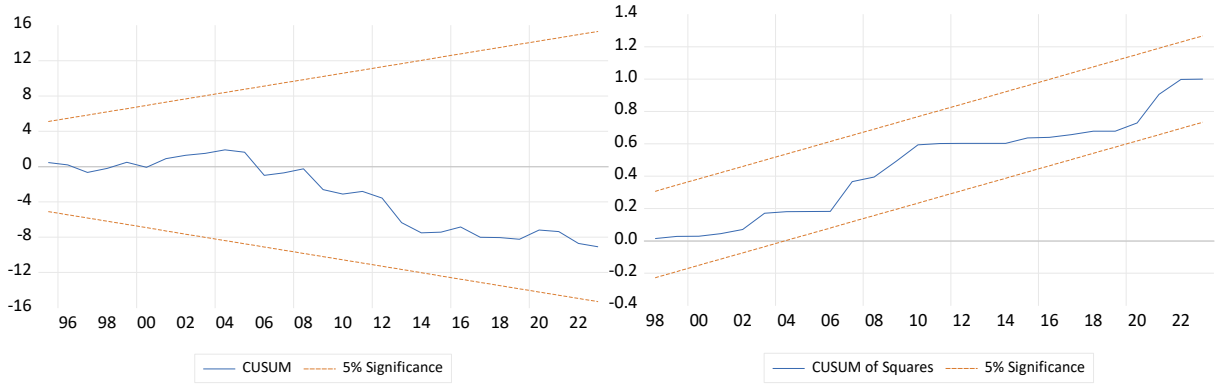

Figure 4.1(iii) :Cusum and Cusum of Squares Plot for Sierra Leone

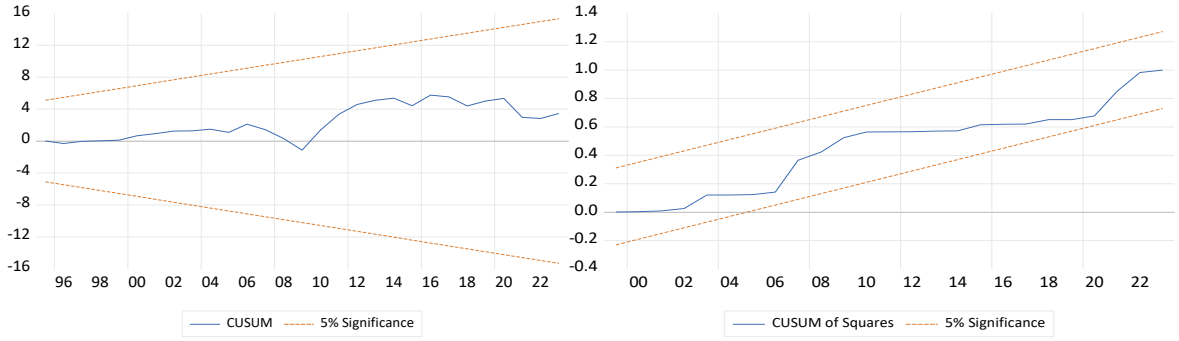

Figure 4.1(iv) :Cusum and Cusum of Squares Plot for Guinea

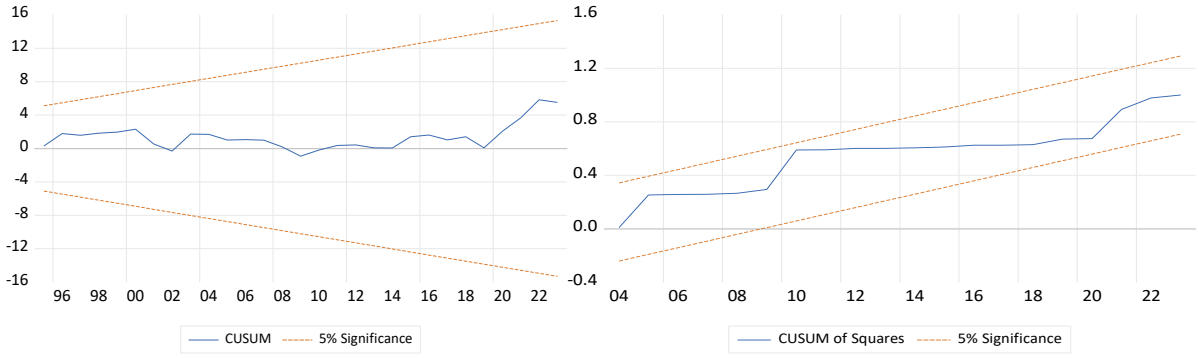

Figure 4.1(v): Cusum and Cusum of Squares Plot for Gambia

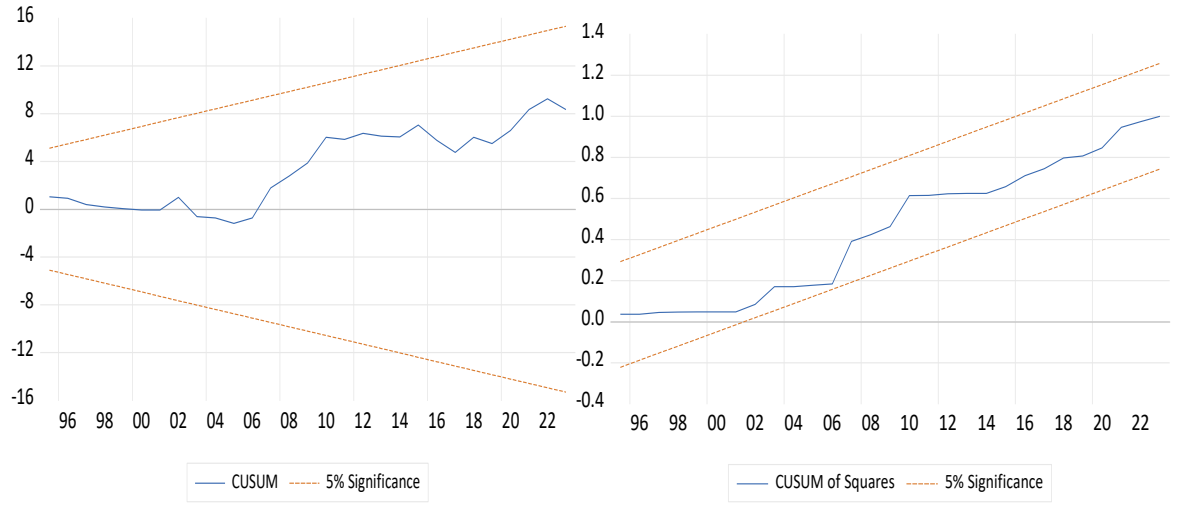

Figure 4.1(v): Cusum and Cusum of Squares Plot for Liberia

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The CUSUM plot, derived from the recursive estimation of the model, indicates that the long-run coefficients are stable over the sample period for all countries. This conclusion is drawn from the fact that the CUSUM plot did not cross either of the 5% critical lines, confirming that the estimated parameters are reliable and can be confidently used for policy decisions.

Test Results of Inflation Threshold Model

This section presents the results of the inflation threshold model for six African countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. Since the stationarity of the variables through unit root tests and the correlation matrix have already been analyzed in the initial model, this section will focus on presenting the subsequent stages of the analysis. Specifically, it will detail the lag selection criteria, the ARDL (Auto-Regressive Distributed Lag) bounds testing, and the diagnostic tests.

Lag Selection Criteria

Before estimating the Autoregressive Distributed Lag (ARDL) model, it is crucial to determine the appropriate number of lags to include in the regression. The optimal number of lags can be selected using the lag length criteria presented in Table 4.9. As a general rule, the model with the lowest value for these criteria is considered the most suitable.

Table 4.9: Optimal Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
NIGERIA						
0	-171.4210	NA	260.9319	8.401002	8.607868	8.476826
1	-163.7226	13.19733*	189.8282	8.082029*	8.330267*	8.173018
2	-162.0487	2.789798	184.0488*	8.049939*	8.339551	8.156093*
GHANA						
0	-180.3390	NA*	398.9854	8.825667	9.032533	8.901492*
1	-180.3197	0.033159	418.4076	8.812365*	9.120604*	8.963355
2	-178.2610	3.431068	398.3041*	8.821954*	9.111566	8.928108
SIERRA LEONE						
0	-185.7008	NA*	515.0410	9.080989	9.287855*	9.156813*
1	-185.3968	0.521029	502.8425*	9.114135*	9.362374	9.205124
2	-185.3373	0.099240	557.9005	9.158919	9.448530	9.265073
GUINEA						
0	-150.8724	NA*	98.07719	7.422497	7.629363*	7.498322
1	-149.0167	3.181211	90.65303*	7.341778*	7.631389	7.447932*
2	-147.1773	3.065684	94.23957	7.381749	7.629988	7.472739
GAMBIA						
0	-134.7638	NA*	45.54394	6.655420	6.862286	6.731245
1	-132.6661	3.596121	43.26040*	6.603147*	6.851385*	6.694136*
2	-132.6555	0.017581	45.40061	6.650264	6.939875	6.756418
LIBERIA						
0	-115.2750	NA*	18.00482	5.727382	5.934248*	5.803207
1	-113.9342	2.298572	17.72973*	5.711152*	5.959391	5.802141*
2	-113.8917	0.070772	18.57861	5.756749	6.046361	5.862903
	* indicates lag order selected by the criterion,LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error,AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion					

Table 4.9 presents the lag length selection criteria, which reveal different optimal lag lengths. The LR test statistic (LR), final prediction error (FPE), Akaike information criterion (AIC), and Schwarz information criterion (SC) all consistently identify lag one as the optimal choice across the six countries analyzed. These criteria are critical for selecting the most appropriate lag length, ensuring the model's accuracy and reliability.

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Ogbokor (2015) emphasized the importance of optimal lag selection in determining the number of lag periods to include in a time series model, as it directly impacts the model's predictive power. McCamel (2017) further reinforced this approach, highlighting that a lower AIC value typically indicates a more effective model. Based on these considerations, the study adopts lag one, as determined by the AIC, as the optimal lag for the analysis.

ARDL Bound Test for Cointegration

After identifying the order of integration and selecting the optimal lag length using relevant criteria, the study utilizes the ARDL approach to cointegration. This method is employed to thoroughly analyze and determine the long-term equilibrium relationships among the variables, providing insights into how they are interconnected over an extended period.

Result of ARDL F-Bound Test

Nigeria				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.943284	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Ghana

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.921219	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Sierra Leone

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.712131	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87

Guinea

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	13.85136	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Gambia

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.606646	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Liberia

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.442327	10%	2.2	3.09

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K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

At the 5% significance level, the ARDL F-Bound Test results as presented in table 4.10 indicate the presence of a long-run equilibrium relationship among the variables in Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. The F-statistics for these countries exceed the critical upper bound value of 3.49, thus, allowing rejection of the null hypothesis of no cointegration. The existence of this long-run relationship forms the basis for the estimation of the error correction mode.

Model Estimation and Evaluation

This section provides an econometric analysis using the ARDL model to assess both the long-run and short-run dynamics of key economic variables for the six countries under study: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. By exploring these effects, the analysis captures how these economies respond to changes in fundamental indicators over time, offering insights into both their immediate and sustained impacts

ARDL Model of Long-run Effect on Inflation Threshold

Table 4.11 presents the results of the ARDL (Autoregressive Distributed Lag) model estimation, which examines the long-run effects of various macroeconomic variables—Demand for Money (M2), Interest Rate (INTR), Exchange Rate (EXCH), and Government Expenditure (GEXP)—on inflation (INF) across six African countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia.

Table 4.11: Result of ARDL Model Estimation for Long run Effect on Inflation Threshold

Dependent Variable: INF				
Nigeria				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	0.554282	0.158091	3.506099	0.0015
INTR	-0.725692	0.270511	-2.682674	0.0118
EXCH	-0.015391	0.004996	-3.080631	0.0044
GEXP	-0.135856	0.087281	-1.556533	0.1301
Ghana				
M2	-0.434275	0.184964	-2.347888	0.0257
INTR	0.441842	0.756236	0.584265	0.5634
EXCH	-0.702872	0.236210	-2.975619	0.0057
GEXP	0.579912	1.028970	0.563585	0.5772
Sierra Leone				
M2	0.604581	0.201984	2.993212	0.0028
INTR	-1.557454	0.268998	-5.789830	0.0000
EXCH	0.281314	2.305380	0.122025	0.9029
GEXP	0.103161	0.057165	1.804610	0.0711
Guinea				
M2	0.693505	0.294653	2.353632	0.0247
INTR	-0.405691	0.156280	-2.595929	0.5553
EXCH	-0.537336	0.179748	-2.989387	0.0052
GEXP	0.038581	-0.023888	-1.615060	0.1158
Gambia				

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M2	-0.597585	0.158959	-3.759365	0.0002
INTR	-0.984969	0.367430	-2.680701	0.0073
EXCH	0.014856	0.004920	3.019781	0.0025
GEXP	0.856855	1.360191	0.629952	0.5287
Liberia				
M2	0.530867	0.261537	2.029797	0.0424
INTR	-0.199466	0.329807	-0.604796	0.5453
EXCH	0.028254	0.016828	1.679034	0.0931
GEXP	-0.421737	0.150579	-2.800763	0.0051

Note: INFR= Inflation Rate, M2= Demand for Money, INTR=Interest Rate, EXCH=Exchange Rate, GEXP = Government Expenditure

The ARDL long-run estimate as presented in table 4.11 revealed that in the WAMZ countries, the coefficient for M2 is 0.554282, indicating that a 1% increase in the demand for money leads to a significant 0.55% rise in inflation. This finding aligns with Adu et al. (2022), who also identified a strong positive relationship between demand for money and inflation in the West African Monetary Zone countries. The negative coefficient for the interest rate (-0.725692) suggests that increasing interest rates by 1% reduces inflation by 0.73%, consistent with Mishra and Montiel's (2023) findings on the effectiveness of interest rates in controlling inflation in developing economies. The exchange rate (EXCH) has a negative coefficient of -0.015391, implying that a 1% appreciation of the currency leads to a 0.015% decrease in inflation, corroborating Tapsoba and Bittencourt's (2021) observation of the deflationary impact of currency appreciation in Sub-Saharan Africa. Government expenditure (GEXP) shows a non-significant negative effect on inflation in the selected WAMZ countries.

ARDL Model of Short-run Effect

The ARDL (Autoregressive Distributed Lag) model estimation, as presented in Table 4.12, provides insights into how various macroeconomic variables affect inflation in the short run across the six West Africa Monetary Zone countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. These findings help to understand the relationships between monetary policy, exchange rates, government spending, and inflation.

Table 4.12: Result of ARDL Model Estimation for Short-run Effect on Inflation Threshold

Dependent Variable: D(INF)				
Nigeria				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2)	0.400324	0.147908	2.706581	0.0111
D(INTR)	-0.467356	0.662843	-0.705078	0.4862
D(EXCH)	-0.517871	0.163438	-3.168602	0.0035
D(GEXP)	-0.114752	0.038764	-2.960241	0.0061
CointEq(-1)*	-0.499129	0.110684	-4.509481	0.0001
R-squared	0.673929	F-stat.	6.071802	
Adjusted R-squared	0.658027	Prob (Fstat.)	0.000183	
Durbin-Watson stat	1.699828			

Ghana

D(M2)	-0.896148	0.354045	-2.531171	0.0163
D(INTR)	0.048981	0.040990	1.194947	0.2406
D(EXCH)	0.197335	0.082700	2.386168	0.0229
D(GEXP)	0.818559	1.065317	0.768371	0.4477

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CointEq(-1)*	-0.896148	0.354045	-2.531171	0.0163
R-squared	0.673929	F-stat.	5.174912	
Adjusted R-squared	0.658027	Prob (Fstat.)	0.000865	
Durbin-Watson stat	1.699828			

Sierra Leone

D(M2)	-0.596547	0.157278	-3.792949	0.0001
D(INTR)	-1.074815	0.193227	-5.562436	0.0000
D(EXCH)	0.391707	0.373574	1.048540	0.2944
D(GEXP)	0.019685	0.009742	2.020655	0.0433
CointEq(-1)*	-0.605877	0.151499	-7.299577	0.0000
R-squared	0.660635	F-stat.	15.26201	
Adjusted R-squared	0.644912	Prob (Fstat.)	0.000000	
Durbin-Watson stat	2.107617			

Guinea

D(M2)	0.116145	0.033058	3.513370	0.0013
D(INTR)	0.236720	0.176789	1.338999	0.1897
D(EXCH)	-0.625879	0.080989	-7.727945	0.0000
D(GEXP)	-0.781056	0.305304	-2.558287	0.0153
CointEq(-1)*	-0.647683	0.066207	-9.782653	0.0000
R-squared	0.851637	F-stat.	43.33395	
Adjusted R-squared	0.836020	Prob (Fstat.)	0.000000	
Durbin-Watson stat	2.156086			

Gambia

D(M2)	-0.613701	0.380531	-1.612750	0.1163
D(INTR)	-0.184466	0.035874	-5.142014	0.0000
D(EXCH)	-0.048876	0.010274	-4.757206	0.0000
D(GEXP)	3.529318	0.931033	3.790756	0.0006
CointEq(-1)*	-0.604970	0.083450	-7.249483	0.0000
R-squared	0.773371	F-stat.	9.774797	
Adjusted R-squared	0.759516	Prob (Fstat.)	0.000001	
Durbin-Watson stat	1.844698			

Liberia

D(M2)	0.243750	0.119700	2.036346	0.0417
D(INTR)	-0.305480	0.077499	-3.941718	0.0001
D(EXCH)	-0.044043	0.009160	-4.808237	0.0000
D(GEXP)	-0.283723	0.097549	-2.908527	0.0036
CointEq(-1)*	-0.728698	0.131532	-5.540076	0.0000
R-squared	0.582039	F-stat.		

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			4.740505	
Adjusted R-squared	0.568044	Prob (Fstat.)	0.001186	
Durbin-Watson stat	1.928535			

Note: INFR= Inflation Rate, M2= Demand for Money, INTR=Interest Rate, EXCH=Exchange Rate, GEXP=Government Expenditure

The estimated ARDL short-run result as presented in table 4.12 shows that in the WAMZ countries, the coefficient for the demand for money (D(M2)) is 0.400324, indicating that a 1% increase in the demand for money leads to a 0.40% increase in inflation. This suggests that when the demand for money rises, it can contribute to inflationary pressures, likely due to increased spending. The coefficient for the interest rate (D(INTR)) is -0.467356, meaning a 1% rise in interest rates reduces inflation by 0.47%. Higher interest rates tend to decrease inflation by reducing consumer and business spending, as borrowing becomes more expensive. The exchange rate (D(EXCH)) has a coefficient of -0.517871, implying that a 1% increase in the exchange rate (depreciation of the local currency) leads to a 0.52% decrease in inflation, possibly due to the effect of increased competitiveness of exports. Government expenditure (D(GEXP)) has a negative coefficient of -0.114752, indicating that a 1% increase in government spending reduces inflation by 0.11%, which might reflect the efficient allocation of government resources that helps control inflation.

Post Estimation Test

This section details the residual diagnostic tests conducted on the econometric models for Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia. These diagnostic tests are crucial for assessing the robustness and reliability of the models. They include the Breusch-Godfrey Serial Correlation LM Test to check for serial correlation, the Breusch-Pagan-Godfrey test to evaluate heteroscedasticity, and the Jarque-Bera test to ensure the normality of residuals.

Table 4.13: Residual Diagnostic Test

Test	**F-statistics**	**Obs* R-squared**	**Probability**
Nigeria			
Serial Correlation	1.302237	0.2256	0.2256
Heteroscedasticity	1.166302	10.37685	0.3208
Normality Test(Jarque-Bera)	0.949921	*******	0.6219
Ghana			
Serial Correlation	2.733824	4.321463	0.1152
Heteroscedasticity	1.414831	11.97240	0.2149
Normality Test(Jarque-Bera)	1.136991	*******	0.5663
Sierra Leone			
Serial Correlation	1.758008	4.380248	0.1119
Heteroscedasticity	1.358375	17.35706	0.2376
Normality Test(Jarque-Bera)	1.036115	*******	0.5956
Guinea			
Serial Correlation	1.283665	3.288769	0.1931
Heteroscedasticity	0.954211	8.879501	0.4485
Normality Test(Jarque-Bera)	1.106906	*******	0.5749
Gambia			
Serial Correlation	0.176580	0.484350	0.7849
Heteroscedasticity	1.589885	13.00569	0.1623
Normality Test(Jarque-Bera)	0.247338	*******	0.8836

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Liberia			
Serial Correlation	0.215675	0.590112	0.7445
Heteroscedasticity	1.367854	14.02884	0.2314
Normality Test(Jarque-Bera)	1.136991	********	0.5663

The residual diagnostic tests as presented in table 4.13 for Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia indicate that the econometric models used are generally well-specified, with no significant issues related to serial correlation, heteroscedasticity, or non-normality of residuals. Specifically, the Breusch-Godfrey Serial Correlation LM Test reveals no significant serial correlation in the residuals for any of the countries, as all p-values are above the conventional 0.05 threshold. This suggests that the error terms in these models are not correlated over time, which is essential for ensuring unbiased and efficient parameter estimates.

The Breusch-Pagan-Godfrey test for heteroscedasticity also shows no significant issues across all countries, as indicated by p-values above 0.05. This result suggests that the variance of the error terms is constant, which is crucial for the reliability of hypothesis testing and confidence intervals within the models.

Furthermore, the Jarque-Bera test for normality confirms that the residuals are normally distributed in all cases, with p-values well above 0.05, the evidence does not suggest a significant deviation from normality. these diagnostic results imply that the models are appropriate for making inferences about the economic relationships under study, as they satisfy the key assumptions required for the validity of regression analysis. This enhances the credibility of any economic forecasts or policy recommendations derived from these models.

Model Stability Test

The stability test was conducted to determine whether the parameters of the model are consistent across the different data samples used in the study. The Cumulative Sum (CUSUM) test and the Cumulative Sum of Squares (CUSUM Squares) test, as proposed by Brown et al. (1975), were applied. Figure 4.2 shows the results of these tests for the six countries under study: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia.

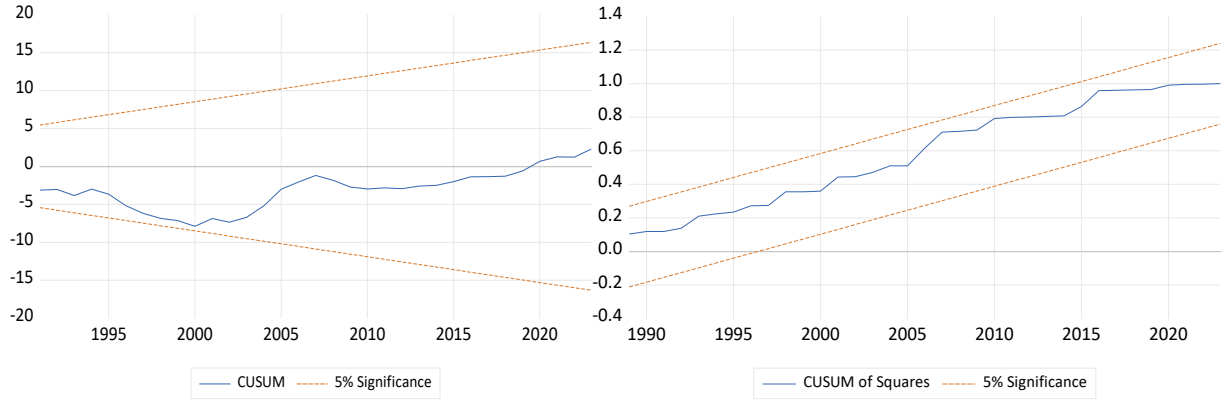

Figure 4.2(i) Cusum and Cusum of Squares Plot for Nigeria

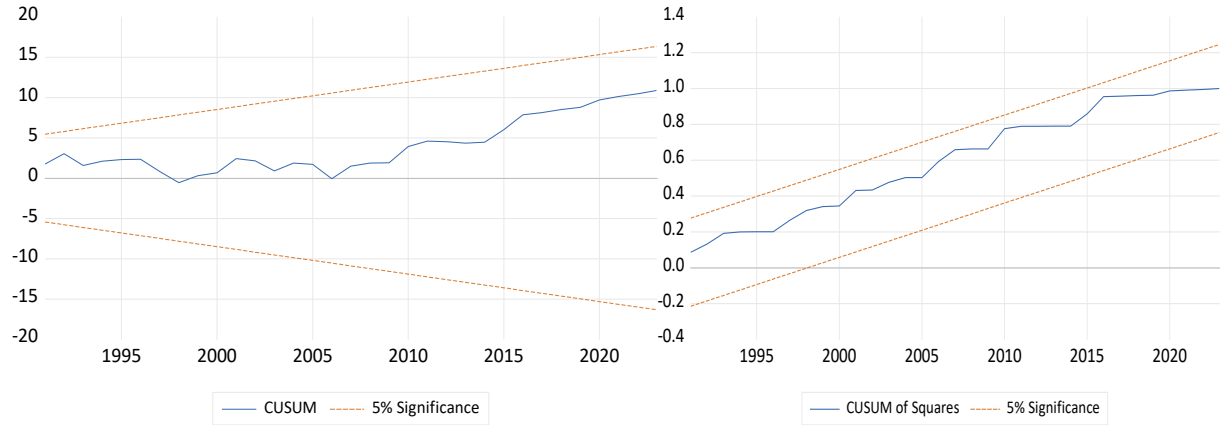

Figure 4.2(ii) Cusum and Cusum of Squares Plot for Ghana

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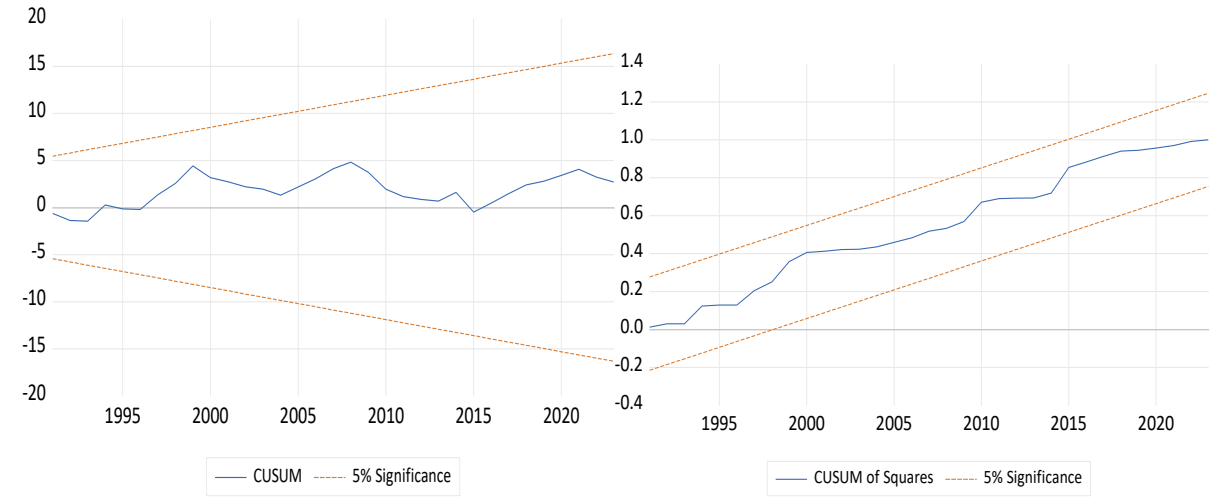

Figure 4.2(iii) :Cusum and Cusum of Squares Plot for Sierra Leone

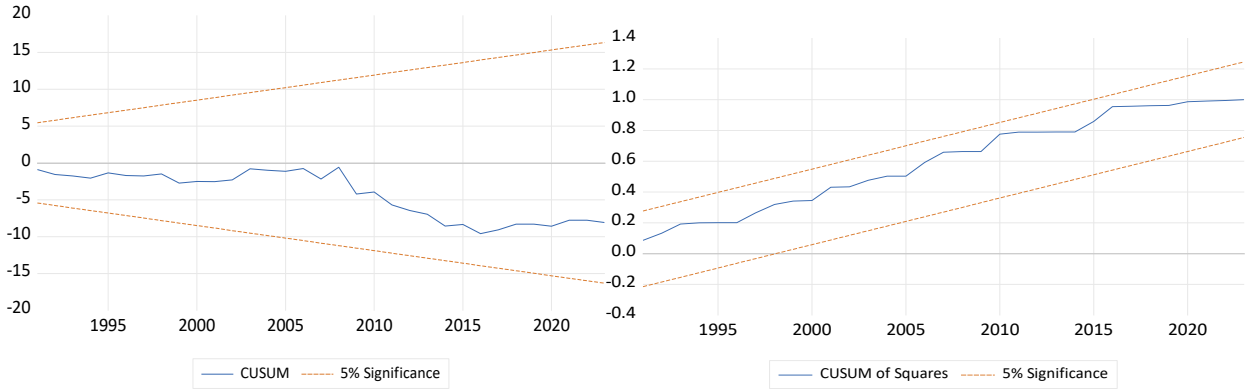

Figure 4.2(iv) :Cusum and Cusum of Squares Plot for Guinea

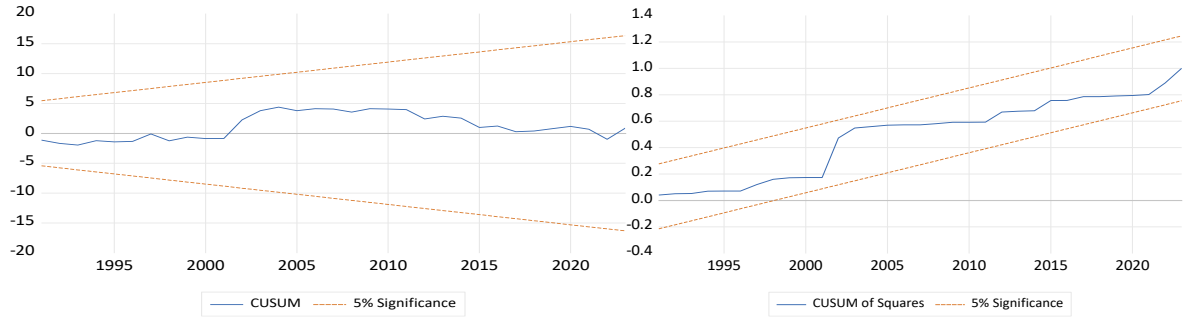

Figure 4.2(v): Cusum and Cusum of Squares Plot for Gambia

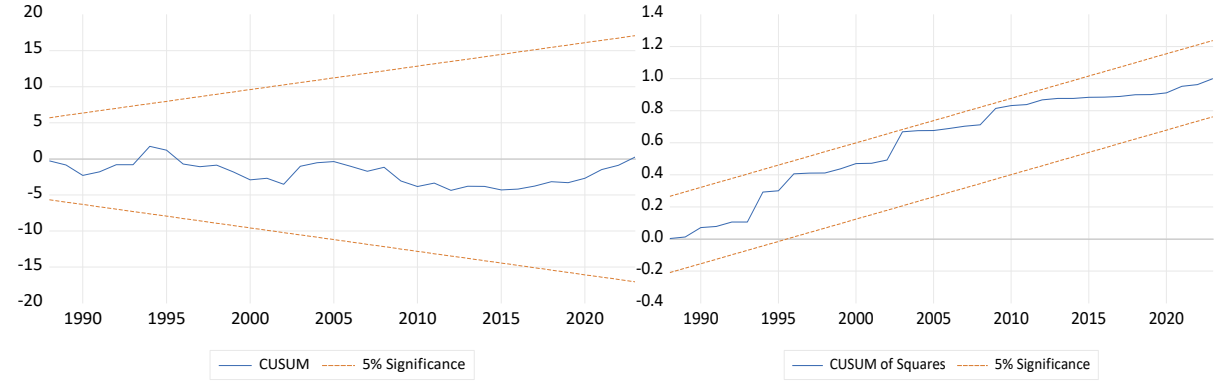

Figure 4.2(v): Cusum and Cusum of Squares Plot for Liberia

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The CUSUM plot, derived from the recursive estimation of the model, indicates that the long-run coefficients are stable over the sample period for all countries. This conclusion is drawn from the fact that the CUSUM plot did not cross either of the 5% critical lines, confirming that the estimated parameters are reliable and can be confidently used for policy decisions.

V. Conclusion and Policy Recommendations

Conclusion

This study investigates the short-run and long-run determinants of the demand for money (M2) and inflation threshold in the six West Africa Monetary Zone countries: Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia between 1980 to 2023, using the Autoregressive Distributed Lag (ARDL) model, it assesses the impact of key macroeconomic variables such as Real GDP (RGDP), inflation rate (INFR), interest rate (INTR), exchange rate (EXCH), fiscal deficit (FISD), and government expenditure (GEXP) on the demand for money (M2). The ARDL model is also applied to the inflation targeting threshold framework to examine how the demand for money, government expenditure, interest rates, and exchange rates influence the differential inflation rate (INFR).

In the short run, the error correction terms across all countries indicate a significant ability to return to long-run equilibrium after short-term deviations, with varying speeds of adjustment. The findings reveal that Real GDP and government expenditure consistently drive an increase in the demand for money, as economic growth and fiscal expansion boost liquidity needs in these economies. In contrast, interest rates and inflation generally exert a contractionary effect on money demand, reflecting the higher opportunity cost of holding money during periods of rising interest rates and inflationary pressures. The study also highlights the different sensitivities of money demand to changes in exchange rates across these countries, reflecting varying degrees of economic stability and policy effectiveness.

In the long run, the results further underscore the positive impact of economic growth and government spending on the demand for money, while inflation and interest rates continue to have a negative effect. The elasticity of M2 with respect to these variables varies across the countries, reflecting their unique economic contexts and fiscal policies. Specifically, in economies where Real GDP is a significant driver, the demand for money tends to expand as the economy grows, accommodating higher transactional needs and investment opportunities. Conversely, in economies where inflation and interest rates are more influential, the demand for money is likely to contract as these factors discourage the holding of liquid assets.

Furthermore, the ARDL model analyses reveal significant insights into the dynamics of inflation threshold across Nigeria, Ghana, Sierra Leone, Guinea, Gambia, and Liberia, highlighting how the demand for money, interest rates, exchange rates, and government expenditure influence inflation in both the short-run and long-run. In the short run, an increase in the demand for money raises inflation in Nigeria, Guinea, and Liberia but decreases it in Ghana, Sierra Leone, and Gambia, indicating varying monetary policy effectiveness and different economic structures across these countries.

Policy Recommendations

In light of the study's analysis and findings, it is clear that managing inflation and promoting economic stability in West Africa requires a multifaceted approach. The recommendations below are designed to provide targeted strategies for policymakers, focusing on the coordination of monetary policies, strengthening institutional frameworks, and tailoring economic interventions to the unique circumstances of each country. By implementing these recommendations, West Africa Monetary Zone Countries can better address inflationary pressures and foster long-term economic growth.

- ✓ Prudent fiscal management is essential for maintaining economic stability. While government expenditure can positively influence the demand for money, excessive fiscal deficits may lead to inflationary pressures. It is crucial for policymakers to maintain a balanced budget and ensure that government spending is directed toward productive sectors that offer long-term benefits to the economy.
- ✓ Strengthening institutional frameworks is crucial for supporting effective policy implementation. The ability of these countries to return to long-run equilibrium after short-term shocks highlights the importance of strong institutions. Governments should focus on enhancing the capacity of their monetary and fiscal institutions to respond promptly and effectively to economic challenges.
- ✓ Monetary policy coordination is essential for effective inflation management in the WAMZ countries. Central banks across the region should collaborate to design inflation-targeting frameworks that account for the varying impacts of demand for money and interest rates in different countries. By tailoring monetary policies to each nation's specific economic conditions, central banks can enhance the effectiveness of their strategies and better manage inflation.
- ✓ Strengthening central bank independence is crucial for successfully targeting inflation. Central banks must operate independently to ensure the consistent application of monetary policy tools, particularly interest rates, without political interference. This independence will enable central banks to maintain focus on long-term economic stability and effectively manage inflationary pressures.

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