

ECONOMETRIC ANALYSIS OF INFLATION AND MONETARY POLICY INDICES IN NIGERIA

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ABSTRACT

This work studied the intricate web of economic relationships in Nigeria, exploring the interactions between exchange rates, inflation, money supply, and economic growth. The research unveiled valuable insights into the dynamics of Nigeria's economy and its implications for policymakers. The work attempts to explore the impacts of exchange rate fluctuation, increasing inflation rates increased money supply on Economic growth in Nigeria. The econometric technique of Error correction model (ECM) was relied upon as a major analytical tool to determine the relationship among the variables. Our findings unveiled a noteworthy connection between exchange rates and inflation, underlining the influence of exchange rate fluctuations on inflationary pressures. Additionally, money supply and economic growth were identified as significant factors affecting inflation rates, aligning with theoretical expectations. Notably, these variables collectively explained a substantial portion of the variation in real Gross Domestic Product (RGDP), signifying their collective influence on economic outcomes. The error correction model (ECM) underscored the statistical significance of the long-term relationships among these variables. In light of these findings, we recommend that policymakers in Nigeria pay close attention to exchange rate policies, monitor and manage money supply, and prioritize economic growth as integral elements in their efforts to control inflation and maintain economic stability. Continuous monitoring and analysis of these variables will be crucial for informed decision-making and effective economic management in Nigeria.

KEY WORDS: Exchange Rate, Inflation, Interest Rate, Money Supply, Economic Growth

Introduction

Nigeria monetary policy is enhanced to target the reduction in the rate of inflation with the framework of maintaining price stability as a single most important objective of monetary policy. Monetary policy is directed towards the reducing inflation presupposes the existence of a stable and predictable

relationship between monetary aggregates and other economic variable in the economy (CBN, 2015).

For most economies, the objectives of monetary policy include price stability, maintenance of balance of payments equilibrium, and promotion of employment, output growth, and sustainable development.

These objectives are necessary for the attainment of internal and external balance, and the promotion of long run economic growth. The importance of price stability derives from the harmful effect of price volatility which undermines the objectives.

This is indeed a general agreement that domestic price fluctuations undermines the role of monetary values as a store of value, and frustrate investments and growth (Ajayi, 2014).

In Nigeria, several fiscal and monetary policies have been implemented in recent years all geared towards improving the rate of economic growth rate (RGDP). However despite these attempts, the economic indicators show very low or negative growth rate in Real Gross Domestic Product. This problem poses a concern which inspires this research.

2 Literature Review

Monetary Policy refers to the specific actions taken by the Central Bank (Monetary Authority) to regulate the value; supply and cost of money in the economy with a view to achieving predetermine macroeconomic goals. CBN (2012)

Generally, monetary policy refers to combination of measures designed to

regulate the supply of money in an economy in relation to the level of economic activity. Monetary policy refers to the credit control measure adopted by the central bank of a country (Friedman, 2000).

In Nigeria, the major objectives of monetary policy include the attainment of price stability and sustainable economic growth. In pursuing these objectives, the CBN recognizes the existence of conflicts among objectives necessitating some sort of trade-offs. The targets of monetary policy are the operational target, the intermediate target and the ultimate targets. The Bank manipulates the operating target (reserve money) over which it has substantial direct control to influence the intermediate target (broad money supply, M2) which has impact on the ultimate objective of monetary policy, i.e., inflation and output (CBN, 2012).

While fiscal policy proves helpful in combating inflationary pressure, monetary policy has been the principal tool often employed by the central banks to ensure price stability. While it is not arguable that monetary authority have formulated various policy measures as an attempt to curbing inflationary menace, the effectiveness of policy pursuit to curb inflationary environments is questionable as most

economies, particularly developing ones still experience inflationary challenges.

2.1 Inflation and monetary indices Problems in Nigeria

Nigeria has faced recurrent episodes of high inflation, exceeding 30 percent, since the early 1970s. These inflationary periods have been characterized by an interplay of factors, including excessive growth in money supply, structural characteristics of the economy, supply shocks such as famine and currency devaluation, and fluctuations in terms of trade. It is imperative to delve deeper into the causes of these high inflation episodes to develop effective strategies for mitigation and stabilization.

One significant episode occurred in 1984 when inflation peaked at 39.6 percent, coinciding with minimal economic growth. The government was pressured to reach an agreement with the International Monetary Fund (IMF), which included devaluing the domestic currency. This impending devaluation expectation exacerbated inflation, as prices adjusted to the parallel exchange rate. Simultaneously, there was an alarming excess money growth of about 43 percent, coupled with a 70 percent increase in credit to the government. These monetary

factors underscore the monetary expansion that coincided with high inflation.

Furthermore, the deteriorating terms of external trade experienced by Nigeria at that time also contributed to inflationary pressures. It appears that Nigeria's inflation episodes are preceded by structural or real factors and are subsequently exacerbated by monetary expansion. This complex relationship between structural and monetary factors necessitates a comprehensive understanding of their interplay.

Another high inflation episode occurred in the late 1980s, specifically in the last quarter of 1987, and intensified through 1988 to 1989. This episode was linked to fiscal expansion accompanying the 1988 budget. Initially, this expansion was financed by credit from the Central Bank of Nigeria (CBN), but it later relied on increasing oil revenues, driven by rising oil prices following the Persian Gulf War, which were not effectively sterilized.

Addressing the recurring issue of high inflation in Nigeria requires a multifaceted approach. This research aims to identify the root causes of inflationary episodes, including both structural and monetary factors, to develop policies and strategies that

promote stability, economic growth, and price control. By understanding the dynamics of inflation and monetary policy indices in Nigeria, we can work towards a more resilient and stable economic environment that benefits the nation and its people.

The general objective of this study is to evaluate the impact of monetary policy on economic growth whereas the specific objectives are to Analyze the relationship between inflation and economic growth in Nigeria, Investigate the relationship between exchange rate and economic growth, Evaluate the relationship between money supply and economic growth

In order to attain the above stated objectives, the following research hypotheses were selected

- (1) Exchange fluctuation has no effect Economic growth in Nigeria
- (2) Inflation rate has no significant impact on Economic growth in Nigeria
- (3) Changes in money supply has no effect on economic growth in Nigeria

This work is of essence in that it will make significant recommendations that will assist policy makers formulate robust policies to properly regulate and guide the economy. It will also add to existing body of literature to

enhance further research on the subject matter

2.2 Monetary Policy

In Nigeria, monetary policy aims to achieve price stability, balance of payments equilibrium, and economic growth. The Central Bank of Nigeria (CBN) is responsible for ensuring these goals by controlling money supply, interest rates, and total credit. Salvin (2011) defines monetary policy as the use of tools like open market operations, changes in discount rates, and reserve requirements to manage money supply growth. The primary objectives are price stability, full employment, and economic growth.

Olumechere (2013) views monetary policy measures as government actions to regulate money supply in support of national goals. According to Umole (2008), monetary policy involves controlling money supply to achieve broader economic objectives. Ezeugo (2011) shares this perspective, emphasizing that it entails specific measures to stimulate economic sectors, generate employment, control inflation, manage the balance of payments, and encourage savings.

2.3 Inflation

Inflation is a commonly discussed economic concept, often misunderstood. Economists generally agree that inflation refers to a continuous increase in prices. In simpler terms, it's when prices for goods and services keep going up. It can be defined as a "continuous rise in prices," as measured by indices like the Consumer Price Index (CPI) or the implicit price deflator for Gross National Product (GNP) (CBN, 2013).

Inflation is often described as a situation where there is "too much money chasing too few goods." When inflation happens, the value of currency decreases, meaning that the same amount of money can buy less over time. For example, if you could buy 10 shirts for N10.00 in one period, and the shirt prices double in the next period, that same N10.00 would only buy 5 shirts (CBN, 2012).

Two crucial aspects of the definition of inflation must be noted. First, it must be a general increase in prices that covers the entire range of goods in the economy, not just isolated price increases for individual items or groups of items. Second, this increase in the overall price level must be continuous and sustained over time, as opposed to a one-time price spike (CBN, 2015).

In broad terms, inflation can be categorized into four types based on its magnitude:

2.3.1 Creeping Inflation :This occurs when prices rise very slowly, with an annual increase of less than 3 percent. Such mild price increases are seen as safe and conducive to economic growth (CBN, 2012).

2.3.2 Walking Inflation: Walking inflation happens when prices rise moderately, with an annual inflation rate in the single digits, typically between 3 and less than 10 percent. This level of inflation serves as a warning sign for the government to take measures before it turns into running inflation (CBN, 2012).

2.3.3 Running Inflation: When prices rise rapidly, at a rate of 10 to 20 percent annually, it's referred to as running inflation. This type of inflation has severe effects on lower and middle-income individuals and requires strong monetary and fiscal interventions for control (CBN, 2012).

2.3.4 Hyperinflation: Hyperinflation occurs when prices soar at double or triple-digit rates. In extreme cases, the inflation rate becomes immeasurable and uncontrollable. Prices can rise multiple times a day, leading to the collapse of the monetary system due to the rapid erosion of purchasing power (CBN, 2012)

2.4 Theoretical and Empirical Literature

According to J.M Keynes (1976), "an inverse in the quantity of money increases aggregate money demand on investment as a result of the fall in the rate of interest". The increase investment will raise effective demand through the multiplier affect thereby increasing income, output and employment. Therefore, when there is full employment, increase in income and output, price will change in the same proportion as the quantity

of money (Jhingan, 2003). This theory deals on short run economy, which tends toward s the area of macroeconomics but has contributed greatly to monetary economic.

In the Keynesian analysis, monetary policy plays a crucial role in affecting economic activity. It contends that a change in the supply of money can permanently change such variables as the rate of interest, the aggregate demand and the level of employment, output and income.

Keynes believed in the existence of unemployment equilibrium. This implies that an income in money supply can bring about permanent increases in the level of output. This rise in supply of money, its first effect is on the rate of interest which tends to fall. Given the marginal efficiency of capital, a fall in the rate of interest will increase investment. The increased investment will raise effective demand through the multiplier effect thereby increasing income, output and employment.

Consequently, Akcay (2014) uses annual Turkish data to analyze the existence of a stable long-run relationship between budget deficits, money growth and inflation, and the results according to them was affirmative. Using the co-integrating vectors found in the

study, they concluded that a significant impact of budget deficit on inflation cannot be refuted under the assumption of long-run monetary neutrality. However, when an unrestricted VAR model was utilized on quarterly data corresponding to the post bond financing period, the results were suggestive of a weakened link from the other variables to inflation.

Kilindo (2013) attempted an experience of Tanzania's economic relationship between fiscal operations, money supply and inflation. Testing the structural model for the period of 1970-84, the evidenced by the significant coefficients of the structural model and simulation results, shows a strong relationship between fiscal operation, money supply and inflation in Tanzania.

Kibritcioglu (2012) consolidates the earlier work in Akcayet *al.*, (2008) by confirming the persistence of inflation in Turkey as a net result of sophisticated dynamic interaction of four group of explanatory factors of demand-side (monetary) shock, supply-side (or real) shocks, adjustment factors, and political processes. This means that an inflationary growth is a result of in-appropriation of various structural and economic factors.

Akinboade (2014) explain the dynamics of inflation in South Africa and in their model which relates domestic inflation to a largely structural phenomenon in the money market, labour market and foreign exchange market conditions, suggests that there is a positive correlation between labour costs, broad money supply and domestic inflation which in the long-run, rising labour costs contribute significantly to inflation. In their view, an increase in the nominal interest rates, the effect of which is insignificant in the short-run will slightly reduce inflation in the long-run, while an increase in the broad money supply will contribute to domestic inflation in the long-run.

3. Research Methodology

This research adopts an ex-post facto design because the nature of the variable in which the researcher does not have any control over these variables. The analytical instrument used in this work is the Error correction model (ECM) This will help us to estimate the short-run dynamic relationship between cointegrated variables and rate of adjustment to the long run equilibrium relationship. To capture the objectives stated in this study, the following econometric model was estimated.

Hence, the specification of model adopted was based on the following functional relationship

$$RGDP = f(MS, EXR, INF, INT)$$

Where: INF_t = Inflation Rate (%),

MS_t = changes in money Supply (%),

EXR_t = Exchange rate (₦/\$),

$RGDP_t$ = Growth Rate of Real Gross Domestic Product (%)

3.1 Unit root test

Unit Root Test In this study, we used the Augmented Dickey Fuller (ADF) Unit root test to check if our variables are stationary. The null hypothesis assumes that the variables have a unit root, while the alternative suggests they do not. To make a decision, we compare the absolute ADF statistic value to the critical value at our chosen significance level. If the ADF statistic is greater, we reject the null hypothesis; otherwise, we don't. We determined the lag length using the Akaike and Schwartz information criteria, and the results can be found in the table below. We conducted the Augmented Dickey-Fuller (ADF) test at a 5% significance level, considering both trend and intercept in the data. Table 1 Unit Root test

Series	ADF	5% critical values	Order of integration	Remarks
	Test Statistic			
	at 1 st difference			
EXR	-5.267327	-3.552973	1	Stationary
INF	-6.181542	-3.552973	1	Stationary
INF _{t-1}	-6.081680	-3.557759	1	Stationary
MS2	-7.689143	-3.552973	1	Stationary

Source: Author' computation

The absolute unit root test indicates that RGDP remained stable at its current levels and exhibited zero integration, denoted as $I(0)$. On the other hand, variables such as EXR, INF, INF_{t-1}, and MS2 were not steady at their original levels but showed stationarity when analyzed in their first differences using the ADF test. When we examined these variables using the Augmented Dickey-Fuller test with both trend and intercept, their calculated statistics exceeded the critical values at a 5% significance level when considering first differences. This suggests that their time series were of the same order of integration, specifically $I(1)$, as indicated by both the ADF and PP tests.

3.2 Johanson cointegration test

Since all the variables are integrated of order one, it's necessary to examine their long-term relationship study utilizes the Engle and Granger cointegration test, which involves conducting an ADF test on the model's residuals. If the residuals are stationary at the original level, it signifies cointegration among the variables. In our analysis, the residual of the model was found to be stationary at the original level at a 5% significance level, indicated by the ADF statistic's absolute value exceeding the critical value. This confirms the presence of a long-term relationship among the variables. See the results below for more details.

Table2 . Long Run Adjustment Mechanism

Series	ADF Test Statistic	5% critical values	Order of integration	Remarks
U	-5.369211	-3.552973	0	Stationary

The Error Correction Model (ECM) conducts a regression analysis to determine the rate at which the system adjusts towards long-term equilibrium. It effectively illustrates the model's movement towards this equilibrium. In the following outcome, the coefficient associated with the lagged residual term is both negative and statistically significant at the 5% level. This implies that the model has

a rate of adjustment of 18.9136%, signifying how quickly it converges towards long-term equilibrium. $\Delta INF_t = f(\Delta EXR_t, \Delta EXR_{t-1}, \Delta EXR_{t-2}, \Delta MS_t, \Delta MS_{t-1}, \Delta MS_{t-2}, \Delta RGDP_t, \Delta RGDP_{t-1}, \Delta RGDP_{t-2}, \Delta INF_t, \Delta INF_{t-1}, \Delta INF_{t-2}, ECM_{-1})$.

Error Correction model (ECM)

Table 3 Dependent Variable: D(INF)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.610338	2.175327	1.199975	0.2406
D(EXR)	0.166469	0.097166	1.713251	0.0981
D(INFT_1)	-0.260463	0.082061	-3.174000	0.0037
D(MS2)	20.87520	9.015741	2.315417	0.0284
RGDP	-0.872607	0.321223	-2.716517	0.0114
ECM-1	-0.189136	0.110524	10.75908	0.0000

R-squared 0.836041 *Adjusted R-squared* 0.805678 *Durbin-Watson stat* 0.937164; *F-statistic* 27.53509; *Prob(F-statistic)* 0.000000

The coefficient for the exchange rate (EXR) is 0.166469, indicating a positive relationship with inflation (INF). Holding other variables constant, a 1% increase in EXR leads to an average 16.6469% increase in INF, aligning with our expectations. The t-statistic for EXR, at 1.713251, is less than 2, and the p-value, 0.0981, is less than 0.05, confirming the statistical significance of EXR. The coefficient for the one-period lag of inflation (INFt-1) is -0.260463, implying a negative relationship with INF. A 1% increase in INFt-1 results in a 26.0463% decrease in INF, consistent with expectations. The t-statistic for INFt-1 is -3.174000, exceeding 2, and the

p-value, 0.0037, is less than 0.05, confirming the statistical significance of INFt-1.

The coefficient for money supply (MS2) is 20.87520, indicating a positive relationship with INF. A 1% increase in MS2 corresponds to a substantial 2087.520% increase in INF, aligning with our economic expectations. The t-statistic for MS2 is 2.315417, exceeding 2, and the p-value, 0.0284, is less than 0.05, confirming the statistical significance of MS2. The coefficient for Real Gross Domestic Product (RGDP) is -0.872607, implying a negative relationship with INF. A 1% increase in RGDP leads to an 87.2607% decrease in INF, consistent with economic expectations. The t-statistic for

RGDP is -2.716517, exceeding 2, and the p-value, 0.0114, is less than 0.05, confirming the statistical significance of RGDP.

Determination (R²) stands at 0.836041, meaning that EXR, INF_{t-1}, MS₂, and RGDP explain approximately 83.6041% of the variance in the dependent variable, LRGDP, signifying a good model fit. The F-statistic, with an absolute value of 27.53509 and a probability of 0.000000, confirms the joint statistical significance of the model's variables.

The error term, ECM, indicates the speed of adjustment back to equilibrium following any disequilibrium in the system. The probability value of ECM in Table 4.4.1 indicates a significant relationship with economic growth in Nigeria. The system returns to equilibrium at a rate of 18.9136%, highlighting the statistical significance of the long-term relationship between the variables. This conclusion is based on the ECM's probability value (0.0000), which is lower than the assumed 0.05 significance level.

4 Conclusions

This study examined the relationships between key economic variables in Nigeria, including exchange rates, inflation, money

supply, and economic growth. The findings indicate significant associations between these variables, providing valuable insights into the country's economic dynamics. The exchange rate (EXR) exhibited a positive relationship with inflation (INF), suggesting that exchange rate movements can impact inflation levels. Money supply (MS₂) and economic growth (RGDP) also played significant roles in influencing inflation rates. These findings align with economic expectations. Furthermore, the analysis revealed that the variables jointly contribute to explaining a substantial portion of the variation in real Gross Domestic Product (LRGDP). The error correction model (ECM) highlighted the significance of the long-term relationship among these variables, emphasizing the importance of monitoring and managing them collectively.

5 Recommendations:

Exchange Rate Policy: Given the positive relationship between the exchange rate (EXR) and inflation (INF), policymakers should carefully consider the implications of exchange rate movements on inflationary pressures. Developing strategies to manage and stabilize exchange rates may help control inflation.

Inflation Management: To curb inflation, policymakers should focus on controlling the money supply (MS2) and promoting economic growth (RGDP). Effective management of these factors can contribute to price stability.

Monitoring and Analysis: Continuous monitoring of economic indicators, such as EXR, MS2, RGDP, and inflation (INF), is crucial for informed decision-making. Regular analysis of these variables can aid in predicting and managing economic fluctuations.

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