Original Research Article

THE ROLE OF MONETARY POLICY MECHANISM IN CONTROLLING INFLATION GROWTH IN NIGERIA USING STANDARDIZED REGRESSION MODEL.

Abstract:

This study examined the role of monetary policy mechanism in controlling inflation growth in Nigeria. SMLRM estimating technique was considered as a tool in fitting the model where inflation rate served as response variable and income growth rate, money supply, exchange rate, domestic credit growth rate and government expenditure served as explanatory variables. Data were collected from the Central Bank of Nigeria (CBN) Statistical Bulletin, December 2018 which covers the period of 1998 to 2018. The R-Statistical software package was adopted to carry out the analysis. The result of the P-vale of real income growth rate (0.372), money supply (0.941), exchange rate (0.754), domestic credit (0.722) and government expenditure (0.337) were all greater than the significance level α(0.05). The study however concludes that all the explanatory variables made significant impact in controlling inflation growth in Nigeria.

Keywords: Monetary policy, Inflation growth, Standardized Regression model, Money supply, Exchange rate, Domestic Credit growth rate, Government expenditure.

Introduction:

Inflation can always and everywhere be considered as a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output. In our own remark we will try to reconcile monetary theory with the current performance of inflation. In view of these, recent development make a compelling case that traditional approach views the connections between monetary policy, money and inflation are outdated and need to be revised. As always our remark represent our own views and not necessarily those of others in the Federal Reserve System.

Before the advent of interest on reserves, the opportunity cost for holding noninterest–bearing bank reserves was the nominal short term interest rate, such as the federal funds rate. Demand for reserves is downward slopping which implies that when the federal funds rate is low, the quantity of reserves banks like to hold increase. Conventional monetary policy works by adjusting the amount of reserves so that the federal funds rate equals a target level at which supply and demand for reserves are in equilibrium. It is implemented by trading noninterest-bearing reserves for interest-bearing securities, typically short term treasury bills.

Consequently, banks have a strong incentive to put reserves to work by lending them out. If the banking system as a whole found itself with excess reserves, then the system would increase the availability of credit facility in the economy, drives private sector borrowing rates lower and spur economic activity.

Precisely, this reasoning lies behind the classical monetary theories of multiple deposit creation and the money multiplier, which hold that an increase in the monetary base should lead to a proportional rise in the money stock.

However, if the economy were operating at its potential, then if the banking system held excess reserves, too much "money" would chase too few goods leading to higher inflation. One of the main responsibilities assigned to monetary agencies is to maintain relative stability in the domestic price of goods and services. The emphasis is premised on the belief that monetary policy promotes sustainable growth and development by strengthing the value of money and prevents inflation and its associated uncertainties, thereby increasing the future growth prospect of the country. Thus, maintaining relative stability remains one of the vital goals of monetary authorities in a country (Anidiobu, Okolie and Olalekan 2018).

A federal exchange of bank reserves that pay interest for a T-bill that carries a very similar interest rate has virtually no effect on the economy. Instead, what matter for the economy is the level of interest rate, which are affected by monetary policy, which implies that the traditional historical association or relationship between the amount of reserves, the money supply and the economy are unlikely to hold in the future. If the banks are happy to hold excess reserves as an interest-bearing asset, then the marginal money multiplier effect on those reserves can be closed to zero. As a result, where the federal pays interest on bank reserves, traditional theories that indicate a mechanical link between reserves, money supply and ultimately inflation are no longer valid. In particular, the work changes if the federal is willing to pay high enough interest rates on reserves.

Definition of Terms:

Monetary Policy: is a set of actions that can be undertaken by a nation central bank to control the overall money supply and achieve sustainable economic growth. It can be broadly classified as either expansionary or contractionary. (www.investopedia.com)

It is the micro economy policy laid down by the central bank. It involves management of money supply and interest rate and is the demand side economic policy used by the government of a country to achieve macroeconomic objectives like inflation, consumption, growth and liquidity. (www.m.economictimes.com)

Inflation: is the rate at which the value of a currency is falling and consequently, the general level of prices for goods and services is rising. It is a decrease in the purchasing power of money, reflected in a general increase in the prices of goods and services in an economy. (www.investopedia.com)

Discount Rate: The discount rate is the rate of interest the monetary authorities charge the commercial banks on loan extended to them. If the central bank wishes to increase liquidity and investment, it reduces the discount rate and on the other hand if the central bank wishes to reduces liquidity in the economy it raises the discount rate.

Liquidity Ration: The central bank imposes upon the bank a minimum liquidity ratio, being vary to the needs of the situation. It is designed to enhance the ability of bank to meet cash withdrawals by the customers. Such liquidity ratio stands for the proportion of specified assets.

Money Supply: is a currency with the public and demand deposits with commercial banks. Demand deposits are savings and current account of depositors in a commercial bank.

Economic Growth: this is a process whereby the real per-capital income of a country increases over a long period of time. Economic growth is measured by the increase in the amount of goods and services produced.

Exchange Rate: This is the value of one nation's currency versus the currency of another nation or economic zone. For instance how many Nigeria Naira does it take to buy one u.s.dollars? Most exchange rate are free floating and will rise or fall based on supply and demand in the markets. Some exchange rate

are not free floating and are pegged to the value of other currencies and may have restrictions. (www.investopedia.com)

Domestic credit growth rate: This is part of any increase in the money supply which is not due to a balance of payments supplies. The money supply can rise through leading by the banking system to either the state or the private sector. (www.oxfordreference.com). This extra internal banking lending is domestic credit expansion. A monetary aggregate that is sometimes used by the international monetary fund in requiring monetary restraints on the part of a member country with a balance of payments deficit as a condition of access to the fund's resources. The main elements of DCE are made up primarily of the annual rate of change of the domestic money supply. (www.financial.ditchonary.thefreedictionary.com)

Government Expenditure: (GE) is final general government consumption expenditure (inclusive of transfer payments). Government expenditure refers to the purchase of goods and services, which include public consumption and public investment, and transfer payments consisting of income transfers (pensions, social benefits) and capital transfer. Government spent money towards the supply of goods and services that are not provided by the private sector but are important for the nation's welfare. The spending goes to the nation's defence, infrastructure health and welfare benefits. (www.myaccountingcourse.com)

MODEL SPECIFICATION:

Standardized Multiple Linear Regression Model (SMLRM): In this type of model, we have the results represents what happens after all of the variables (predictors and outcome) have initially been converted into Z-Scores (formula). Standardized coefficient simply represent regression results with standard scores, by default, most statistical software automatically converts both criterion (DV) and predictors (IVS) to Z-scores and calculate the regression equation to produced standardized coefficients. Many statisticians argued that standardized coefficient offer no or little advantage over unstandardized coefficient and often offer confusing information. In some cases discipline researchers routinely prefers standardized coefficient over unstandardized because they believe that standardized coefficients are more interpretable, provide an assessment of predictor importance. The larger the standardized coefficient in absolute value is, the more important the predictor. Standardized coefficients are dependent upon the sample standard deviation and if that value is inflated or deflated relative to the population standard deviation, then standardized coefficients will produce an incorrect inference for the population value.
http://www.bwgriffin.com/gsu/course/edu8132/notes/king standardized coefficients.pdf.

OLS Estimator:

Denote by Y the $N\times1$ vector of independent variable and X the $N\times K$ matrix of regressors, so that the regression equation can be written in matrix form as

$$Y=X\beta+\varepsilon$$

Where β is the $K\times1$ vector of regression coefficients and ε is the $N\times1$ vector of error terms.
The OLS estimator of β is

$$\hat{\beta}=\left(X^TX\right)^{-1}X^TY$$

When all the variables are standardized, the OLS-estimator can be written as a function of their sample correlations.

Denote by x_i the i-th row of X. Note that the $(K,I)-th$ element of (X^TX) is

$$(X^TX)_{KI}=\left(\sum_{i=1}^{N}x_i^T.x_i\right)_{Ki}=\sum_{i=1}^{N}x_{ik}.x_i=Nsk=Nrk$$

Furthermore the $K-th$ elements of X^TY is

$$(X^TY)_K=\left(\sum_{i=1}^{N}x_i^T.y\right)_K=\sum_{i=1}^{N}x_{ik}y_i=Nsk_{.}=Nrk_{.}$$

Denote by r_{xx} the sample correlation matrix of X that is the $K\times K$, matrix whose $(K,I)-th$ entry is equal to r_{xy}

.

Then $X^TX=Nr_{xx}$

Similarly denote by r_{xy} the $K\times 1$ vector whose $K-th$ entry is equal to r_{ky}, so that

$$X^TY=Nr_{xy}$$

Thus, we can write the OLS estimator as a function of the sample correlation matices:

$$\hat{\beta}=(X^TX)^{-1}X^Ty=r_{xx}^{-1}r_{xy}$$

Hence, a variable is said to be standardized if we subtract the mean value of its variable from its individual values and divide the difference by the standard deviation of that variable. Hence, we have $Z=\frac{X-M}{sd}$

Where X is the raw score, M is the mean and SD is the standard deviation.

Thus, the regression of Y on X, if we redefine these variables as

$$Y_i^*=\frac{Y_i-Y}{S_Y}$$

$$X_i^*=\frac{X_i-X}{S_X}$$

Where Y=Sample mean of Y, S_Y= Sample standard deviation of Y, X= Sample mean of X and S_X= Sample standard deviation of X; the variables Y_i^* and X_i^* are called standardized variables, with mean zero and variance one. However instead of running the regression $Y_i=\beta_0+\beta_1x_{i1}+\beta_2x_{i2}+\ldots+\beta_{p-1}x_{i,p-1}+\varepsilon_i$

we could run regression on the standardised variables as

$$Y_i^*=\beta_0^*+\beta_1^*x_{i1}^*+\beta_2^*x_{i2}^*+\ldots+\beta_{p-1}^*x_{i,p-1}^*+\varepsilon_i$$

Therefore we have

$$\beta_0^*=Y_i^*-\beta_1^*X_{i1}^*-\beta_2^*X_{i2}^*-\ldots-\beta_{p-1}^*X_{i,p-1}^*$$

Since $Y_i^*=X_{i1}^*=\ldots=X_{i,p-1}^*=0$ (standardized variables has mean zero (0)) and $\beta_0^*=0$

Hence we have

$$Y_i^*=\beta_1^*x_{i1}^*+\beta_2^*x_{i2}^*+\ldots+\beta_{p-1}^*x_{i,p-1}^*+\varepsilon_i$$

Is called a standardized multiple linear regression model with $P-1$ predictor variables. It can also be written as: $Y_i = \sum_{k=1}^{P-1} \beta_k^* X_{ik}^* + \varepsilon_i$

Since $E(\varepsilon_i)=0$, the response function for SMLRM above becomes: $E(Y)=\beta_1^* x_1^* + \beta_2^* x_2^* + \ldots + \beta_{p-1}^* x_{,p-1}^*$

Interpretation: β_1^* up to β_{p-1}^* are known in the literature as beta coefficient. The interpretation is that if the (standardized) regressor increases by one standard deviation, on average, the (standardized) regressand increases by β_1^* standard deviation units. Thus, unlike the traditional model, we measure the effect not in terms of the original units in which Y and X are expressed, but in standard deviation units.

The Model of interest:

Standardized model;

$PF^* = \beta_1^* RY^* + \beta_2^* MS^* + \beta_3^* EXR^* + \beta_4^* DC^* + \beta_5^* GEXP^*$ OR

$Z\sim PF = \beta_1^* Z\sim RY + \beta_2^* Z\sim MS + \beta_3^* Z\sim EXR + \beta_4^* Z\sim DC + \beta_5^* Z\sim GEXP$

Implication of Terms:

$PF \Rightarrow$ Inflation rate

$RY \Rightarrow$ Real income growth rate

$MS \Rightarrow$ Money supply

$EXR \Rightarrow$ Exchange rate

$DC \Rightarrow$ Domestic credit growth rate

$GEXP \Rightarrow$ Government expenditure

$Z\sim PF \Rightarrow$ Standardized Inflation rate

$Z\sim RY \Rightarrow$ Standardized Real income growth rate

$Z\sim MS \Rightarrow$ Standardized Money supply

$Z\sim EXR \Rightarrow$ Standardized Exchange rate

$Z\sim DC \Rightarrow$ Standardized Domestic credit growth rate

$Z\sim GEXP \Rightarrow$ Standardized Government expenditure.

MATERIAL:

The data used for this study was extracted from the central Bank of Nigeria (CBN) statistical bulletin. It covered the period 1998 to 2018.

DISCUSSION OF RESULTS:

The statistical model fitted for this research work with their estimated parameters is SMLRM. The R-statistical software package was adopted to obtain the necessary results for discussion.

Output of Standardized Regression Analysis

$Z\sim PF$ Versus $Z\sim RY$, $Z\sim MS$, $Z\sim EXR$, $Z\sim DC$, $Z\sim GEX$

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
X1	-0.29938	0.32574	-0.919	0.372
X2	0.01498	0.19875	0.075	0.941
X3	0.16666	0.52385	0.318	0.754
X4	-0.18683	0.51651	-0.362	0.722
X5	-0.23926	0.24162	-0.990	0.337

a. Dependent variable $Z\sim PF$

Source: Authors computation from R-Software Package

From the SMLRM output in table above, the model becomes:

$$Z\sim PF=-0.29938Z\sim RY+0.01498Z\sim MS+0.16666Z\sim EXR-0.18683Z\sim DC-0.23926Z\sim GEX$$

Interpretation:

The coefficient of z-score in the above model could be interpreted as follows;

$\beta_1^*=-0.299$: A1 standard deviation decrease in $Z\sim RY$ is predicted to result in a -0.299 standard deviation decrease in $Z\sim PF$ holding $Z\sim MS$, $Z\sim EXR$, $Z\sim DC$ and $Z\sim GEX$ constant.

$\beta_2^*=0.014$: A1 standard deviation increase in $Z\sim MS$ is predicted to result in a 0.014 standard deviation increase in $Z\sim PF$ holding $Z\sim RY$, $Z\sim EXR$, $Z\sim DC$ and $Z\sim GEX$ constant.

$\beta_3^*=0.1666$: A1 standard deviation increase in $Z\sim EXR$ is predicted to result in a 0.1666 standard deviation increase in $Z\sim PF$ holding $Z\sim RY$, $Z\sim MS$, $Z\sim DC$ and $Z\sim GEX$ constant.

$\beta_4^* = -0.1868$: A1 standard deviation decrease in $Z \sim DC$ is predicted to result in a -0.1868 standard deviation decrease in $Z \sim PF$ holding $Z \sim RY$, $Z \sim MS$, $Z \sim EXR$ and $Z \sim GEX$ constant.

$\beta_5^* = -0.2392$: A1 standard deviation decrease in $Z \sim GEX$ is predicted to result in a -0.2392 standard deviation decrease in $Z \sim PF$ holding $Z \sim RY$, $Z \sim MS$, $Z \sim EXR$ and $Z \sim DC$ constant.

CONCLUSION:

In this research, SMLRM was considered as a tool in carrying out the analysis with the aid of R-Package software. The P-values of the estimated variables were all greater than the significance level $\alpha(0.05)$. the study therefore concluded that all the explanatory variables made significance impact in reducing inflation rate in Nigeria.

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