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The Relationship between Rate of M1 and Inflation- Evidence from a Regression Analysis (1990-2016)

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ABSTRACT: The paper evaluates the relationship between rates of M1 which is generally known as the narrow definition of money in Nigeria, over the period 1990q1 to 2016q2, using Ordinary least square (OLS) technique, and the Correlation result conducted showed that, the rate of M1 and inflation rate has a strong positive relationship with a coefficient of 98%. The regression result showed that, there exists a significant positive impact of the rate of M1 on inflation rate in Nigeria, which is significant at 1% level of significance showing that a unit change in M1 will significantly increase INFLATION RATE by 5.2%. Therefore, the paper recommends that, that the government should effectively control the amount of money supplied in form of coins and naira notes to the economy in order not to increase inflation, and also it is tentative for monetary authority to note that money supply (m1) could be used to regulate the level of inflation in the economy.

KEYWORDS: OLS, Rate of M1, Inflation rate, Monetary policy Nigeria.

1.1 INTRODUCTION

Many economic agents, notably, fixed income earners squall for the fear of evaporating purchasing power with rising inflation rates. Consequently, policymakers deploy multiple variants of decelerators to tame rising inflation. There are quite a few therapies, at least, in textbooks that are effective for the purpose of keeping aggregate prices less variable over time. Increase taxes, surplus government budgets, remove market hiccups, improve production infrastructure to reduce production lags, reduce the growth of money supply, the list is just endless. But there is always a dilemma. Which of these treatments is suitable for the economy at any point in time? If a combination of the prescriptions is required, what is the appropriate dosage for each? In fact to be able to recommend any of the prescriptions policy should recognize the functional form of the dynamics of aggregate prices and this is not a mean job considering the myriad of issues involved – changing structure of the economy, technical issues including estimation techniques, international influence on domestic production etc.

Monetary authorities, central banks for most countries, face a more difficult challenge with respect to fighting inflation. They generally assume that excess growth in money supply is on the roots of wayward price developments so that all potent tools, 'halt the growth in money supply' is capable of fixing inflation. However, causality between inflation and other macro-variables is a contentious subject. In the opposition to monetarism heterodox economists argue that the money supply is endogenous - determined within the interactions in the economy - but not by the central bank and that the sources of inflation must be found in the distributional structure of the economy. In addition, those economists seeing the central bank's control over the money supply as feeble say that there are two weak links between the growth of the money supply and the inflation rate. First, in the aftermath of a recession, when many resources are underutilized, an increase in the money supply can cause a sustained increase in real production instead of inflation. Second, if the velocity of money, i.e., the ratio between nominal GDP and money supply, changes, an increase in the money supply could have either no effect, an exaggerated effect, or an unpredictable effect on the growth of nominal GDP.

Although jumping on the campaign to show that money matters in driving inflation is not the main purpose of this paper, but however this paper is set to explore and analyze the relationship that exist between rate of money supply (M1) and inflation rate thereby trying to generate positive statement on whether controlling m1 would have a significant impact on inflation using both Correlation and Regression analysis.

The next section discusses theoretical and empirical literature as well as stylized facts on the link between money supply and inflation in Nigeria. Section III contains methodological issues. Section IV presents econometric results and findings. The last section concludes with recommendations.

2.1 LITERATURE REVIEW

2.1.1 Theoretical literature

a. The Monetarist Theory of Inflation

In the monetary theory of inflation, inflation is said to be driven by the excess of money supply over its demand, where at equilibrium real money supply equals real money demand. The Monetarists affirm that money plays an active role by leading to changes in income and prices. The argument is that changes in income and prices in an economy are mainly driven by the changes in money stocks. And because money supply exerts an upward pressure on prices inflation is seen as always and everywhere a monetary phenomenon. Monetarists however argue that though money is dominant in determining the level of prices and output in the short run, it can only determine price level in the long run. Thus, a sustained increase in the rate of money supply growth would lead to inflation. To contain inflation, monetarists commonly argue that decreasing money supply will increase nominal interest rates which will in turn slow aggregate demand and rein in inflation.

b. The Keynesian theory of inflation

The Keynesians describe the relationship between growth money supply and the level of prices in terms of the ease of access to money. The quantity of money in circulation should have a direct impact on the level of aggregate demand for goods and services in an economy. Scarcity of money constrains demand for goods and services while a glut will energize demand. Thus, demand-pull inflation would arise when aggregate demand rises above aggregate supply. One of the underlying arguments is that changes in income influence the money stock but not the reverse.

2.1.2 Empirical literature

The relationship between money and inflation has been well researched in the past and in contemporary literatures. Lucas (1980), Dwyer and Hafer (1988), Friedman (1992), and others have found that changes in the nominal quantity of money and the price level are closely related. Hossain (2005) showed that there exist short run bidirectional causality between money growth and inflation, evidence from the Indonesian economy. Babatunde and Shuaibu (2011) revealed that a positive and significant relationship exist between money supply and capital stock but a negative relationship exist between inflation relationship between inflation and growth in Nigeria.

Bakare (2011) conducted a study on the determinants of money supply growth and its implications on inflation in Nigeria. The study employed quasi-experimental research design approach. The results showed that credit expansion to the private sector determines money supply growth and inflation in Nigeria. He therefore concluded that changes in money supply are concomitant to inflation in Nigeria.

Adenuga et al. (2012) using the ordinary least square technique examined whether inflation is purely a monetary phenomenon in Nigeria for the period of 1970 to 2009. Following the quantity theory of money by fisher (1997) and the model by Grauwe (2005) and Tang (2008), they specified a model expressing inflation as a function of growth of money supply and gross domestic product. Though the variables in the model had the expected signs as depicted by the quantity theory of money, the result however showed that inflation is not purely a monetary phenomenon in Nigeria as the coefficient of growth of money supply is less than unity. Based on the result, the study recommended that the management of inflation in Nigeria should not be solely in the hands of the monetary authority.

Getawa et al. (2017) analysed that money supply contributed positively to economic growth in the long-run while in the short-run the opposite has been the case.

From the various empirical findings there is support that money supply (M1) does have a relationship with inflation rate as keened by McCandless and Weber (1995). So, we proceed to isolate the exact effect which money growth rate (M1) has on inflation in Nigeria.

3.1 METHODOLOGY

The importance of situating the exact effect of variations in the money supply (rate of M1) on aggregate price levels (inflation rate) cannot be over emphasized, especially, in policy making realms.

However, what is not less controversial is the appropriate methodology to adopt for the effect of money on inflation to be read correctly. In literature most studies have used the OLS based regressions separating variables into dependent and independent. Since we are interested in estimating the relationship as well as the impact between both variables we would use correlation and regression to estimate this relationship the following Occam's razor "**principle of parsimony**", we would like to keep our regression model as simple as possible. If we can explain the behavior of *Y* "substantially" with two or three explanatory variables and if our theory is not strong enough to suggest what other variables might be included, why introduce more variables? The model of a simple linear regression as specified in Gujarati (2004) can be written as;

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$$y_t = \beta_1 + \beta_2 X_t + U_i$$

Following the monetarist view on the relationship between money supply and inflation rate, the model could be specified as;
Infr =f (m1)

$$Infr_t = \beta_1 + \beta_2 m1_t + U_i$$

Where;
Infr means inflation rate
m1 means rate of M1
β_1 means the constant term which shows the mean value of inflation rate, i.e. the intercept term.
β_2 means the slope which shows the effect/relationship between inflation rate and the rate of money supply.

However since the OLS has a problem of generating spurious regression result if the variables included in the model are non-stationary, hence the log value of the differenced variable will be used (logΔ) in estimating the model, hence the need for unit root testing in which the ADF and PP test will be used to test for stationarity. The model is however re-specified as;

$$\log\Delta infr_t = \beta_1 + \beta_2 \log\Delta m1_t + U_i$$

Although, before estimating the regression result a time series graph will be drawn which would show how both variables relate diagrammatically.

4.1 RESULTS AND EMPIRICAL FINDINGS

4.1.1 Time Series Plot Analysis

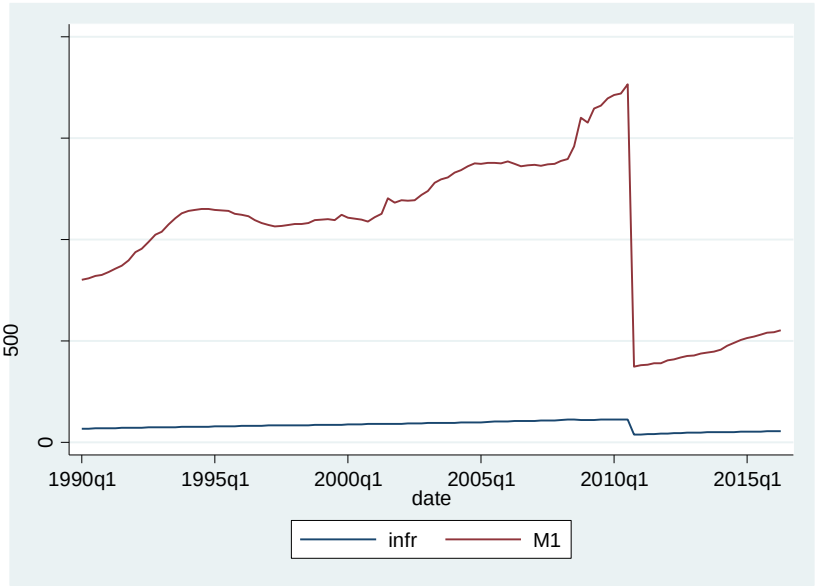

FIGURE 1.Time Series Plot of Inflation Rate and Rate of Money Supply (M1)

We can clearly see that the above time series graphical plot of infr and m1 simultaneously possess a significantly sharp "**break**" in the 2nd quater of 2010 which diagrammatically tells that a strong relationship exit between infr and rate of m1. This method is a little bit traditional and cannot be relied upon, till a formal test is conducted, in order to justify our stand.

4.1.2 UNIT ROOT TEST

The time series properties of the data were examined through the Dickey-Fuller (1979) and Phillips-Perron (1988) tests. The Dickey-Fuller test depends on a nuisance parameter so the Phillips-Perron test acts as a complementary test, as it is known to be robust to nuisance parameters. In addition, the Phillips-Perron test is not affected by weak dependence and heterogeneity of the sample data. The two variables (infr and m1) were tested in both their original form and natural log-differenced form for the presence of unit roots. The results of ADF test (Table 1) suggest a nonstationary I (1) time series for the two variables while the Phillips-Perron test suggest stationarity at I(1) in table 2. Accordingly, each of the series was first differenced. The joint hypothesis of a unit root and no linear trend could be rejected for each of the variables following the P-P test.

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Table 1: Augmented Dickey Fuller Unit Root Test

VARIABLES	LEVELS		FIRST DIFFERENCE		SECOND DIFFERENCE		ORDER OF INTEGRATION
	ADF STATISTICS	PROB*	ADF STATISTICS	PROB*	ADF STATISTICS	PROB*	
LDM1	-1.264	0.6454	-2.623	0.0882	-3.983	0.0031	I (2)
LDINFR	-1.428	0.5686	-2.38	0.1476	-3.682	0.0044	I (2)

Source: Researcher's Computation Via Stata

Table 2: Phillips-Perron Unit Root Test

VARIABLES	LEVELS		FIRST DIFFERENCE		ORDER OF INTEGRATION
	P-P STATISTICS	PROB*	P-P STATISTICS	PROB*	
LDM1	-1.870	0.3464	-10.448	0.000	I (1)
LDINFR	-1.790	0.3855	-10.203	0.000	I (1)

Source: Researcher's Computation Via Stata

4.1.2 CORRELATION

Table 3: Correlation Result

VARIABLES	Ldinfr	ldm1
Ldinfr	1	0.9801
ldm1	0.9801	1

SOURCE: RESEARCHER'S COMPUTATION VIA STATA

Table 3 shows a strong positive correlation between money growth rate (m1) and inflation. The result from the table above confirms the robustness of the high correlation between money growth (m1) and inflation. The high correlation between money growth (m1) and inflation suggests that the relationship between these two variables is very close to linear, this however coincides with the findings of McCandless and Weber (1995).

4.1.3 REGRESSION RESULT

Table 4

```
      Source |       SS       df       MS              Number of obs =     104
-------------+------------------------------           F(  1,   102) = 2485.52
       Model |  5497.24773     1  5497.24773            Prob > F      =  0.0000
    Residual |  225.594484   102  2.21171063           R-squared     =  0.9606
-------------+------------------------------           Adj R-squared =  0.9602
       Total |  5722.84222   103  55.5615749           Root MSE      =  1.4872

------------------------------------------------------------------------------
      ldinfr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ldm1 |   .0524611   .0010523    49.85   0.000      .050374    .0545483
       _cons |   .0146136   .1458537     0.10   0.920     -.2746865    .3039136
------------------------------------------------------------------------------
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Source: Researcher's Computation Via Stata 13

The model thus, as specified in section III, could be re-written as;

$$\log\Delta \mathbf{infr}_i = \boldsymbol{\beta_1} + \boldsymbol{\beta_2}\log\Delta \mathbf{m}_1 + \boldsymbol{U_i}$$

$$\mathbf{ldinfr}_i = \mathbf{0.014} + \mathbf{0.052ldm}_1 + \boldsymbol{U_i}$$

$$\mathbf{(0.920)\quad (0.000)^*}$$

Note: * indicates significance at 1% level of significance.

The intercept is approximately 0.015, this shows that if the explanatory variable m1 is held equal to zero (0) inflation rate will have an average positive rate of 1.5%. The slope coefficient which shows the impact of the rate of money supply (m1) on inflation rate is 0.05246 (approximately 5.3%) which also indicates a positive relationship between the rate of m1 and inflation rate which is significant at 1% level of significance. This deductively means that a unit increase in the rate of money supply (m1) would significantly increase inflation rate by 5.3%. This also confirms the fact that since there is a significant positive relationship between inflation rate and the rate of m1, m1 as a definition of money supply could be used to control inflation rate in Nigeria.

R^2 which shows goodness-fit of the model used has a coefficient of 0.9606 (i.e. 96%) indicates that the model is well fit since 96% of the variation in the dependent variable (inflation rate) is caused as a result of variation in the independent variable (rate of m1) leaving an insignificant part of only 4% for the residual.

Also the probability value of the F-statistics is significant at 1% (0.0000) * level of significance, indicating that there an overall level of significance of the variables used in the model.

5.1 CONCLUSION

The paper sought to ascertain the relationship between rate of M1 and inflation rate in Nigeria. The data properties favoured the use of the Ordinary Least Square methodology. And using this method, the results showed that money supply (rate of M1) is a crucial variable for determining inflation in Nigeria since there exist a strong positive correlation between both variables as well as from the regression which clearly shows this from the impact studies conducted showing that m1 has a significant impact on inflation rate.

The implication of this result is that the government should effectively control the amount of money supplied in form of coins and naira notes to the economy in order not to increase inflation, and also money supply (m1) could be used to regulate the level of inflation in the economy evidence from the regression result computed.

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