Money, Output and Price Level in Nigeria: A Test of the Monetary Neutrality Proposition

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Abstract: This paper presents and tests a model to determine either or both how anticipated or unanticipated money affects real output and inflation in Nigeria. The Barro two-step estimation procedure was explored. Also, the effects of devaluation and business cycles in the industrialized countries on output fluctuation in Nigeria were pursued. The evidence reveals that while anticipated money affects real output, the unanticipated money did not. Thus, the tests contradict the policy ineffectiveness proposition. Also, cyclical movements in the output of industrialized countries negatively affect real output with spread effect; and devaluation exhibits a delayed positive impact on output performance, with greater effect on inflation.

I: INTRODUCTION

The idea that money growth affects the real economic activity only when such monetary growth is purely random or unexpected, is a key issue in modern macro-economic theory and stabilisation policy. This idea popularly known as policy ineffectiveness proposition has its root in the new macro-economic rational expectations. Historically, macro-economic expectation is often traced to the article by Muth (1961), a concept borrowed from the engineering discipline. The rational expectation thesis argues that economic agents make efficient use of all available information to predict future changes in the economy. Therefore, any systematic attempt to influence economic actions that are anticipated would have no effect. Thus, it is argued that only surprise changes in policy affect real output growth in the economy.

Following the theoretical insights of Lucas (1972, 1973) and Sargent and Wallace (1975) hereafter referred to as LSW and the monumental empirical investigations of Barro (1977,1978), the policy neutrality hypothesis has gained considerable currency. Given that the rational expectation hypothesis has significant implications for the task of stabilisation policy, several studies have been carried out to evaluate its empirical validity. The empirical results are unambiguously inconclusive.

This article empirically investigates the LSW proposition: that it is only the unanticipated changes in monetary policy that affect real output while the anticipated changes only affect price level, using data from Nigeria. In examining the LSW hypothesis, the study takes into account the openness of the Nigerian economy. This is pursued in two ways. First, is the use of exchange rate as a possible determinant of real output growth. This is to provide some indication as to whether the short run effect of devaluation is positive or negative. Second, is the consideration of the impact of fluctuations in economic activities in industrialised countries on cyclical output shift in Nigeria. These important aspects long considered in studies on some Latin American countries (e.g., Edwards, 1983; and Sheehey, 1986), have hitherto been generally ignored by African policy analysts.

Several factors influence the choice of Nigeria. First, very little empirical investigations have been carried out with respect to the LSW hypothesis using Nigerian data. Second, there have been unprecedented increases in money supply in Nigeria, engendered largely by money-financed budget deficits since the mid -1970s. Third, Barro (1977) has suggested that testing

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the LSW hypothesis in a variety of experiences would provide adequate assessment of its validity. Following the implementation of the Structural Adjustment Programme (SAP) since the mid-1980s, demand management policies were pursued with vigour. Thus, the results of this enquiry will provide a basis for evaluating the effects of such policies on real output growth in Nigeria.

The rest of the article is organised into four sections. In Section II, the earlier empirical literature on this dynamic theme is sketched. Discussed in section III are the analytical framework and the data sources. The quantitative estimates are reported in section IV, while section V provides the conclusion.

II: PREVIOUS LITERATURE[1]

Early empirical testing of the LSW policy ineffectiveness hypothesis was with respect to developed countries, especially on the United States by Barro (1977,1978). The findings of these widely acclaimed studies show that unanticipated changes in monetary policy affect real output growth. The investigation of Attfield, Demery, and Duck (1981) was on the United Kingdom; that by Demery, Duck and Musgrave (1982) focused on West Germany, while Hoffman and Schlagenhauf (1982) and Darrat (1985) examined the hypothesis using Canadian data. Their results tended to validate the LSW hypothesis.

With respect to developing countries, profound empirical test of the validity of the new classical macro-economic hypothesis have been carried out for several Latin American countries. Particularly striking is the article by Hanson (1980), which drew data from Brazil, Chile, Colombia, Mexico, and Peru. The Barro two-step procedure was explored and estimates covering 1954 to 1970 show that unanticipated inflation significantly affected real output growth in the selected countries. However, this conclusion contradicts the findings of Barro (1979) who found that the distinction between anticipated and unanticipated money growth made little difference in explaining real output growth in Brazil, Colombia, and Mexico. These opposing results led Sheehey (1984) to carry out further tests of the LSW policy ineffectiveness hypothesis. He submitted that no relationship between random and unpredictable part of money growth and real output could be established. Even Edwards (1983) has argued that the slender evidence of Hanson (1980) was due to the inelegant money supply functions estimated; that it was inappropriate to have ignored government deficits in the functions used to generate expectations in money growth. Taking into consideration this and other weaknesses, Edwards (1983) found surprise money growth significantly influenced real output growth in Brazil, Colombia, Mexico, and Peru between 1954 and 1974.

Prior to these empirical investigations, Bomberger and Makinen (1976) had drawn cross-sectional data from sixteen Latin American countries -with specific focus on the effects of expected inflation on unemployment, measured by lagged deviation of output below its trend. An inverse relationship between inflation and unemployment was reported for most of the countries covered. This result was attributed to the definition of real gross national product (GNP) that was deflated using consumer price index rather than using the GDP deflator (Sheehey, 1979). Employing the 'appropriate' measurement of real GNP, Sheehey (1979) found a feeble negatively sloped Phillips curve for the sixteen countries. Using the same set of Bomberger and Makinen (1976), Nugent and Glezakos (1982) found unexpected inflation and unemployment to be positively related for the sample countries. When the sample was divided into three sub-groups taking account the relative importance of agriculture in their economies, the magnitude and statistical significance of the negative coefficient of expected inflation increased with the rising share of agriculture in total output. Still on Latin

[1] The review of literature presented here benefited largely from our earlier work (Egwaikhide, Aziakpono, Ayodele and Aregbenyen (forthcoming).

America, Choudhary and Parai (1991) explored the Mishkin methodology (see Mishkin, 1982) to decompose actual money growth into anticipated and unanticipated components. The statistical evidence of these authors showed a strong positive effect of anticipated money growth on real output growth thereby rejecting the LSW hypothesis.

There is the argument by Montiel (1987) that the Barro reduced-form tests are not adequate since they are generally founded on a one-good closed-economy framework. Even when extended to take into consideration open economies, the variables used are often introduced in an ad hoc fashion. Consequently, Montiel (1987) charts a different course by constructing a small simultaneous dependent economy model that exhibited the salient features of the new classical macroeconomics with fixed exchange rates. The reduced-form output equations derived for the non-tradeable and tradable sectors, expanded from the work of Blejer and Fernandez (1980), were estimated for Mexico between 1953 and 1975. Applying the Barro two-step estimation technique, results show that unanticipated money growth significantly affected the output of the non-traded goods sector. Also, the effect of anticipated monetary policy was found to be non-neutral.

Empirical tests of the validity of the LSW have also been carried out for some other developing countries. For instance, Mohabbat and Al-Saji's (1991) study was based on Iraq. Their regression estimates, which covered the period 1961 to 1977, overwhelmingly rejected the policy neutrality proposition. Only the anticipated part of money growth was found to exert a significant influence on real output in the country. Marashdeh (1993) developed a five-variate econometric model that takes account the interrelationship between fiscal policy, monetary policy, inflation, balance of payments and real output with application to Malaysia. Statistical estimates and diagnostic tests reveal that anticipated changes in fiscal impulse and balance of payments did not affect real output growth in the Malaysian economy. In the short run, anticipated changes in money growth and inflation influence real output growth. Evidence also suggests that unanticipated changes in fiscal policy, monetary policy and balance of payments have no effects on real output growth. All these results lead to the rejection of the LSW policy ineffectiveness hypothesis. Similar conclusions had earlier been reached on Greece, Thailand, and Jordan by Paleogos (1986), Khatri-Chhetri, and Ampon (1990), and Marashdeh and Khali (1991), respectively. However, the findings of a relatively recent study by Hwa (1996) on Malaysia are discordant with the conclusions of Marashdeh (1993), but strongly supported the validity of the new classical macro-economic theoretical postulate.

Data have also been pooled for several countries to assess the foundation of the LSW proposition. In this respect, the research by Sheehey (1986) is particularly illuminating. The Lucas-type supply function was explored to examine the effects on short run output growth of unanticipated inflation, changes in the cost of foreign exchange and fluctuations in output of industrialized countries. The results of two stage least squares (TSLS) estimation (with pooled data for sixteen Latin American countries) support a negatively sloped Phillips curve for the countries examined. It was apparent that devaluation was necessarily recessionary while business cycles in the industrialized countries tended to engender economic growth. Nwanna (1987) who pursued the same theme as Sheehey (1986) also found a strong positive effect of unexpected inflation on real output growth. This indicates a negatively shaped short-run Philips curve for the selected group of low-income economies (LIEs) and upper middle-income economies (UMIEs) as a group for the twenty-six years, 1960-1985. It was clear that in the short run, devaluation had a contractionary impact on real output.

In Nigeria, Odedokun (1988, 1991), Anyanwu (1995) and Egwaikhide, Aziakpono, Ayodele and Aregbenyen (forthcoming) have attempted

empirical verification of the LSW proposition. These authors applied the Barro two-step procedure; and their findings did not validate the neutrality thesis. The evidence from Ghana can be juxtaposed against the findings on Nigeria. In their estimate of the determinants of real output in Ghana, Jebuni, Sowa and Tutu (1991), included surprise money growth in the output growth equation. This was found not to be statistically significant at the conventional levels.

III: ANALYTICAL FRAMEWORK AND DATA SOURCES

To begin, consider a model describing a "goal" variable (for example, real GNP) of the form:

$$Y_t = \alpha(L)Y_{t-1} + \beta(L)(M_t - E_{t-1}M_t) + \mu_t \quad (1)$$

Where Y_t is the goal variable; M_t is a policy variable (for example, the nominal money supply); $E_{t-1}Mt$ denotes the expectation formed on the basis of information available in $_{t-1}$; $\alpha(L)$ and $\beta(L)$ are polynomials in the operator $L(\alpha_o = 1)$; $L(\beta_o = 1)$; and μ_t is a white noise random error.

Su ppose the policy variable follows the rule

$$M_t = \gamma(L)Y_{t-1} + \varepsilon_t \quad (2)$$

Where $\gamma(L)$ is another polynomial in $L(\gamma_o = 1)$, and ε_t is another white noise random error distributed independently of μ_t. If expectations are formed rationally such that

$$\varepsilon_{t-1}M_t = \gamma(L)Y_{t-1}, \quad (3)$$

Then substitution of (2) and (3) into (1) produces the following expression for the real variable:

$$Y_t = \alpha(L)Y_{t-1} + \beta(L)(\varepsilon_t) + \mu_t \quad (4)$$

Equation (4) shows that only innovations in the policy rule will affect the real variable. As a consequence, the time path of the real variable is independent of anticipated movements in the policy rule.

In order to test the hypothesis, I adopted the Lucas-Barro two-stage framework. In the first stage, movement in money supply is decomposed into expected and unexpected components. The second stage involves the estimate of the output and price level models. These are pursued in turn.

Money Growth Models

In the first stage, expectations of money growth in Nigeria are generated. Two separate methods have been used to find the anticipated and unanticipated parts of the money growth and these are described below.

Method A.

First a structural econometric method is employed to predict the anticipated money growth. The model is based on Mishkin (1982), which employs an atheoretical statistical model. Mishkin (1982) has contended that an atheoretical statistical model is superior to the one implied by the economic theory because of the tendency of misspecification due to omission of relevant information based on theoretical grounds in predicting policy actions. Thus, as in Mishkin (1982), since an appropriate monetary feedback rules should be based on all the available and pertinent macroeconomic information, the money supply growth was regressed on its own past values and other pertinent monetary policy response macro variables which are readily available to the public for predicting future policy actions. The macro variables considered are: the nominal GDP growth, Central Bank discount rate, exchange rate, government expenditure and inflation rate. These variables, apart from being readily available to the public to form expectations of future monetary policy actions, they also have macroeconomic relevance.

In the estimation of the feedback equation, an appropriate lag length was first specified. In this respect, a common lag length of four is used for each variable. The choice of a common lag length is to prevent the researchers from searching for alternative specification that would produce results confirming any a priori belief (Glick and Hutchison, 1990; Devadoss, 1995; Devadoss and

Hennessy, 1996). Thus, the following money supply function is estimated:

$$MG_t=\alpha+\beta(L)MG_t+\Omega(L)GE_t+\phi(L)Y_{gt}+\phi(L)DR_t+\Phi(L)ER_t+\Psi(L)INR_t+\mu_t \quad (5)$$

Where MG represents annual money growth, GE stands for government expenditure[2], DR is the central bank discount rate, and L is the lag operator. The variable Yg denotes growth in nominal gross domestic product. ER and INR are the exchange rate and inflation rate respectively. The residuals generated from equation (1) represent the unanticipated part of actual money growth.

Method B

Following Beladi and Samanta (1988), I also employed an autoregressive moving average (ARIMA) model of money growth during the period 1966-1999, to estimate the anticipated aspect of money growth. Though ARIMA method is not exactly recommended by the rational expectation policy neutrality (REPN) hypothesis, since it utilizes the information available in the sample observations of money growth only, while REPN emphasizes the information available from all sources, however, I use it in order to provide an alternative way of predicting the anticipated money growth.

Also, as noted by Beladi and Samanta (1988), ARIMA has been proved to be a very advanced method of prediction for many macro variables, and on occasions it is even better than the structural econometric methods. In fitting the ARIMA model to the money growth data, alternative ARIMA models were experimented with and the best was chosen on the basis of a simple diagnostic check on the residuals estimated from these models as to whether it is white noise or not, and the forecasting power of the model judged by, Root Mean Squared Error, Theil Inequality Coefficient, and Bias Proportion.

[2] We also employ budget deficits (BOt) instead of government expenditure as an alternative measure of the effect of government fiscal operations.

The estimated values from the first stage, AGMt. and the residuals $UGM_t = GM_t - AGM_t$ are used to measure, respectively, the anticipated and unanticipated components of money growth.

Output and Price Models

The second stage uses the results of the random and non-random components of the money growth to estimate real output growth and price level models. The output model is of the form:

$$YG_t=\alpha_o+\delta(L)AMG_t+\theta(L)UMG_t+\theta(L)EX_t+\phi(L)OD_t+\varphi T+Wt \quad (6)$$

Where YG is the growth in real output measured by real GDP; AMG and UMG denote anticipated and unanticipated money growth in that order, and EX and OD are exchange rate and output of industrialised countries, respectively. T is the time trend, which accounts for the natural growth rate of output. The effects of monetary expansion on real output are measured by the current and lagged values of the anticipated and unanticipated money growth. If the unanticipated components were significant while the anticipated components are insignificant, this result would lend strong support to the proposition that only unanticipated policy matters. Anticipated policy would be ineffective in influencing real growth. The inclusion of exchange rate provides an assessment of the dominant view that devaluation tends to expand domestic output. This is particularly important when it is realized that Nigeria's exchange rate has substantially depreciated with the implementation of SAP since 1986. Changes in economic activity of the advanced countries affect output growth in the developing countries. Thus, the coefficient of OD measures how fluctuations in output of Nigeria are influenced by business cycles in the industrialized countries. We now examine the relationship between the price level and unanticipated money growth in Nigeria. The following price function is specified:

$$Pt=\delta_o+\delta(L)AMG_t+\theta(L)UMG_t+\phi(L)EX_t+\varphi T+V_t \quad (7)$$

Where P_t is the consumer price index (CPI); AMG_t and UMG_t are the anticipated and unanticipated money growth; EX_t is nominal exchange rate of the Naira to US Dollar; T is time-trend and V_t is the white noise error term.

Following the policy ineffectiveness thesis, the current and lagged values of anticipated money growth are expected to exert a significant positive influence on price level, while the unanticipated components is expected to be insignificant in this equation. The exchange rate variable was added to account for the effect of the devaluation of the Naira on price level. The price level equation includes a time-trend variable, T, designed to capture the natural growth of price level.

The models would be estimated using ordinary least squares (OLS). Based on the results from OLS estimation of equation 6 and 7; the actual test of the LSW proposition would be carried out using two approaches. First, the coefficients of the contemporaneous and lagged values of surprise and anticipated monetary variables would be evaluated individually using their t-values and their significance gauged at the conventional levels of significance. Second, following Marashdeh (1993), the joint significance of the coefficients would be assessed using *F*-statistic. The *F*-statistic test is used to test whether the sum of the coefficients is significantly different from zero. A significant *F*-statistic test indicates that the included variables are directly influencing the dependent variable. The *F*-statistic was calculated as follows:

$$\frac{F = (R^2_{UR} - R^2_R)/m}{(1-R^2_{UR})/(n-m)} \qquad (10)$$

Where R^2_R is the coefficient of determination of the restricted model - without both the anticipated and unanticipated;

R^2_{uR} is the coefficient of determination of the new model including either the anticipated or unanticipated variables;

M represents the number of new variables included in the unrestricted model- i.e. the contemporaneous plus the lags of the anticipated or unanticipated variables; and N is the number of observation.

The current study is different from our earlier study in four major ways. First, unlike the former study which estimated a money growth model based on economic theory, the current study is based on Mishkin (1982), which employs an atheoretical statistical model. Second, an alternative way of predicting the expected money growth was employed using an ARIMA modeling. Also, in this a price level model was estimated using anticipated and unanticipated money with other variables. This further strengthened the validity of the test of the proposition. Lastly, a joint significance of coefficients tests was carried outusing the *F*-statistic. To my knowledge, this and the alternative money growth model (ARIMA model) make this study unique as far as empirical tests of the proposition in Nigeria is concerned.

Data Definition and Source

Annual time series data for the period between 1966 and 1998 are used to estimate the models specified. The sources of the variables are indicated explicitly below. Except for Domestic Budget Balance, all the other variables were obtained from various issues of the International Financial Statistics (IFS), a publication of the International Monetary Fund. Output proxied by real GDP, while broad definition of money (M2) is used. Nominal exchange rate is used instead of effective real exchange rate. This is due to lack of reliable time series data on the latter for the 1970s. An index of industrial production of industrialized countries is employed as for Real GDP of Industrialized Countries. Domestic Budget Balance is defined as the difference between total domestic expenditure and domestic revenue. The variable is computed from expenditure and revenue data collected from: (i) Annual Report and Statement of Accounts; and (ii) Statistical Bulletin, both of the Central Bank of Nigeria.

MODEL ESTIMATION AND TEST RESULTS

Money Growth Models

The OLS estimates of the money supply growth equations are presented in Table 1. The broad money definition of money (M2)[3] was used. Alternative structural money growth models were estimated. Based on the descriptive statistics of the models, the regressors predict the anticipated money growth reasonably well. Specifically, the adjusted R2 shows that 99% of the variation in actual money growth is due to the explanatory variables. The F -statistic reveals that the regression was significant at the 5% level; and the relatively low value of the standard error of the regression (SEE) is a confirmation of the goodness of fit of the estimated equation.

The coefficient of the MG_{t-1} bears a sign that is consistent with economic logic. However, it is statistically insignificant at the conventional levels of significance. When this is combined with the negative coefficients of the second-lag and third-lag money growth variable, it can be inferred that there is no 'persistence effects' of money growth in the economy. A plausible explanation for this is that in Nigeria, monetary policy has generally been conducted to accommodate budget policy.

Government expenditure exerts a significant influence on money growth.[4] This shows that the injection of oil revenue into the economy tends to enhance money growth. The stronger influence of government expenditure is an evidence of strong interactions between money growth and government expenditure. The coefficients of the two-lag nominal GDP growth rates do not significantly impact on money growth. The inflation and interest rate variables are, also, not significant determinants of money growth.

As an alternative to the above, we fitted an ARIMA model to estimate the anticipated money growth. The fitted model is ARIMA (0, 1, 2) with the following results:

$$\Delta^2 M_t = -0.1787 - 1.044e_{t-1} + 0.092e_{t-2}$$
$$(-0.2986)\ (-8.223)\ (0.4454)$$
$$t= (0.7674)\ (0.000)\ (0.6595)$$

Adj.-R^2 = 0.62, D.W = 2.285, *F*-Stat =21.8421, Inverted MA Roots = 0.95 +0.10. Root Mean squared error = 12.909, Theil Inequality Coeff. = 0.5545, Bias Proportion = 0.3125.

The predicted values and the residuals from the feedback rules represent the anticipated and unanticipated money growths, respectively. Contemporary and four-lagged values of these anticipated and unanticipated policy components enter the real output growth and price equations with other relevant variables.

Table 1: *Estimated structural money growth equation*

Variable	Coeff.	Std. Error	t-Stat	P-value
Constant	-4.781	2.047	-2.335**	0.052
GMt-1	0.4415	0.415	1.064	0.323
GMt-2	-0.201	0.434	-0.464	0.657
GMt-3	-0.630	0.402	-1.567	0.161
GMt-4	0.365	0.475	0.768	0.467
GYt-1	0.514	0.292	1.764	0.121
GYt-2	0.102	0.369	0.277	0.790
GYt-3	0.915	0.421	2.174**	0.056
GYt-4	0.231	0.488	0.473	0.651
ERt-1	0.014	0.018	0.770	0.467
ERt-2	0.021	0.026	0.808	0.446
ERt-3	-0.043	0.036	-1.177	0.278
ERt-4	-0.020	0.042	-0.462	0.658
GEt-1	1.662	0.583	2.849**	0.038
GEt-2	0.411	0.215	1.915*	0.063
GEt-3	-0.020	0.166	-0.121	0.907
GEt-4	-0.187	0.191	-0.981	0.359
DRt-1	-0.009	0.019	-0.443	0.671
DRt-2	-0.001	0.188	-0.070	0.946
DRt-3	-0.005	0.013	-0.420	0.687
DRt-4	-0.016	0.025	-0.504	0.629

Adj.R^2 = 0.999; D.W = 2.137; S.E. = 0.111; F-stat. = 359.31; SC = 0.44

Note: * significant at 10% level
** Significant at 5% level

[3] The narrow definition (M1) was also explored, but basically the results were not as good as that of M2 judged by their standard errors and Schwarz Criterion.

[4] When the domestic budget balance is employed, it was also found to be significant at 5% level of significance. However, the coefficient was lower than that of government expenditure.

Real Output Model

The result of the real output growth are reported in Tables 2 and 3. Variants of the output equation outlined in the preceding section were estimated. In general, equations (1) in tables 2 to 5 represent the estimated model using the predicted and random components obtained from the structural money growth model. While in equation (2), the anticipated and unanticipated components of money growths were derived from the ARIMA model. Basically, the results obtained from the alternative models lead to the same conclusion. As shown in Table 2, in both equations, the coefficient of the contemporaneous expected money growth exert a significant positive influence on real output growth. However, none of the lags was significant at the conventional level of significance. When the test of joint significance of both the contemporaneous and lagged systematic money growth was carried out, we obtained an overwhelming evidence of a strong impact of the anticipated money on real output.

In contrast to these results, neither the contemporaneous nor the lagged values of the random component of money was significant at the conventional levels of significance. Also, the test of joint significance of the contemporaneous and the lagged values of unexpected money growth was not significant. These results overwhelmingly reject the LSW thesis that it is only the unanticipated components of money growth matter in promoting growth of real output, as earlier studies on Nigeria by Odedokun (1988; 1991) and Anyanwu (1995) suggest.

Time trend was included in the model to capture secular movements in the regressors. It is apparent that the short run cyclical movements in the output of the industrialized countries have tended to affect adversely (though not in a statistically significant way) real output in Nigeria. However, this phenomenon has a significant negative spread effect on output growth.

Table 2: *Estimated real output growth equations*

Variable	Eq1	Eq2
Constant	7.526 (15.133)*	3.975(0.047)
AMGt	0.871 (2.697)	0.717 (2.423)
$ANMG_{t-1}$	-0.516 (-1.469)	0.024 (0.075)
AMGt-2	-0.040 (-0.119)	-0.117 (-0.441)
AMG_{t-3}	-0.259 (-0.084)	0.166 (0.661)
AMG_{t-4}	-0.026 (-0.903)	0.149 (0.584)
UMGt	-0.131 (-0.133)	0.287 (1.319)
UMGt-1	-0.386 (-0.372)	-0.569 (-0.781)
UMGt-2	0.453 (0.323)	-0.505 (-0.775)
UMGt-3	0.506 (0.474)	-0.152 (-0.474)
UMGt-4	0.039 (0.041)	-0.136 (-0.453)
EX	-0.009 (-0.615)	1.182 (0.806)
Ext-1	-0.024 (-1.075)	-1.041(-0.492)
Ext-2	0.011(1.855)**	0.320 (0.227)
Odt	-0.011 (-0.545)	-1.165 (-0.655)
Odt-1	0.017 (0.788)	2.043 (0.976)
Odt-2	-0.008 (-048)	-1.742 (-0.976)
T	0.002 (1.605)	-3.941 (-1.112)
R^2	0.68	0.64
F	5.85	2.478
DW	2.03	2.26
SC	0.325	9.30

Note: Equation 1 corresponds to the structural model, and Equation 2 corresponds to the ARIMA model. The values in parenthesis are *t*-values

The results of the exchange rate variable are interesting and deserve some elaboration because of the negative coefficient, though not statistically significant at the conventional levels. These results show that devaluation of the currency tends to have a contractionary effect on real output growth in the short run. However, in the long run, the impact of devaluation on output becomes positive and significant. This supports the theoretical argument that the positive impact of devaluation on real output growth may be delayed.

Table 3: *Real out-put models (Joint Test Results)*

Variable	F-Statistic	F-Table 5%(5,24)	Value 10%(5,24)
Anticipated (1)	8.429	2.62	2.10
Anticipated (2)	5.234	2.62	2.10
Unanticipated (1)	0.792	2.62	2.10
Unanticipated (2)	0.989	2.62	2.10

Note: (1) corresponds to the structural model, and (2) corresponds to the ARIMA model.

Price Model

The relative impacts of systematic and unsystematic money growth on price level in Nigeria can be seen from the values of coefficient estimates, t-values and F-statistic as shown in tables 4 and 5.[5] In this model, neither the expected nor the unexpected components were significant in any of the tests performed. Despite the fact that anticipated monetary policies have a larger effect on inflation than the unanticipated component, its statistical insignificance however provides a further rejection of the LSW proposition.

A very interesting property of the estimated price level equation relates to the role of the exchange rate variable. The current and second period lag coefficients have a very strong positive impact on inflation, which show that exchange rate movement has both instantaneous and delayed impact on inflation. As can be observed, the lagged impact is even more powerful thanthe immediate effect. This justifies the popular claim that inflation in Nigeria has been caused mainly by the devaluation of the Naira, since the introduction of structural adjustment programme (SAP).

The fit of the price level equation is very good according to the values of estimated R^2 and *F*-statistic. This is due mainly to the exchange rate variable. Indeed, when the exchange rate variable was excluded, the explanatory power of the model fell from its present level of more then 96% to about 30%. The time trend had the expected positive sign, but not significant at the conventional levels of significance.

Table 4: *Estimated price level equations*

Variable	Coeff.	Std. Error	t-Stat	P-value
Constant	198.87	178.74	1.113	0.286
AMGt	-4.139	90.388	-0.046	0.964
AMGt-l	-41.54	144.48	-0.288	0.778
AMGt-2	-2.897	145.73	-0.099	0.984
AMGt-3	53.592	158.08	0.339	0.74
AMGt-4	20.408	01.51	0.201	0.844
UMGt	-141.8	370.22	-0.383	0.708
UMGt-l	-302.9	370.89	-0.817	0.429
UMGt-2	-265.6	410.75	-0.647	0.529
UMGt-3	-286.9	345.33	-0.831	0.421
UMGt-4	-308.03	322.74	-0.954	0.357
EX	14.27	6.884	2.072	0.059
EXt-l	-3.953	10.199	-0.388	0.705
EXt-2	33.142	7.125	4.65	0.0005
T	0.278	0.426	0.653	0.525

R2 = 0.962; F = 23.87; DW = 1.947; SC = 12.49

[5] Only the model based on the structural money growth model is reported. The alternative model's results compared favorably.

Table 5: *Price level models (Joint Test Results)*

Variable	F-Statistic	F-Table 5%(5,26)	Value 10%(5,26)
Anticipated (1)	1.231	2.59	2.08
Anticipated (2)	0.823	2.59	2.08
Unanticipated (1)	0.792	2.59	2.08
Unanticipated (2)	0.591	2.59	2.08

Note: (1) corresponds to the structural model, and (2) corresponds to the ARIMA model.

CONCLUSION

Following the on-going debate on the effect of anticipated and surprise money growth on real output, this article has empirically examined the effect of unanticipated money growth on real output in Nigeria. The result of this study rejects the LSW hypothesis. This result is consistent with those Odedokun (1988, 1991), Anyanwu (1995) and our earlier findings. This implies that stabilization and other economic policy measures aimed at influencing economic activities in Nigeria would have the desired impact on real output growth without economic agents really anticipating their influence. The Nigerian govemment can therefore continue the use of such measures without fear of their effects being neutralized.

The findings also suggest that the effect of exchange rate devaluation on real output growth may not be immediate. It would rather take some time before the positive effect of such a policy

decision on output begins to manifest itself. This corrects the impression of the government that the Nigerian economy will quickly recover given the exchange rate policy measures implemented in the country. Govemment should, however, create the enabling environment for this to materialize. An important policy implication of the study is that there is an urgent need to diversity the productive base of the Nigerian economy. This will significantly reduce the high level of dependence of the economy on fortunes of the industrialized countries; the principal buyers of Nigeria's primary export products and the major suppliers of consumer goods, capital equipment and machinery. Needless to say, this policy proposal is predicated on the finding that business cycles in the industrialized countries adversely affect output performance in Nigeria.

Also very important, is the effect of the exchange rate devaluation of inflation. It is pertinent that movements in the exchange rate be closely monitored to ensure that its effect on price level is mitigated. It is expected that more work will be done on this important issue of macroeconomics of rational expectations, and the different issues surrounding it to provide further evidence on its validity and applicability.

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