International Journal of Development and Sustainability
Online ISSN: 2168-8662 – www.isdsnet.com/ijds
Volume 2 Number 4, (2013): Pages 2414-2428
ISDS Article ID: IJDS12082501

Special Issue: Development and Sustainability in Africa – Part 3

A model of price determination and fiscal policy in Ghana

Baba Insah [1*], Kenneth Ofori-Boateng [2]

[1] *School of Business, Wa Polytechnic P.O. Box 553, Wa, Upper West Region, Ghana*
[2] *GIMPA Business School, Ghana Institute of Management and Public Administration, Achimota-Accra, Ghana*

Abstract

This study modelled and examined the dynamic relationship among fiscal deficits, money supply, and inflation using annual data from 1980 to 2010. A static error correction model (ECM) and the Stock-Watson dynamic OLS (DOLS) model based on leads and lags of the variables were used. This technique is robust to small sample and eliminates simultaneity bias. The model was used to investigate the elasticities for both short run and long run determinants of the general price level. Results indicate that both money supply and deficit have significant impact on inflation dynamics in Ghana. The key result of the study showed that the lagged values of money supply play a key role and provides evidence that the response of inflation dynamics to money supply relies on current and cumulative effects of past doses of money supply.

Keywords: Ghana, Dynamic ordinary Least squares, Fiscal deficits, Money supply, Inflation

***Cite this paper as*:** Insah, B. and Ofori-Boateng, K. (2013), "A model of price determination and fiscal policy in Ghana", *International Journal of Development and Sustainability,* Vol. 2 No. 4, pp. 2414-2428.

* Corresponding author. *E-mail address:* nsahbaba@yahoo.com

1. Introduction

The debate over the impact of government budget deficits on an economy, especially on key macroeconomic variables have being ongoing. One of the most contentious issues has been the relationship between fiscal deficits, money supply, and inflation. A fiscal-induced monetary expansion implies that the central bank is not independent of the government. The empirical relationship between deficits and the money supply and in turn inflation is usually weak, leading some to conclude that deficits may not be very important in determining the course of inflation. Blanchard and Fischer (1989) stated that a cursory inspection of fiscal and price data does not suggest a strong positive relationship between the size of the budget deficit and the inflation rate. Nevertheless, an extensive theoretical literature (Metzler 1951; Patinkin 1965; Freidman 1968; and Miller 1983, among others) argued that public sector deficits are a major cause of inflation through the impact on the supply of money.

The central Bank of Ghana is not prohibited from participating in the primary market, it buys government bonds in the secondary market to avoid direct influence on interest rates. Moreover, the financing of the government deficit has been through the issue of bonds and also from external borrowing. Persistent deficits have been the case in the Ghanaian economy. Therefore, it is imperative to trace the links between deficits and other macroeconomic variables.

2. Literature review

In theory, there are several mechanisms available to a government to determine a link between deficits and monetary expansion (Nelson, 1993). Central banks may provide monetary financing of the deficit through the creation of base money at a rate. If this rate is in excess of demand at the current level of prices, it has the potential to create more money than the public is willing to hold. The public gets rid of the surplus cash holdings, imposing upward pressure on the general price level. Fischer and Easterly (1990) commented that the effects of this behaviour would not be obvious nor necessarily immediate.

Woodford's (1995) Fiscal Theory of Price Determination describes policy rules such that the price level is determined by government debt and the present and future tax and spending plans. The theory argues that the government's choice of how to finance its debt plays a crucial role in the determination of the time path of the inflation rate. According to the theory, fiscal policy affects inflation rates if and only if the government can behave in a fundamentally different way from households (Kocherlakota and Phelan, 1999). Households must satisfy intertemporal budget constraints, no matter what price paths they face. Woodford (1995) argues that the government does not face the same requirement. The government can follow non-Ricardian fiscal policies under which the intertemporal budget constraint is satisfied for some, but not all price paths.

In addition, the focal point of Woodford's (1995) Fiscal Theory of Price Determination, as pointed out by Breuss (1998), uses modern dynamic optimizing models based on the Present Value Budget Constraint. It states that the real value of existing public sector liabilities must be equal to the present value of current and expected future primary surpluses.

Fischer et al. (2002) using a broad cross-country panel data have found that a 1 percentage point reduction of budget deficit in GDP leads to 4.2 percentage points decrease of annual inflation. In their regression, they used budget deficit to explain inflation rate. Their findings revealed that there existed no significant relationship between inflation and fiscal balances. They noted however that this was only for low income countries. As noted by Cochrane (2001), governments can issue long term debt where current deficits no longer coincide with inflation and inflation rate increases are postponed for future periods. They concluded that this tended to reduce the effect of the budget deficit on inflation.

Furthermore, Dejthamrong (1993) concluded that fiscal deficits exert pressure on monetary authorities to increase the money supply to mitigate pressure on interest rates. Hondroyiannis and Papapetrou (1997) pointed out that this has an adverse impact on the economy, lowering productivity and triggering an increase in price levels. Fiji's case however, can be perceived to be a little different. Furthermore, Dejthamrong (1993) investigated the deficit-money relationship for six Asian developing economies and found relationships for Singapore and Sri Lanka and weaker evidence for Malaysia and the Philippines. In a similar study, Nelson (1993) analysed data from ten Asian countries for the period 1970–91 to investigate several propositions about monetary policy. His results showed little systematic relationship between monetary expansion and government deficits. There is a possibility of seignorage revenue accruing to the government by way of inflation from holding additional cash balances. This revenue is determined by the demand for money, the economic growth rate, and the elasticity of demand for real money with respect to inflation and income (Fischer and Easterly, 1990). Miller (1983) believes that chronic deficits and government borrowings tend to push up interest rates and thus crowd out private investment. This relationship was supported by Modeste (2000), using Jamaican data for the 1964–96 period.

A study by Elbadawi (1990) on the determinants of inflation in Uganda during the period 1988-89 revealed that rapid monetary expansion and the depreciation of parallel exchange rate were the principal determinants of inflation in Uganda. Also, Tegene (1989) adopted Granger and Pierce causality test and found a unit-directional causality from monetary growth to inflation. Laryea and Sumaila (2001) on the determinants of inflation in Tanzania asserted that in the short-run, output and monetary factors are the main determinants of inflation in Tanzania. They however noted that parallel exchange rate also influences inflation in the long-run. They thus concluded that inflation is a monetary phenomenon in Tanzania. On the role of exchange rate depreciation, Agenor and Montiel (1996) found that exchange rate depreciation only have a short-run impact on inflation in small, open developing countries. They noted further that seigniorage financing of deficits resulted in high inflation.

In Nigeria, Egwaikhide et al. (1994) used time series econometric techniques of cointegration and error correction mechanism (ECM) to investigate the quantitative impact of monetary expansion and exchange rate depreciation on price inflation. They concluded that Nigerian inflation is caused by both monetary and structural factors and that both the official and the parallel market exchange rates exert upward pressure on the general price level. They recommended the use of a combination of policy measures to put inflation under effective control in Nigeria. Using annual data from 1960-1977, Adeyeye and Fakiyesi (1980) tested the hypothesis that government expenditure is the main factor responsible for instability of prices and

inflation in Nigeria. Their conclusion was that the rate of inflation was linearly related to government expenditure.

For Ghana, Sowa and Kwaye (1993) concluded that the inflation problem is a multi-faceted issue with many causes. Furthermore, Ocran (2007) using among other methods a VAR approach, identified inflation inertia, changes in money and changes in Government of Ghana treasury bill rates, as well as changes in the exchange rate as the determinants of inflation in the short run. Of these, inflation inertia was the dominant determinant of inflation in Ghana. Adu and Marbuah (2011) investigated the dynamics of inflation in Ghana using the bounds test and some econometric techniques. In their study, they found that real output, nominal exchange rate and broad money supply significantly affected inflation in Ghana. They also asserted that nominal interest rate and fiscal deficit also played a role in determining inflation. Their conclusion was that a combination of structural and monetary factors explained the dynamics of inflation in Ghana which they found consistent with prior studies.

On the other hand, Narayan (2004) concluded that there were no cointegrating relationships between government borrowing and private investment during the period 1976 to 2001. The relationship between the budget deficit, the money supply, and inflation has been extensively researched in industrial countries, particularly in the United States. Buchanan and Wagner (1977) were among the very first to recognise this relationship in the United States. Based on data for the 1961–74 period, Hamburger and Zwick (1981) concluded that deficits appeared to have a significant impact on US money supply throughout most of the period. However, they also indicated that the deficit-money relationship depends on whether government deficits place upward pressure on interest rates and whether the central bank monetises the debt in an effort to stabilise interest rates.

Allen and Smith (1983) re-estimated Barro's money supply model, including a debt variable, on quarterly data from 1954Q1– 1961Q2 and 1961Q2–1980Q4. Their results supported the budget deficit-money supply hypothesis. Darrat (1985) used the OLS approach to examine post 1960 US data and established that federal deficits have an expansionary effect on money supply and inflation.

3. Theoretical framework

The theory that links general price level to the public sector is Woodford's Fiscal Theory of the Price Level and the familiar government budget constraint. The starting point is a representative agent model in which the government must satisfy both an intertemporal budget constraint and, in every period, a static budget constraint. Following Fischer and Easterly (1990) there are four ways of financing the public sector deficit: by printing money, running down foreign exchange reserves, borrowing abroad, and borrowing from domestic agents.

Each of the different ways of financing the deficit has its own problems. For example, foreign reserve use can lead to exchange rate crises, while foreign borrowing may lead to an external debt problem. The printing of money to finance the deficit may also lead to inflation. With the exception of money printing, there are

limitations on the extent to which a government can pursue these financing options. The static budget constraint is expressed

$$D = G - T = \Delta B + \Delta M \quad (1)$$

where D is the government deficit, G is government expenditure, B is government debt, T is tax receipts and M is the money supply. It says that budget deficit can be financed by issuing money or by government debt through the issue of bonds.

Following Burnside (2004), the government's budget constraint can be expressed as:
net issuance of debt = interest payments – primary balance – seignorage. There is common knowledge that aisde money creation, the main method of financing government expenditure is debt; domestic and foreign. The net issuance of debt is gross receipts from issuing new debt minus any amortization payments made in the period. The identity can be written as

$$B_t - B_{t-1} = I_t - X_t - (M_t - M_{t-1}) \quad (2)$$

The subscript t indexes time, measured in years, B_t is the stock of public debt at the end of period t, I_t is interest payments, X_t is the primary balance (revenue minus non interest expenditure) and M_t is the monetary base at the end of period t. This is modified as

$$I_t = (1 + i_t^d)B_{t-1} + E_t(1 + i_t^f)B_t^* \quad (3)$$

where i_t^d is domestic interest rate, i_t^f is foreign interest rate. The primary balance can be expressed as

$$X_t = G_t - T_t \quad (4)$$

where G_t is government expenditure and T_t is revenue. The government budget constraint can be expressed as:

$$G_t - T_t + I_t = \left(D_{t+1} - D_t\right) + \left(M_{t+1} - M_t\right) \quad (5)$$

where $G_t - T_t + I_t$ = PD, is the primary balance.

Building on the above, the study extends further the framework to differentiate domestic debt from foreign debt, the government budget constraint for period t in terms of domestic currency is

$$PD_t = (B_t^d - B_{t-1}^d) + E_t(B_t^* - B_{t-1}^*) + (M_t - M_{t-1}) \quad (6)$$

Interest payments on both domestic and external debt are separated to give the formulation a richer economic meaning. Where PD_t, the government primary balance for period t, is to be financed by seignorage, net domestic and external indebtedness. Interest payment, (I_t) on both domestic and foreign debt as:

$I_t = i_t^d B_t^d + E_t i_t^f B_t^*$. A further extension of the framework is the incorporation of aid. This modification is informed by the fact that aid has become a major component of the budget of Ghana especially after 2000 till date. Following the formulation by Dinh (1999), aid as a component can be expressed to have a reducing effect on the deficit and consequently a change in debt levels. Taking into consideration the Domar (1944) framework and therefore substituting interest payments from Equation (3), the government budget constraint for period t in domestic currency can be expressed as:

$$G_t - T_t + i_t^d B_t^d + E_t \boldsymbol{i}_t^f (1 - A_t) B_t^* = \Delta B_t^d + E_t \Delta B_t^* (1 - A_t) + \Delta M_t \qquad (7)$$

where ΔB_t^d is the change in domestic debt, ΔB_t^* is change in external debt and ΔM_t is change in the monetary base. Aid is represented by *A*. All other variables as explained before. Normalize Equation (7) by dividing by nominal income, $P_t Y_t$. Where P is the price level and Y is real GDP. To express in real terms we divide by P. For simplicity, assume the absence of external debt and aid financing.

$$\frac{G_t}{P_t} - \frac{T_t}{P_t} + \frac{i_t^d B_t^d}{P_t} = \frac{\Delta B_t^d}{P_t} + \frac{\Delta M_t}{P_t} \qquad (8)$$

On the left hand side of Equation (8) is the budget deficit comprising repayment of external debt. The right side is seigniorage.

Following from the last component of Equation (8), $\frac{\Delta M_t}{P_t}$ is the real resources the government acquires through increases in the nominal money balances the public is willing to hold.

In a discrete time mode, seigniorage denoted as S_M, in period t is given by

$$S_M = \frac{M_t - M_{t-1}}{P_t} \qquad (9)$$

A useful way to rewrite this expression is as

$$S_M = \pi_t m_{t-1} + (m_t - m_{t-1}) \qquad (10)$$

where $\pi_t = (P_t - P_{t-1}) / P_t$ and $m = M / P$. This expression emphasizes two distinct sources of seigniorage. Combining Equation (10) and (8), we can express Seignorage revenues (S_M) as a function of the inflation rate and real money supply:

$$S_M = f(\pi_t) \frac{M_t}{P_t} \qquad (11)$$

where $f(\pi_t)$ is a reduced form money demand equation. Furthermore, the rate of inflation can be written as:

$$\pi_t = \frac{d_t P_t}{M_t} = \frac{d_t}{m_t} \quad (12)$$

where the primary balance d_t in real terms is expressed as:

$$d_t = \frac{G_t}{P_t} - \frac{T_t}{P_t} + \frac{i_t^d B_t^d}{P_t}$$

Linearising Equation (12) we arrive at

$$\pi_t = \phi_1 \ln d_t - \phi_2 \ln M_t + \varepsilon_t \quad (13)$$

$$\phi_1 > 0, \phi_2 > 0.$$

ε_t is the error term generated. Equation (13) is the main analytical tool in this study.

3.1. Econometric model and methodology

3.1.1. Unit root and cointegration tests

Annual data for the period 1980 to 2010 was used due to the unavailability of quarterly data. Before estimating Equation (13) we verify if the series are stationary by using the Augmented Dickey-Fuller, Philips Perron and KPSS tests. The series is investigated for stationarity both with and without a deterministic trend.

3.1.2. Error correction model

Cointegrated variables have the tendency to return to their equilibrium values. If a set of first-difference stationary variables are cointegrated, it presupposes that the error term generated from the cointegrating regression is stationary. There, the error correction model is useful in capturing both short run and long run relationships. If there exists at least one cointegrating vector and by definition U~$I(0)$, thus we can express the relationship between Y_t and X_t with an error correction specification in a generic form as:

$$\Delta Y_t = a_0 + b_1 \Delta X_t - \alpha \xi_{t-1} \quad (14)$$

This would now have the advantage of including both short-run and long-run information. In this model, b_1 is the impact multiplier (the short-run effect) that measures the immediate impact that a change in X_t will have on a change in Y_t. On the other hand, α is the feedback effect, or the adjustment effect and shows how much of the disequilibrium is been corrected, i.e. the extent to which any disequilibrium in the previous

period affects any adjustment in Y_t. Equation (14) emphasises the basic approach of cointegration and error correction models.

Furthermore, DOLS estimation procedure is used for the estimation where the estimators are more robust in small range of samples compared to alternative approaches. According to Stock and Watson (1993), the presence of leads and lags of different variables which has integration vectors, eliminates the bias of simultaneity within a sample and DOLS estimates have better small sample properties and provide superior approximation to normal distribution. The Stock-Watson's DOLS model is specified as follows:

$$Y_t = \beta_0 + \vec{\beta} X_t + \sum_{j=-q}^{p} \vec{d} \Delta X_{t-j} + u_t \qquad (15)$$

where Y_t dependent variable, X_t matrix of explanatory variables, $\vec{\beta}$ is a cointegrating vector; i.e., representing the long-run cumulative multipliers or, alternatively, the long-run effect of a change in X on Y. *p is* lag length *qis* lead length.

The role of the inclusion of lag and lead terms in the regression is to ensure that the error term is independent of past innovations in stochastic regressors found in the equation. "In the unit root literature, a regression is technically called a spurious regression when its stochastic error is unit-root nonstationary" (Choi et. al.c, 2008, p. 327).

With reference to Equation (13), the model is estimated using DOLS method developed by Stock and Watson (1993) as follows:

$$\ln CPI_t = \alpha_0 + \alpha_1 \ln MS_t + \alpha_2 \ln DEF_t +$$

$$\sum_{i=-l}^{l} \delta_i \Delta \ln MS_{t-i} + \sum_{i=-l}^{l} \lambda_i \Delta \ln DEF_{t-i} + \varepsilon_t \qquad (16)$$

In the model, variables are in natural logarithm where CPI is the consumer price index, MS is money supply and DEF is fiscal deficit, and *l* shows the lead and lag values. The empirical model described as DOLS is shown by Equations (17) respectively. In the practical studies, the optimal lag structure[1]can be determined by using information criteria such as Akaike and Schwarz or by using the value of $T^{\frac{1}{2}}$ recommended by Stock-Watson (1993) exclusively for DOLS approach. As mentioned earlier, annual data comprising the 1980-2010 period was used in the current study, and the total observation number is 31[1]. Accordingly, in the estimation of the model, the lag values may be defined as 5. This would be confirmed by the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criteria (SBC).

The annual variables are government primary deficit/financing (a proxy for total public sector deficits). Money supply comprised M1 and the general price level is represented by the consumer price index (CPI). In examining Ghana's data on fiscal deficits, money supply and CPI over the past 31 years, one can notice that

[1] Hence, if we use Stock-Watson's recommendation, then, the optimum lag length is $31^{1/2}$= 5.57.

inflation has fluctuated but changes in the money supply have more or less the deficit. We also notice that import prices and domestic prices move closely in the same direction. The control variables considered were imports to capture imported inflation and exchange rate as an attribute of an open economy.

4. Empirical findings

4.1. General trends of the variables used in the model

The trend analysis of the variables in the model reveal all variables have appreciated in value over the 31 year period as shown in Figure 1. The correlation matrix on the other hand, reveals the degree of association between pairs of variables used in the analysis.

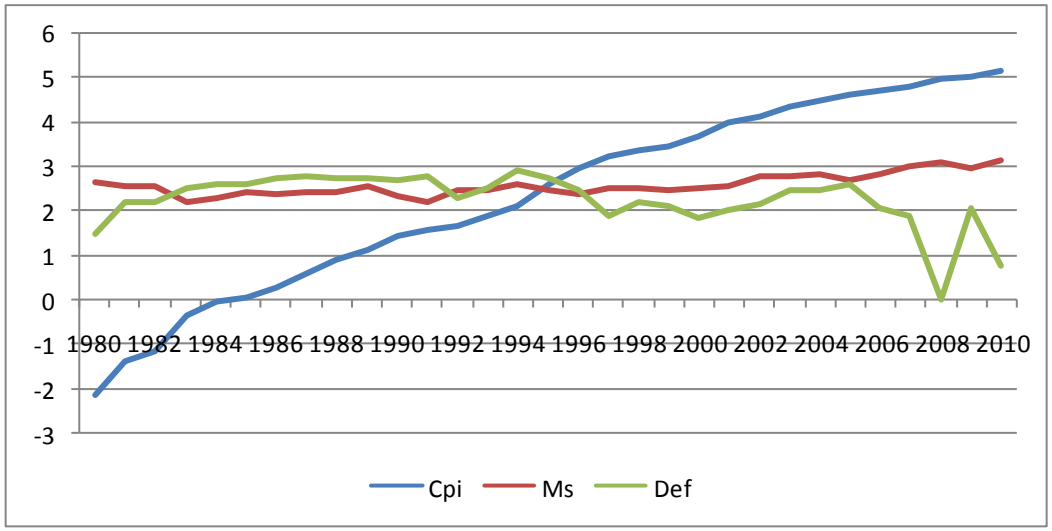

Figure 1. Natural Logs of CPI, Money supply and Deficit for Ghana (Source: Author's construct)

Table 1. Correlation matrix of variables

	CPI	MS	DEF
CPI	1	0.660809	-0.36295
MS	0.660809	1	-0.68824
DEF	-0.36295	-0.68824	1

Source: Author's construct

Testing the series in first difference using the ADF a PP tests reveal that the null hypothesis of a unit root is rejected at least at 0.05 significance level. Therefore both ADF and PP conclusively show that the variables are unit root non-stationary. The KPSS tests further confirm this assertion. According to the KPSS tests results, the null hypothesis of a stationary process can be rejected for the series in level, but cannot be rejected for the series in first difference.

Table 2. Results of stationarity tests with and without trend

		Level		First Difference	
	Variable	**Constant**	**Constant +Trend**	**Constant**	**Constant +Trend**
ADF TEST	CPI	-4.1809**	-2.8274	-5.3568**	-6.5331**
	MS	-0.7421	-3.0275	-6.2054**	-4.9836**
	DEF	-1.1808	-2.8187	-9.8445**	-10.1491**
Phillips-Perron TEST	CPI	-4.4138*	-2.835	-5.3415**	-10.008**
	MS	-0.3282	-2.8617	-6.5912**	-13.3598**
	DEF	-3.1902*	-4.2121	-10.2876**	-16.9275**
KPSS	CPI	0.7302**	0.187**	0.5883	0.0897
	MS	0.5645**	0.2107*	0.3864	0.379
	DEF	0.415**	0.1635**	0.4025	0.5

Source: Authors' construct

ADF and PP: Null hypothesis is that the variable being examined is non-stationary.

KPSS: Null hypothesis is that the variable being examined is stationary.

*** and * denotes statistical significance at 1% and 5% levels, respectively.*

After determining the order of integration in the series to be I(1), a test for cointegration using the Johansen approach was employed. The trace test indicated one cointegtration equation at 5% level. The error correction model (ECM) was then formulated to combine short run dynamics with long run equilibrium characteristics. The short run relation model results with ECM term are presented in Table 5. Clearly, a good time series modelling should describe both short-run dynamics and the long-run equilibrium simultaneously. The signs of the coefficient are not the same as in the long run. The short-run money supply elasticity is equal to -0.43 and this value is lower than the long run elasticity level. Furthermore, the estimated error correction term is equal to -0.06 and significant at the 1% level. This clearly shows that, the speed of adjustment is not quick with 6% to reach long run equilibrium level in response to the disequilibrium caused by short run shocks of previous period.

Table 3. Error Correction Model Results

Dependent: ΔlnCPI	Coefficient	t-statistic
Constant	0.251*** (0.024)	10.587
lnΔMS	-0.431** (0.212)	-2.035
lnΔDEF	-0.019 (0.042)	-0.451
ECTt-1	-0.056*** (0.017)	-3.288

****, **, and * denotes 1%, 5% and 10% level of significance respectively. Figure in ( ) indicates standard error.*

After ascertaining the order of integration of the respective variables, next is to find the lag length. The lag length selection criteria was obtained from the unrestricted VAR estimation results based on the AIC and the SBC. The lag length criteria results are reported in Table 4.

Table 4. Selection of lag length

Lag Order	Akaike Information Criterion (AIC)	Schwarz Bayesian Criteria (SBC).
2	-0.973	-0.643
3	-1.141	-0.665
4	-2.076	-1.343
5	-2.129(m)	-1.355(m)
6	-1.959	-1.033

(m) refers to the minimum lag length

The DOLS estimation results are reported in Table 5. The adjusted R^2 is equal to 0.86 and this indicates a good-fit situation of the series. Both MS and DEF are statistically significant at the 1% level. The elasticity of DOLS estimation shows that in the long run, MS and DEF stimulates CPI growth. The elasticity of DOLS estimation shows that in the long run, a percentage change in money supply leads to a 3.8% increase in CPI. On the other hand, a percentage change in DEF also results in a 2.1% reduction in CPI. The leads and lags impact indicate many interesting results. Except $\Delta lnMS_{t-1}$ and $\Delta lnMS_{t+2}$ whose impact are significant at 5% significance level, the remaining are significant at the 1% level.

Table 5. DOLS estimation based on Equation (14)

Dependent Variable: lnCPI	**Coefficient**	**t-statistic**
Constant	-2.439932 (-3.444833)	-0.708287
lnMS	3.8326*** (-0.946226)	4.050451
lnDEF	-2.0774*** (-0.553)	-3.756506
$\Delta lnMS_{t-1}$	2.6913** (-1.103415)	2.439047
$\Delta lnMS_{t-2}$	3.882*** (-1.149206)	3.378004
$\Delta lnMS_{t-3}$	2.8488*** (-1.093876)	2.604339
$\Delta lnMS_{t+1}$	3.74*** (-1.262304)	2.962917
$\Delta lnMS_{t+2}$	2.101** (-1.206811)	1.740918
$\Delta lnMS_{t+3}$	1.834* (-1.125981)	1.628825
Adjusted R^2	0.857	
LM(1) test (p-value)	0.0024	
LM(2) test (p-value)	0.0098	
LM(3) test (p-value)	0.0256	
Wald's test(F-value)	68.62***	
White's test(p-value)	0.647	
JB test (p-value)	0.723	
CUSUM	*See appendix*	
CUSUMSQ	*See appendix*	

Source: Authors' construct

****, **, and * denotes 1%, 5% and 10% level of significance respectively. Figure in ( ) indicates standard error.*

Among the relevant model diagnostic tests performed is the Wald coefficient test using normalised restriction. This is necessary because the choice of functional form connecting these variables was imposed. Also, since the data is time series, the dynamic structure of the relationship between the variables needs to be investigated. The F-statistic of the Wald test and the associated ρ-value indicate that we can decisively reject the null hypothesis of non-constant parameters. If the residuals are normally distributed, the Jarque-Bera statistic should not be significant as shown in table 4. The null hypothesis of the Bresuch-Godfrey serial correlation LM test is that there is no serial correlation up to the lag order specified. White's test is a test of the null hypothesis of no heteroskedasticity which is not rejected. The CUSUM and CUSUMSQ tests of Brown et al. (1975) indicate stability of the model at the 5% significance limits (see appendix).

5. Conclusion

By utilizing data for the period 1980-2010, this study modelled the dynamic determinants of inflation. The results from time series analysis reveal that inflation, money supply and deficits are cointegrated. Two distinctive empirical techniques; ECM and DOLS were employed for the study. The results are consistent with most of the earlier empirical findings. Findings suggest that the model's feedback effect is low and therefore a slow pace of adjustment towards equilibrium due to shocks in the short run. Also there exists a positive relationship between money supply and inflation. Meanwhile deficit exerts a negative effect on inflation. Furthermore, past values of money supply have a significant influence on inflation. Policy makers should not concentrate on current supply of money when managing inflation but keenly consider past values of money supply.

References

Adeyeye, E.A. and Fakiyesi, T.O. (1980), "Productivity Prices and Incomes Board and anti inflationary policy in Nigeria", in *The Nigerian Economy under the Military 1980 proceedings of the Annual Conference of the Nigeria Economic Society,* Ibadan.

Adu, G. and Marbuah, G. (2011), "Determinants of inflation in Ghana: An Empirical Investigation", *South African Journal of Economics,* Vol. 79, Issue 3, pp. 251–269.

Agenor, P.R and Montiel, P.J. (1996), *Development Macroeconomics*, University Press Princeton.

Allen, S.D. and Smith, M.D. (1983), "Government borrowing and monetary accommodation", *Journal of Monetary Economics*, Vol. 12, No. 4, pp. 605–16.

Blanchard, O.J. and Fischer, S. (1989), *Lectures on Macroeconomics*, MIT Press, Cambridge.

Breuss, F. (1998), "Sustainability of the fiscal criteria in stage III of the EMU", working paper No. 29, Research Institute for European Affairs, University of Economics and Business Administration, Viena, August, 1998.

Brown, R.L., Durbin, J. and Evans, J.M. (1975), "Techniques for testing the constancy of regression relations over time", *Journal of the Royal Statistical Society*, Series B, No. 37, pp. 149-163.

Buchanan, J. and Wagner, R. (1977), *Democracy and Deficit*, Academic Press, New York.

Burnside, C. (2004), "Assessing new Approaches to Fiscal Sustainability Analysis", World Bank, Economic Policy and Debt Department Washington D.C.

Choi, C.Y., Ling, H. and Masao, O. (2008), "Robust Estimation for Structural Spurious Regressions and a Hausman-type Cointegration Test", *Journal of Econometrics*, Vol. 142, pp. 327-51.

Cochrane, J.H. (2001), "Long Term Debt and Optimal Policy in the Fiscal Policy of Price Level", *Econometrica*, Vol. 69, pp. 69-116.

Darrat, A.F. (1985), "The impact of fiscal policy under rational expectations: some tests", *Journal of Macroeconomics*, vol. 7, No. 4, pp. 553–65.

Dejthamrong, T. (1993), "The budget deficits: its impact on money supply and output in selected SEACEN countries", available at http://www.seacan.org/GUP/pdf/publications/reserach_proj/rp21.pdf (accessed 30th August 2012).

Dinh, H. (1999). "Fiscal solvency and sustainability in economic management", working paper No. 2213, World Bank, Washington D.C., October 1999.

Domar, E.D. (1944), "The burden of the debt and the national income", *The American Economic Review*, Vol. 34, No. 4, pp. 798-827.

Egwaikhide, F.O., Chete, L.N. and Falokun, G.O. (1994), "Exchange rate, money supply and inflation in Nigeria: An empirical investigation", *African Journal of Economic Policy*, Vol. 1, No. 1, pp. 57–73.

Elbadawi, I.A. (1990), "Inflationary Process, Stabilisation and the Role of Public Expenditure in Uganda", working paper, World Bank, Washington D.C, July 1990.

Fischer, S. and Easterly, W. (1990), "The economics of the government budget constraint", *World Bank Research Observer*, Vol. 5, No. 2, pp. 127–42.

Fisher, S., Sahay, R. and Vegh, C. (2002), "Modern Hyper-and High Inflation", *Journal of Economic Literature*, Vol. 40, No. 3, pp. 837-80.

Freidman, M. (1968), "The role of monetary policy", *American Economic Review*, Vol. 58, No. 1, pp. 12–24.

Hamburger, M.J. and Zwick, B. (1981), "Deficits, money and inflation", *Journal of Monetary Economics*, Vol. 7, No. 1, pp. 141–50.

Hondroyiannis, G. and Papapetrou, E. (1997), "Seasonality-cointegration and the inflation, productivity and wage growth relationship in Greece", *Social Science Journal,* Vol. 34, No. 2, pp. 235-47.

Kocherlakota, N. and Phelan, C. (1999), "Explaining the fiscal theory of the price level". *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 23, No. 4, pp.14-23.

Laryea, S.A. and Sumaila, U.R. (2001), "Determinants of Inflation in Tanzania", working paper No. 12, Chr Michelsen Institute, Norway, 2001.

Metzler, L.A. (1951), "Wealth, saving and the rate of interest", *Journal of Political Economy*, Vol. 59, No. 2, pp. 280–83.

Miller, P.J. (1983), 'Higher deficit policies lead to higher inflation', *Central Reserve Bank of Minneapolis Quarterly Review*, Vol. 7, pp. 8–19.

Modeste, N.C. (2000), "The impact of budget deficits on long-term interest rates in Jamaica, 1964–1996: An application of the error correction methodology", *Rivista Internazionale di Scienze Economiche e commercial*, Vol. 47, pp. 667–78.

Narayan, P.K. (2004), "Do public investments crowd out private investments? Fresh evidence from Fiji", *Journal of Policy Modeling*, Vol. 26, No.6, pp.747–53.

Nelson, E. (1993), "Money, budget deficits, economic activity and prices: Asian evidence", discussion Paper, Centre for Studies in Money, Banking and Finance , Macquarie University, Sydney.

Ocran M.K. (2007), "A Modelling of Ghana's Inflation Experience: 1960–2003", *AERC Research Paper*, No. 169. African Economic Research Consortium, Nairobi.

Patinkin, D. (1965), 'An indirect utility approach to the theory of money, assets and savings', in Hahn F.H. and Brechling F.P.R. (Eds.), *Theory of Interest Rates*, Macmillan, London.

Sowa, N.K. and Kwaye, J.K. (1993), "Inflationary Trends and Control in Ghana", *AERC Research Paper*, No. 22, African Economic Research Consortium, Nairobi.

Stock, J.H. and Watson, M. (1993), "A Simple Estimator of Cointegration Vectors in Higher Order Integrated Systems", *Econometrica*, Vol. 61, pp. 783-820.

Tegene, A. (1989), "The Monetarist Explanation of Inflation; the Experience of Six African Countries*", Journal of Economic studies*, Vol.16, No5, pp. 5-18

Woodford, M. (1995), "Price level determinacy without control of monetary aggregate" *Carnegie-Rochester conference series on public policy,* Vol. 43, pp. 1-46.