

© Journal of Contemporary Issues in Business Research
ISSN 2305-8277 (Online), 2014, Vol. 3, No. 2, 75-87.
Copyright of the Academic Journals JCIBR
All rights reserved.

GDP GROWTH, MONEY GROWTH, EXCHANGE RATE AND INFLATION IN GHANA *

ANTHONY CHIARAAH[†] & PAUL KWAME NKEGBE

Department of Economics and Entrepreneurship Development, University for
Development Studies

ABSTRACT

This paper analyses the implications of exchange rate, GDP growth and monetary policies for inflation in Ghana. Although domestic money supply has significant influence on the behavior of the inflation rate in the long run, the short run dynamics based on an error correction model indicate that money supply has little impact on the domestic price level. This paper is unable to prove a significant long-run relationship between exchange rate and inflation in Ghana. The results confirm a long-run equilibrium relationship between inflation, money supply, foreign price and the real income. In line with theoretical assumptions, the findings demonstrate that in the long run, inflation in Ghana is positively related to the money supply while it is negatively related to real income and foreign price level. The results of the paper give enormous support to the current policy by the Bank of Ghana of anchoring inflation targeting on monetary policy.

Keywords: Inflation; Error correction model; Money supply; Ghana.

INTRODUCTION

After 50 years of the attainment of independence, the Ghanaian economy is still at about the same level it was during the earlier period (Aryeetey, Harrigan and Nissanke, 2000). The performance of the Ghanaian economy in the early years after its independence in 1957 was high by many developing countries standards. Anaman (2006) has noted that the per capita GDP in 1960 for Ghana was higher than the newly industrialized Republic of South Korea. Then (in 1960), the per capita income of Ghana stood at US\$198.6 as compared to US\$151.4 for South Korea. Ghana's real GDP growth rate averaged 4.42% during the period 1957 to 1967. Within the same period, South Korea's average real GDP growth was 6.1%. Since then, South Korea's real GDP consistently grew at the fast rate of 6.0% or higher, while Ghana slammed into a period of political agitations from 1966 to 1983. When political stability was restored in 1984 the economy was put on a growth path again with an average real GDP growth of about 4.0% over five years.

Thus, the growth record of the Ghanaian economy has been characterized by unevenness when the post-reform period is compared to the earlier period. With a reasonably high GDP growth in the 1950s and early 1960s, the Ghanaian economy began to experience a

* The views or opinions expressed in this manuscript are those of the author(s) and do not necessarily reflect the position, views or opinions of the editor(s), the editorial board or the publisher.

[†] Corresponding author

slowdown in GDP growth in the mid-1960s and for a greater part of this period, the growth rates were negative.

The Ghanaian economy steadily deteriorated throughout the 1970s. The decade was characterized by persistent high inflation, declining production and exports, flourishing illegal activities and political instability. To reverse the deterioration in the economy since 1970, and resume sustained and accelerated growth at low inflation, the Ghana government launched a series of reform initiatives, namely, the Economic Recovery Programme (ERP) from 1983 to 1986; and the Structural Adjustment Programme (SAP) from 1986 to 1990.

These were aimed at achieving macroeconomic stability and sustained growth. Just after a year of ERP (that is, in 1984) GDP growth was 8.0 percent and on the average, annual growth rates were 5.3 percent from 1983 to 1986. Also, aggregate growth has averaged 4.7 percent per annum since 1987. Within the period 1984 to 2000, the average growth rate was 4.4%. During the period 2001 to 2008, the economy continued on the high growth path with an average growth of about 5.4%. The Ghanaian economy had its fair share of the impact of the global financial crises when the growth rate fell from 7.2% in 2008 to 4.1% in 2009.

Based on the above background, it is all the more imperative to identify the factors that contribute significantly to Ghana's growth process (both in the short run and long run) and also to establish the variables that engender macroeconomic stability. Based on economic theory, exchange rate, money growth and inflation are key macroeconomic variables that are likely to drive the economic growth process and also serve as a barometer for measuring the health of the economy. That is why it is useful to conduct this study to contribute to the literature on Ghana's growth process and to enhance the formulation of policies suited for Ghana's specific experience. Some of the similar studies to which it will be adding literature to in the Ghanaian case are; Bamumia and Abradu-Otoo (2003), Asafu-Adjaye (2008), Kyereme (2004), Anaman, (2006) and Aryeetey and Fosu (2002). This will in particular be useful for the purposes of economic development planning.

Also, since the launch of the Economic Recovery Programme (ERP) in April 1983, monetary policy has gone through considerable metamorphosis in line with changes in the financial system. The forward-looking aspect of monetary policy requires that monetary authorities have knowledge of where macroeconomic variables such as inflation and output, are heading in the future so that policies can be engineered to achieve desired objectives. This paper therefore examines the relationship between monetary growth, exchange rate and inflation in Ghana from a dynamic perspective. Though other factors such as exchange rate depreciation, wages, exogenous shocks in domestic food supply, petroleum prices and fiscal policy also influence price movements in Ghana (Bawumia and Abradu-Otoo, 2003), this study focuses the radar on the causal association between growth rate, money growth, exchange rate, foreign price and inflation.

At least three reasons justify this paper. First of all, related studies have limited scope in terms of the time span and also ignore the possible impact of foreign price on domestic price. This paper covers a relatively longer period (30 years). Secondly, as Ghana works towards becoming a middle income country by 2015, it is important to unravel the factors that impinge on sustained and accelerated economic growth in Ghana. Lastly, with the advent of the global financial crisis and its attendant repercussions, it is necessary for developing countries like Ghana to refocus economic policy based on results of rigorous empirical studies.

Inflation and the Monetary Policy Framework in Ghana

Until recently, inflation performance in Ghana has been very poor, rising at a sustained rate with the passage of time (see Figure 1). Based on CPI changes, inflation climbed from 3% in 1970 to 50% in 1980. Since then inflation has remained very high,

reaching 123% in 1983. In these periods, economic activity in the country has not been very impressive (see Figure 2).

FIGURE 1
Year-on-year growth rate of Inflation

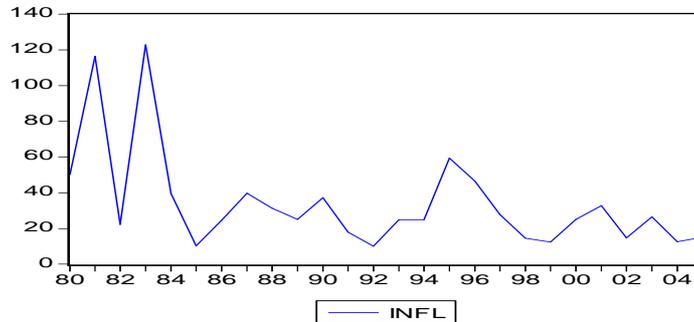
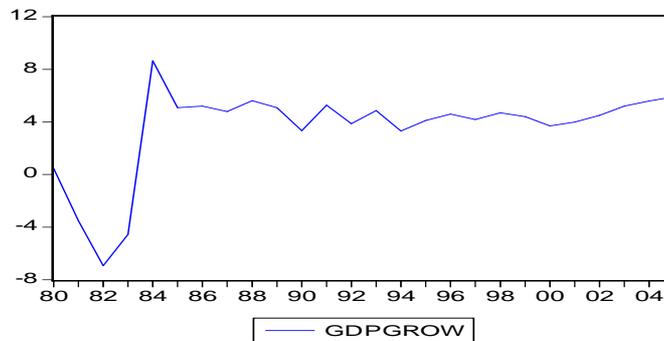


FIGURE 2
Year-on-year growth of real GDP



The introduction of ERP and better monetary and fiscal policies in the early 1980's combined to push down the level of inflation to 10.0% in 1992. However, strong inflationary pressure re-emerged after 1993 which led to the rise of inflationary rate again to 60.0% in 1995. Since then, inflation has been a mixed trend declining to 12.0% in 1999 then accelerating to 32.0% in 2001 and declining to 26.0% in 2003 and further to 15.0% at the end of 2005. Factors responsible for inflation in Ghana include rapid money growth, the rapid depreciation of the exchange rate (see Figures 3 and 4), inconsistent monetary and fiscal policies. In addition, terms-of-trade shocks, such as higher oil prices or falling exports prices for cocoa and gold (two of Ghana's main exports), do push up prices in Ghana, either through the prices of imported goods or rise in money-finance deficits.

FIGURE 3
Year-on-year growth rate of money supply

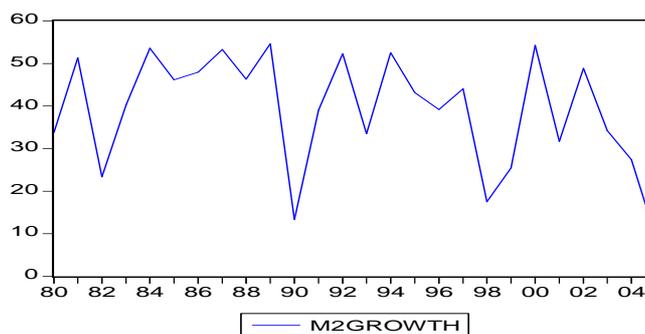
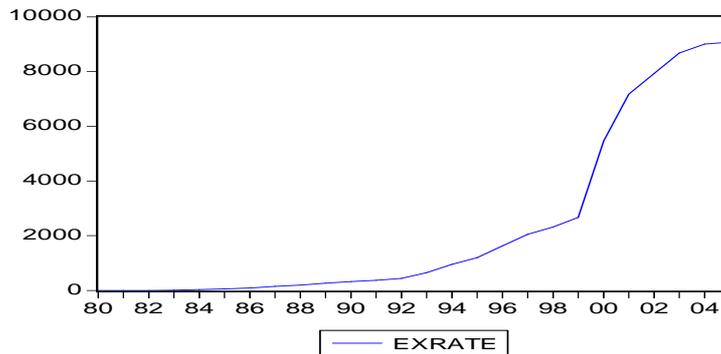


FIGURE 4
The Level of Exchange Rate



Monetary Policy in Ghana

Under the new Bank of Ghana Act (2002), the primary goal and objective of the Bank of Ghana is the pursuit of price stability. The monetary policy setting of the Bank is that of a small open economy model, with several practical complications specific to the Ghanaian economy:

- About 50% of GDP is used to bring in imported goods, with most of the transactions denominated in US dollars;
- The exchange and payments system is a liberal one and the exchange rate is freely floating and interest rates are fully liberalized;
- Significant portions of the deficits are typically financed on the domestic market through the issue of Treasury bills;
- Strong inertial inflationary expectations have become embedded in the economy due to history of high inflation and exchange rate volatility. This has allowed dollarisation to take hold, with significant foreign exchange deposits being held in the banking system;
- A large proportion of the money stock is held outside the banking system and is highly dependent on the cocoa season; and
- Any shifts in local investor and bank confidence, be these the result of an exogenous shock (e.g. a spike in oil prices) or a weakening in policies, have rapid repercussions.

Under the new Bank of Ghana Act (2002), a Monetary Policy Committee (MPC), which is in charge of formulating monetary policy (primarily setting interest rates), has also been established. The MPC has placed the process of monetary policy formulation in Ghana on a more analytical and transparent footing.

Monetary Policy Instruments

The operational target used in the monetary policy framework in Ghana is the reserve money supported by a set of broad economic indicators. The central bank regulates reserve money to achieve a desired growth rate of broad money supply consistent with the programmed inflation and real GDP growth rates. The central bank has also relied on a variety of instruments in the conduct of monetary policy, including reserve requirements, open market operations, repurchase and reverse-repurchase agreements, and more recently, the Bank of Ghana Prime Rate.

Trends in GDP Growth, Money Growth, Exchange Rate and Inflation in Ghana

Table 1 shows the annual percentage changes in the rate of GDP, Money and Inflation. The exchange rate is expressed using the Ghanaian local currency, the cedi with the US dollar.

TABLE 1
GDP growth, Money growth, Exchange rate and Inflation

YEAR	GDP growth	Money growth	Exchange rate	Inflation
1980	-0.47	33.80	2.75	50.07
1981	-3.50	51.32	2.75	116.50
1982	-6.92	23.34	2.75	22.30
1983	-4.56	40.21	8.83	122.87
1984	8.64	53.62	35.99	39.66
1985	5.09	46.17	54.37	10.30
1986	5.20	47.94	89.20	24.57
1987	4.80	53.33	153.73	39.82
1988	5.63	46.28	202.35	31.36
1989	5.09	54.67	270.00	25.22
1990	3.33	13.30	326.33	37.26
1991	5.28	39.08	367.83	18.03
1992	3.88	52.28	437.09	10.06
1993	4.85	33.50	649.06	24.96
1994	3.30	52.57	959.71	24.87
1995	4.11	43.17	1200.43	59.46
1996	4.60	39.20	1637.23	46.56
1997	4.20	44.09	2050.17	27.89
1998	4.70	17.49	2314.15	14.62
1999	4.41	25.42	2669.30	12.41
2000	3.69	54.24	5455.06	25.19
2001	4.00	31.69	7170.76	32.91
2002	4.50	48.85	7932.70	14.82
2003	5.20	34.23	8677.37	26.67
2004	5.60	27.44	9004.63	12.62
2005	5.90	9.35	9072.54	15.12

Source. WDI, World Bank

As it can be seen from the table, GDP growth started at a very low level in the early 1980's even reaching negative rates in 1981-83, but after the introduction of the ERP in 1983, it shot up to all time high level of 8.64%. From then, it has gone to an annual average of about 4.0% until 2003 when it was growing at 5.0% attaining 5.9% and 6.2% for 2005 and 2006 respectively. Money growth peaked at 54.67% in 1989. Thereafter, the pursuit of a tighter monetary policy resulted in broad money growth reducing to 17.49% in 1998 and going down to its lowest level of 9.35% at the end of 2005.

The exchange rate between the US dollar and the Ghanaian cedi is seen in the Table 1 which shows that the Ghanaian cedi continues to depreciate against the US dollar. In the early

1980's, \$1=2.75 cedis but the cedi depreciated over the period reaching an all time high value of \$1=9,072.54 cedis. Over the period, inflation also declined from a peak of 122.87% in 1983 to 10.0% by 1992. After that, it began to increase again but started reducing to reach 15.12% by the close of 2005.

BRIEF LITERATURE REVIEW

Empirical literature on exchange rates and prices falls basically into two main groups of studies, depending on their underlying principle and emphasis. The first group of studies emphasizes how quickly tradable goods prices respond to a change in the exchange rate i.e. the validity of the Purchasing Power Parity (PPP). Studies by Dunn (1970) and Magee (1973, 1974) were the first to support this assertion. More recent contributions have attempted to use modern techniques and different aspects to establish PPP condition, particularly since the seminal work by Granger (1981), and Engle and Granger (1987) on the co-integration relationship. Dornbusch (1987) for example, emphasized the industrial organizations as opposed to currency contraction while MacDonald (1995) used co-integration methods to support long-run PPP. MacDonald (1996) tests for PPP in OECD countries using unit root tests. Coakley and Fuertes (1997) provide strong support for long run PPP using the Im, Pesaran, and Shin (IPS) technique. Meanwhile, Nagayasu (1998) finds support for PPP by conducting panel co-integration tests. Habermeier and Mesquita (1999) provide support for PPP to hold in advance economies, as well as open and high-inflation economies using unit root tests.

The second group of studies place emphasis on the divergent behavior of domestic and export prices or the violation of the law of one price. The work of Balassa (1964) which uses a simple cross-section analysis, Isard (1977), Kravis and Lipsey (1977, 1978) and Heston and Summers (1981) strongly rejected the PPP while Krugman (1978) and Frenkel (1981) found scant support for PPP except for hyperinflationary economies. It appears that more recent empirical literature tends to be more supportive of PPP, although studies have mainly focused on advanced countries and evidence from developing countries is still scarce. One of the basic assumptions made in the present study is that absolute PPP holds in the Ghanaian case. It has been discovered that a misalignment in the real exchange rate can lead to lower growth outcomes (Ghura and Greenes, 1993). According to Aryeetey and Fosu (2002), Ghana has generally experienced a high and varied exchange rate ranging from 13.0% to 19.0% for interbank rates and from 0.8 to 59.0% for the bureau from the period 1986 to 1996. Consequently, the rapid rate of depreciation of the cedi has had a strong upward pressure on inflation. For instance, in analyzing the determinants of inflation in Ghana from 1964 to 2006, Asafu-Adjaye (2008) found that though the exchange rate depreciation does not have an appreciable effect on inflation in the short run, in the long run the impact is great.

In a similar vein, Kyereme (2004) who used an autoregressive model containing the cedi per dollar exchange rate, money supply, the price level, per person real output and real interest reported some interesting results. His finding revealed that while money supply is the main determinant of inflation, the nominal exchange rate is the major determinant of long run real output. The study by Asafu-Adjaye (2008) also revealed that money supply growth has both short- and long-run impact on inflation. The shortcoming of this study is that it failed to establish the relationship between these two variables (inflation, exchange rate) and economic growth which is a key objective of economic policy.

Studies based on the macroeconomics of the Ghanaian economy have employed cointegration based models (see Kyereme, 2004, 2008; Anaman, 2006; Bawumia and Abradu-Otoo, 2003) utilizing econometric techniques. Generally, the requirement of a time series analysis like this requires that the macroeconomic variables must first be tested for

stationarity in order to avoid the problem of spurious regressions. In examining monetary growth, exchange rate and inflation in Ghana from 1983 to 1999, Bawumia and Abradu-Otoo (2003) used an error correction model after a unit root test. Their findings confirmed the position of economic theory. They reported the existence of a long run equilibrium relationship between inflation, money supply, the exchange rate, and real income. They established that, in the long run inflation positively correlates with money supply and the exchange rate, but negatively correlates with real growth. This study adopts the approach of Bamumia and Abradu-Otoo (2003) but with the inclusion of extra variables (foreign price and GDP growth) and also by extending the time span from 17 years to 30 years.

EMPIRICAL MODEL AND ESTIMATION TECHNIQUE

This study employed time series data from 1980 to 2010. Data was collected from the WDI online database. The main variables for the study are; GDP, money supply, exchange rate, domestic price level and foreign price level. The United States price (inflation) is used as a proxy for foreign price level.

The economy produces both tradable and non-tradable goods. Following the exposition in Obstfeld and Rogoff (1996), the overall price level is considered to be a weighted average of the price of tradable goods and non-tradable goods. Following previous research, we assume that the price of tradable goods is governed by the absolute purchasing power parity condition (PPP) i.e. the hypothesis that the long-run exchange rate is determined by domestic prices relative to foreign prices. The price of non-tradable is assumed to depend on both supply and demand factors. Demand for non-tradable is assumed to be related to overall demand in the economy which for simplicity, can be represented by the money market equilibrium.

We would therefore expect an increase in nominal money supply, exchange rate, nominal interest rate or the foreign price level to induce an increase in the domestic price level while an increase in real income to cause a fall in domestic prices

RESULTS AND DISCUSSION

Testing for Unit Roots and Cointegration

A meaningful econometric estimation of a model using time series data requires that the data series should be stationary. According to Granger and Newbold (1974), econometric estimation using non-stationary time series data often leads to spurious results. A unit roots test is used to check whether variables are stationary or non-stationary. One way to address this problem of non-stationarity of time series data is the use of first-differenced time series in estimating econometric equations.

It is widely believed that variables hypothesized to be linked by some theoretical economic relationship should not diverge from each other in the long run. Although such variables may drift apart in the short run, they converge toward equilibrium in the long run, thanks to disequilibrium forces. Co-integration is viewed as a statistical expression of the nature of such long run equilibrium relationships. However, before an error-correction model (ECM) can be constructed according to Engle and Granger's (1987) representation theorem, we need to establish that variables are integrated of the same order and are co-integrated.

The unit root test was carried to see whether the variables are stationary or non-stationary. The Dickey-Fuller (DF) and the augmented Dickey-Fuller (ADF) tests were used. The table below shows the unit root results of the variables GDP (IGDP), money supply (Im), exchange rate (lexrate), domestic price (linfl) and foreign price (linflus). The test was carried out at levels, first differences and second differences all in log form. The unit root test was

carried out based on three different criteria namely, intercept, trend and intercept, and none. The results are shown in Tables 2 and 3.

TABLE 2

Intercept

Variables	Level	1 st Difference	2 nd Difference
Lexrate	-2.337	-3.021 ^{**}	-7.783 ^{***}
LGDP	0.290	-2.944	-5.764 ^{***}
Linfl	-4.620 ^{***}	-7.513	-7.088
Linflus	-.3376 ^{**}	-4.704 ^{***}	-7.150
Lm	-1.977	-4.083 ^{***}	-5.273

Test Critical Values: 1% level=-3.724, 5% level=-2.986 & 10% level=-2.633; ^{***}, ^{**} & ^{*} denote 1%, 5% & 10% significance level respectively.

From Table 2 above, it can be seen that at level, only domestic price level is significant at 1% meaning that there is no unit root and that it is not stationary. Foreign price is significant at 5%. At 1st difference, foreign price and money supply are significant at 1% while exchange rate is significant at 5%. But at 2nd difference, GDP and exchange rate are both significant at 1%.

TABLE 3

Trend and Intercept

Variables	Level	1 st Difference	2 nd Difference
Lexrate	-2.508	-5.853 ^{***}	-7.384
LGDP	-8.016 ^{***}	-2.950	-5.932
Linfl	-4.620 ^{***}	-7.513	-7.088
Linflus	-3.121	-4.745 ^{***}	-6.980
Lm	-0.614	-4.552 ^{***}	-5.434

Test Critical Values: 1% level=-4.394, 5% level=-3.612 & 10% level=3.243; ^{***}, ^{**} & ^{*} denote 1%, 5% & 10% significance level respectively.

When both Trend and Intercept terms are included in the equation, at level, only gdp and domestic prices are significant at 1% level meaning that those two variables have no unit root problem and that they are not stationary. At 1st difference, exchange rate, foreign price and money supply are all significant at 1% level.

TABLE 4

None

Variables	Level	1 st Difference	2 nd Difference
Lexrate	0.822	-1.978 ^{**}	-7.799 ^{***}
LGDP	2.623	-1.382	-5.670 ^{***}
Linfl	-1.146	-7.718 ^{***}	-7.473
Linflus	-1.890 [*]	-4.738 ^{***}	-7.150
Lm	13.863	-0.746	-5.361 ^{***}

Test Critical Values: 1% level=-2.665, 5% level=-1.956 & 10% level=-1.608; ^{***}, ^{**} & ^{*} denote 1%, 5% & 10% significance level respectively.

When none of the trend and intercept terms are included in the equation, all the variables have unit root problem and are therefore non-stationary at level because none of them is significant at level except that of foreign price which is only significant at 10%. At 1st difference, domestic and foreign prices are significant at 1% level while exchange rate is

significant at 5% level, but at 2nd difference, exchange rate, GDP and money supply are all significant at 1% level.

Long Run Dynamics

On the basis of the integration findings, we use the Engle-Granger (1987) method to test for the possibility of cointegration. The empirical results show that there is a long run equilibrium relationship between domestic price (linfl), GDP (lgdp), foreign price (linflus), exchange rate (lexrate) and money supply (lm). The findings indicate that in the long run, inflation in Ghana is positively related to money supply and foreign prices, and negatively related to real income and exchange rate (though the exchange rate variable is not significant). The OLS result is shown below in the equation (with *t*-statistics in parenthesis). The detailed regression output is shown in table A.1 on the appendix.

$$\begin{aligned} \text{linfl} = & 230.83 + 0.32\text{linflus} - 0.38\text{lexrate} + 1.94\text{lm} - 12.27\text{IGDP} \\ & (2.39) \quad (2.44) \quad (-1.46) \quad (2.29) \quad (-2.35) \\ \text{R-square} = & 0.42 \quad \text{SE} = 0.54 \quad \text{DW} = 2.46 \end{aligned}$$

From the above results, it can be seen that in the long run, a 1% increase in foreign price level increases inflation by 0.32% and a 1% appreciation of the cedi will decrease inflation by 0.38%. Also, a 1% increase in the level of money supply increases inflation by 1.94%. On the other hand, a 1% increase in real income decreases inflation by 12.27%.

Short Run Dynamics

Once variables are co-integrated which means that there is a long run relationship or equilibrium among the variables, there is the need to look at what happens in the short run because even though there may be a long run relationship, in the short run there can be disequilibrium among the variables.

In order to explore the short run dynamics, we make use of the error-correction model (ECM), which is formulated as:

$$\Delta \text{linfl} = \alpha_0 + \text{EC}_{t-1} + (\alpha_{ij} \Delta x_{t-j}) + \varepsilon_t$$

where x_t is the vector of regressors, EC is the error-correction term. The table below shows the results of the error-correction model:

TABLE 5
Dependent variable Δinfl

Variable	Coefficient	Standard error	t-statistic
C	0.77 ^{**}	0.30	2.65
D(lm(-1))	0.28	0.67	0.41
D(lm(-2))	-0.50	0.59	-0.84
D(linflus(-1))	0.18	0.20	0.89
D(linflus(-2))	-0.07	0.15	-0.45
D(IGDP(-1))	-9.03 ^{**}	3.03	-2.98
D(IGDP(-2))	-3.18	3.19	-1.01
D(lexrate(-1))	0.06	0.32	0.19
D(lexrate(-2))	0.20	0.26	0.80
D(linfl(-1))	-0.14	0.17	-0.80
D(linfl(-2))	-0.19 [*]	0.11	-1.74
EC	-0.85	0.82	-1.04

R-square = 0.85 SE = 0.19

***, ** & * denote significant at 1%, 5% & 10% respectively.

The model performs well in terms of its explanatory power, explaining about 85% of the total variation in inflation. Also the constant term and $D(\text{IGDP}(-1))$ are significant at 5% level while that of $D(\text{linfl}(-2))$ is significant at 10%. Thus, in the short run inflation is mainly fuelled by lag GDP and lag inflation.

CONCLUSIONS AND RECOMMENDATIONS

The relationship between inflation, money supply growth and the exchange rate in Ghana is an important one for policy makers. This study has explored this relationship by looking at the correlations of the variables as well as undertaking an econometric analysis. The econometric analysis used cointegration and error-correction techniques. The results confirmed that there is a long run equilibrium relationship between inflation, money supply, foreign price and the real income. It, however, fails to establish a significant long run relationship between inflation and exchange rate. In line with theoretical assumptions, the findings demonstrate that in the long run, inflation in Ghana is positively related to the money supply while it is negatively related to real income and foreign price level. More specifically, a 1% increase in money supply increases inflation by 1.94% and a 1% increase in real income decreases inflation by 12.27%.

The finding that money supply influences inflation in Ghana lends more support to the Bank of Ghana's policy of using money anchor as in inflation targeting. It is clear from the above that an increase in money supply above output growth can be inflationary, so the Bank of Ghana should monitor the money supply growth rate as it is strongly linked to the price formation in Ghana. If this is done, it can lead to stable and low inflation and sustainable economic growth in Ghana.

The study also establishes some amount of trade off between output and inflation in line with the findings of Asafu-Adjaye (2008) implying to a certain degree that, inflation can be curbed by keeping output near its potential level. This trade off could also mean that, the pursuit of single digit inflation if not well managed could derail economic growth. This paper in line with the above throw its support behind the suggestion that Bank of Ghana should also target real sector variables such as employment and investment which not only have potential of spurring economic growth, but will also help in poverty alleviation.

REFERENCES

- Anaman, K. A. (2006). Determinants of Economic Growth in Ghana, IEA Monograph No.14.
- Asafu-Adjaye, J. (2008).. Analysis of inflation in Ghana, 1964 to 2006. *Ghana Policy Journal*, 2, 51-69.
- Aryeetey, E. and A. Fosu (2002). *Explaining African Growth Performance: the Case of Ghana*, Working Paper No. 7, AERC, Nairobi.
- Aryeetey, E., J. Harrigan and M. Nissanke (2000). *Economic Reforms in Ghana: The Miracle and the Mirage*, Woeli Publishing Services, Accra.
- Balassa, B. (1964). The Purchasing Power Parity Doctrine: A Reappraisal, *The Journal of Political Economy*, 72, 584-596.
- Bawumia, M. and P. Abradu-Otoo (2003) *Monetary Growth, Exchange Rates and Inflation in Ghana: an Error Correction Analysis*, Working paper W/P BOG 2003/05, Bank of Ghana.
- Bandara, A. (2001) *Short-Run Dynamics of Inflation: Do Monetary and Exchange Rate Policies Matter?-An Empirical Investigation for Sri Lanka*, Central Bank Staff Series.

- Bank of Ghana (2005), *Bank of Ghana Annual Report*.
- Coakley, J. and A. M. Fuertes, (1997), 'New Panel Unit Root Tests of PPP,' *Economics Letter* 57, 17 - 22.
- Dickey, D. A. and W. A. Fuller (1979) 'Distribution of the Estimators for Autoregressive Time Series with a Root', *Journal of the American Statistical Association* 74, 427-31.
- Dornbusch, R. (1988), 'Exchange Rates and Prices', *American Economic Review*, 77, 93-106.
- Dunn, R. M., Jr., (1970) 'Flexible Exchange Rates and Oligopoly Pricing: A Study of Canadian Markets', *Journal of Political Economy*, 78, 140 - 51.
- Engle, R. F. and C. W. J. Granger (1987) 'Co-integration and Error-Correction: Representation, Estimation and Testing', *Econometrica*, 55, 251-76.
- Frankel, J., (1981) 'The Collapse of Purchasing Power Parity During the 1970's' *European Economic Review* 16, 145 - 165.
- Ghura, D. and T. J. Greenes (1993) 'The real Exchange Rate and Macroeconomic Performance in Sub-Saharan Africa', *Journal of Development Economics*, 42, 155-74.
- Granger, C. W. J. (1981) 'Some Properties of Time Series Data and Their Use in Econometric Model Specification' *Journal of Econometrics*, 1, 121-30.
- Gujarati, D. N. (2003) *Basic Econometrics*, McGraw-Hill, Boston
- Harbermeier, K. F. and M. Mesquita (1999) *Long Run Exchange Rate Dynamics: A Panel Data Study*, Working paper 99/50, International Monetary Fund, Washington D. C.
- Heston, A., and R. Summers (1991) 'Penn World Table (Mark 5): An Expanded set of International Comparisons 1950-1988,' *Quarterly Journal of Economics* 106, 327 - 368.
- Israd, P. (1977) 'How far can we push the 'Law of One Price'?' *American Economic Review*, 67, 942-8.
- Institute of Statistical, Social and Economic Research (Various Issues), *The State of the Ghanaian Economy*, ISSER, University of Ghana, Legon.
- Kawakatsu, H. (1998) A Computer Handbook Using Eviews to accompany Econometric Models & Economic Forecasts. In Pindyck Robert S. and Daniel Rubinfeld L. (1998).
- Kravis, I. B. and R.E. Lipsey, (1978), "Price Behaviour in the Light of Balance of Payments Theories". *Journal of International Economics*, .8, 193-246.
- Krugman, P., (1978) 'Purchasing Power Parity and Exchange Rates', *Journal of International Economics* 8, 397 - 407.
- Kyereme, S. (2004) Effects of Exchange Rate Volatility and Changes in Macroeconomic Fundamentals on Economic Growth in Ghana, *Proceedings of the International Conference on Ghana's Economy at the Half-Century*, ISSER, Legon, M-Plaza Hotel, Accra, July 18-20.
- MacDonald, R., (1995) 'Long-Run Exchange Rate Modelling. A Survey of the Recent Evidence', *Staff Papers* 42, No.3. International Monetary Fund, Washington DC

- Magee, S. P., (1974) 'U. S. Import Prices in the Currency Contract Period', *Brookings Papers on Economic Activity*, 1, 303 - 23.
- Nagayasu, J., (1998) *Does the long-run PPP Hypothesis hold for Africa? Evidence from Panel Co-integration Study*, Working Paper 98/123, International Monetary Fund, Washington DC.
- Pindyck R. S. and D.L. Rubinfeld (1998) *Econometric Models and Economic Forecasts*. McGraw-Hill Inc., Singapore.

TABLE A.1

Regression results showing Co-integration

Dependent Variable: LINFL

Method: Least Squares

Sample: 1980-2010

Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-12.25636	5.205925	-2.354309	0.0284
LEXRATE	-0.379642	0.259739	-1.461628	0.1586
LM	1.935453	0.846892	2.285359	0.0328
INFLUS	0.318015	0.130287	2.440877	0.0236
C	230.8252	96.64268	2.388439	0.0264
R-squared	0.423174	Mean dependent var		3.300559
Adjusted R-squared	0.313302	S.D. dependent var		0.650816
S.E. of regression	0.539314	Akaike info criterion		1.774002
Sum squared resid	6.108040	Schwarz criterion		2.015944
Log likelihood	-18.06202	F-statistic		3.851528
Durbin-Watson stat	2.463731	Prob(F-statistic)		0.016859