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What is the effect of monetary policy on the exchange rate in Ghana?

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Abstract

The paper examines the monetary policy exchange rate nexus for Ghana during the period 1960 to 2012 using annual time series data. Using the Johansen, and vector error correction method (VECM), it is found that there exists a stable long-run and short-run relationship between monetary policy and exchange rate. Using the ordinary least square method (OLS), it is also found that there exists a positive effect of monetary policy on the exchange rate. Monetary policy must be well managed to ensure a stable exchange rate and sustainable growth and development. Multivariate modelling should be considered in future studies taking into account other variables such as interest, and inflation.

Keywords: Monetary policy, Exchange rate, Economic growth, Long run
Jel Codes: E50, E51, E52, F31, O24,

Introduction

A large literature has evolved that examines the potential effect of monetary policy on exchange rate since the seminal work of Dornbusch (1976). The question of whether monetary policy influences exchange rate has been an issue of particular interest (see example Levin, 1997; Kearns & Manners, 2005; Zettelmeyer, 2004; Bawumia & Abradu-Otoo, 2003; Benita & Lauterbach, 2007; Nucu, 2011; Ali, Mahmood, & Bashir, 2015). Dornbusch (1976) explained that the central bank permanently changes the money stock and that the growth rate of the money supply is zero. However, the central banks do not maintain money stock targets in an economy but rather maintain money supply growth targets in an economy.

This has led to the re-examination of exchange rate dynamics in an economy using money supply growth rate as the central bank's policy instrument. This is to determine whether an increase in money supply cause the exchange rate to overshoot or not. In Ghana, among the objectives of monetary policy is price stability and attainment of the stable domestic and external value of the currency and sustainable growth. Exchange rate stability promotes price stability, investment and economic growth in an economy.

The theoretical explanation of the relationship between money supply and the exchange rate is that an increase in a country's money supply causes the domestic currency to depreciate, whereas a decrease in a country's money supply causes the domestic currency to appreciate. That is, a permanent increase in a country's money supply is expected to cause a proportional long-run depreciation of its currency with a large depreciation first and a smaller subsequent appreciation. On the other hand, a permanent decrease in a country's money supply causes a proportional long-run appreciation of its currency with a large appreciation first and a smaller subsequent depreciation.

According to Levin (1997), whereas the real exchange rate always overshoots in the model estimated, the nominal exchange rate either overshoot or undershoot in response to a monetary growth shock in the estimated model. In the study by Kearns & Manners (2005), they stated that monetary policy changes account for only a small part of the observed variability of exchange rates in the countries in their study.

In an estimated model of the relationship between inflation, exchange rate, and output, Bawumia and Abradu-Otoo (2003) reported that the exchange rate responds immediately to changes in the money supply. Nucu (2011) reported of a negative relationship between money supply and exchange rate for Romania. Ali et al. (2015) reported that a high money supply and increase in interest rate raises the price level that leads to an increase in exchange rate volatility. The findings of their study suggest that money supply (policy variable) has an inverse relationship with exchange rate volatility. They recommended that to restraint the exchange rate volatility money supply might be efficient.

The objective of the paper is to contribute empirically to the body of knowledge in the area of international finance by examining the relationship between monetary policy and exchange rate. The study specifically, investigate both the long run and short-run effects of monetary policy on the exchange rate for Ghana

The research questions underlying the paper are as follows: (1) what is the nature of the short-run relationship between monetary policy and exchange rate? (2) What is the nature of the long-run link between monetary policy and exchange rate? The paper is based on the assumption that monetary policy has a significant effect on the exchange rate in the short run and the long run.

The rest of the paper focuses on the research methodology, results, discussion, and conclusions.

Methodology

The study is a quantitative research design using time series data. The link between monetary policy and the exchange rate is quantified and explained in the study. The paper is based on a time series model as specified in equation (1). The dependent variable is the exchange rate (EXR), whereas the independent variable is monetary policy (MP). The estimation methods for the study are the ordinary least square (OLS) regression method; the Johansen method, and the error correction model. The Johansen test is used to examine the stable long-run link between monetary policy and exchange rate. The error correction model (ECM) is used to investigate the short-run adjustment to the long-run equilibrium. The augmented Dickey-Fuller (ADF) test was used to investigate the stationarity properties of the variables. The paper is based on annual time series data covering the periods 1960 to 2013 for Ghana. Data was obtained from World Development Indicators (WDI).

$$EXR_t = \alpha_0 + \beta_i MP_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Empirical Results

Summary Statistics

Table 1 provides a summary statistics of the test variables in the estimated model. The mean measures the central tendencies, and the values indicate a good fit. The coefficients of variation measure the volatility of the data. The results show that monetary policy (0.2590) is less volatile than the exchange rate (1.6905). The monetary policy falls as low as 11.3050 and as high as 34.1080, whereas the exchange rate falls as low as 0.0000 and as high as 1.7958. The standard deviation measures the dispersion of a set of data from its mean. The more spread apart the data, the higher the deviation. The results indicate that the exchange rate (0.4825) is less spread from the mean than monetary policy (5.7488). The coefficient of Skewness measures the nature of the distribution of the series. The results show the monetary policy is positively skewed (0.1928) whereas the exchange rate is also positively skewed (1.6152). The coefficient of kurtosis measures the nature of peaks. The values (0.6943) and (1.4096) are more than zero and does not indicate more flat-topped distribution.

Table 1 Descriptive Statistics

Summary Statistics, using the observations 1968 – 2013				
Variable	Mean	Median	Minimum	Maximum
MP	22.1950	21.2190	11.3050	34.1080
EXR	0.2854	0.0089	0.0000	1.7958
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
MP	5.7488	0.2590	0.1928	-0.6943
EXR	0.4825	1.6905	1.6152	1.4096

Source: Author's calculation from data collected from WDI, 2016

Time Series Plots of Monetary Policy (MP) and Exchange Rate (EXR)

Figures 1 to 4 show the time series plots for MP and EXR. Figure 1 indicates monetary policy is non-stationary in levels. However, figure 2 indicates the variable attained stationarity on the first difference. Figure 3 shows exchange rate EXR) is non-stationary in levels. However, the variable attained stationarity on the first difference as shown in figure 4. Formal investigation of the nature of stationarity properties of the variables using the ADF test is performed and reported in Table 2.

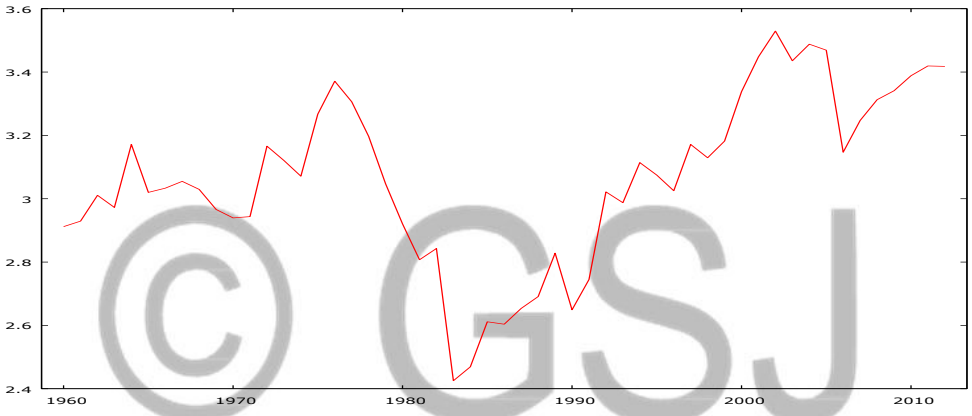

Fig 1. Time series Plot of lnMP in level

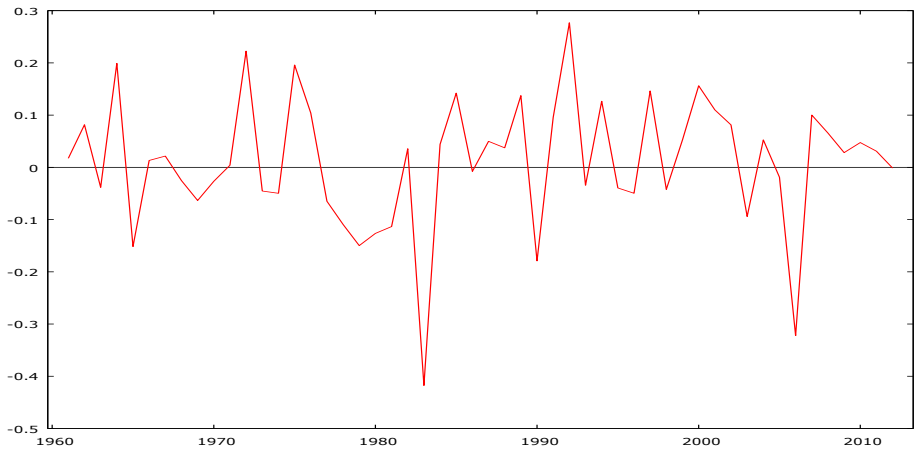

Fig 2. Time series Plot of MP in first difference

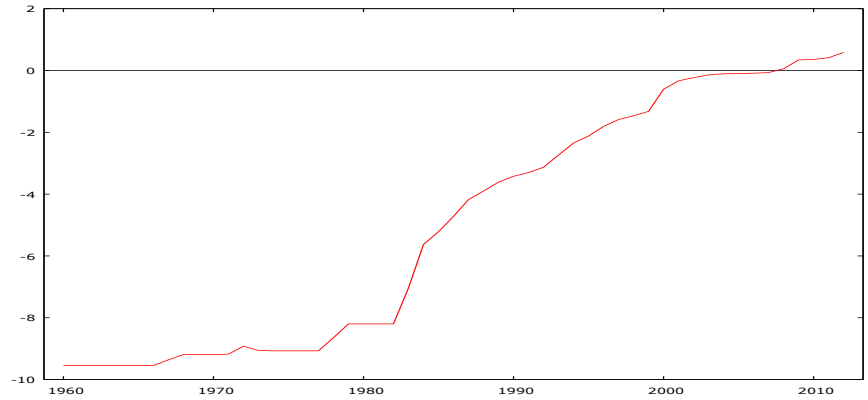

Fig 3. Time series Plot of lnEXR in level

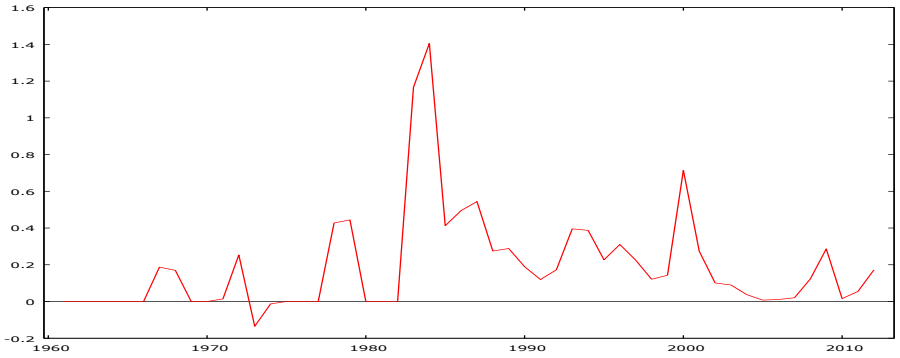

Fig 4. Time series Plot of lnEXR in first difference

3.3 Stationarity Test

The results of the ADF test for stationarity are reported in Table 2. The results show the variables are non-stationary in levels using the ADF test. However, they attained stationary in levels and on first difference.

Table 2 ADF Stationarity Test Results with a Constant and a Time Trend

Variables	ADF-value	T-statistics	P-value	Results	Max Lag
lnMP	-0.1636	-2.0419	0.5777	Not stationary	10
lnMP-1st dif.	-1.07463	-7.4654	0.0000***	Stationary	10
lnEXR	-0.0839	-2.1091	0.5401	Not stationary	10
lnEXR-1st diff.	-0.4906	-3.9575	0.0165**	Stationary	10

Source: Author's calculation from data collected from WDI, 2016

3.4 Regression Results

3.4.1 Johansen Test Results

The results of the investigation of the stable long-run relationship between monetary policy and exchange rate are reported in Table 3. The results show that there is a significant long-run relationship between monetary policy and exchange rate using the Johansen method since both the trace test and the maximum Eigen-value test passed the test of stability.

The error correction test (ECM) used to examine the short-run relationship between monetary policy and exchange rate indicate that there is no disequilibrium in the short run since the error correction term (ECM-1=0.0871; p=0.0000) is significant. The value does not have the expected a priori theoretical sign of negative. The positive value may indicate that, in the long-run, the relationship may explode and that there is no convergence in the process. The value indicates that only about 8.71% of errors generated in the previous period is corrected in the current period for the exchange rate equation.

Table 3 Johansen Cointegration Test Results and the Vector Error Correction Results

Johansen test:			
Number of equations = 2			
Lag order = 1			
Estimation period: 1961 - 2012 (T = 52)			
Rank	**Eigenvalue**	**Trace test/p-value**	**Lmax test/p-value**
r=0	0.3483	26.7750[0.0005***]	22.2660[0.0016***]
r=1	0.0831	4.5090[0.0337**]	4.5090[0.0337**]
Vector Error Correction Results			
Variable	**Coefficient**	**Std. Error**	**T-Ratio**	**P-value**
EC-1	0.0871	0.0176	4.9560	0.0000
Mean dependent var	0.0345	S.D. dependent var	0.0756	
Sum squared resid	0.1954	S.E. of regression	0.0625	
R-squared	0.3294	Adjusted R-squared	0.3160	
rho	0.1499	Durbin-Watson	1.6399	

Source: Author's Calculation from Data Collected from WDI, 2016. Note *** and ** denote significance at 1% and 5% levels of significance.

3.4.2 OLS Regression Results

Since there is a stable long-run relationship between monetary policy and exchange rate, the OLS regression was used to investigate the nature of the coefficients (magnitude, and direction of signs). The results are shown in Table 4. The result shows that monetary policy is positively related to the exchange rate. The results indicate that a 1% increase in monetary policy leads to about a 587.4% increase in the exchange rate. The values of the R^2 and adjusted R^2 in Table 5 are no indication of a well-behaved model. The results indicate that the estimated model accounts for only about 14.69% of the changes in the exchange rate equation.

Table 4 OLS Regression Results

Model 6: OLS, using observations 1960-2012 (T = 53) Dependent variable: lnEXR HAC standard errors, bandwidth 2 (Bartlett kernel)				
	Coefficient	Std. Error	t-ratio	p-value
const	-23.0268	7.6477	-3.0110	0.0040***
lnMS	5.8740	2.5234	2.3279	0.0239**
Mean dependent var	-5.0206	S.D. dependent var		3.9199
Sum squared resid	668.4927	S.E. of regression		3.6205
R-squared	0.1634	Adjusted R-squared		0.1469
F(1, 51)	5.4189	P-value(F)		0.0239
Log-likelihood	-142.3742	Akaike criterion		288.7484
Schwarz criterion	292.6890	Hannan-Quinn		290.2637
rho	0.9725	Durbin-Watson		0.0529

Source: Author's Calculation from data Collected from WDI, 2016. Note ** denotes significance at 5% level.

3.4.3 Results of Diagnostic and Stability Tests

Table 5 reports the results of the diagnostic tests of the OLS regression to examine the reliability of the estimated parameter coefficients. The estimated model did not pass the specification test, the heteroskedasticity test, the normality test, and the autocorrelation test.

Table 5 Diagnostic Test Results of OLS Regression

A. Reset Test for Specification
Null hypothesis: specification is adequate Test statistic: F(2, 49) = 6.9453 P-value = P(F(2, 49) > 6.9453) = 0.0022
B. Breusch-Pagan Test for Heteroskedasticity
Null hypothesis: heteroskedasticity not present Test statistic: LM = 6.9866 P-value = P(Chi-square(2) > 6.9866) = 0.0304
C. Test for Normality of Residual
Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 33.6352 P-value = 0.0000
D. LM Test for Autocorrelation up to order 7
Null hypothesis: no autocorrelation Test statistic: LMF = 712.1960 P-value = P(F(1,50) > 712.1960) = 0.0000

Source: Author's Calculation from data Collected from WDI, 2016.

The stability tests results (CUSUM and CUSUMSQ) as reported in figures 5 and 6 show that the estimates and the variance as well as the residuals are not stable, as well as the square residual since the plots fall outside the 5% critical boundaries.

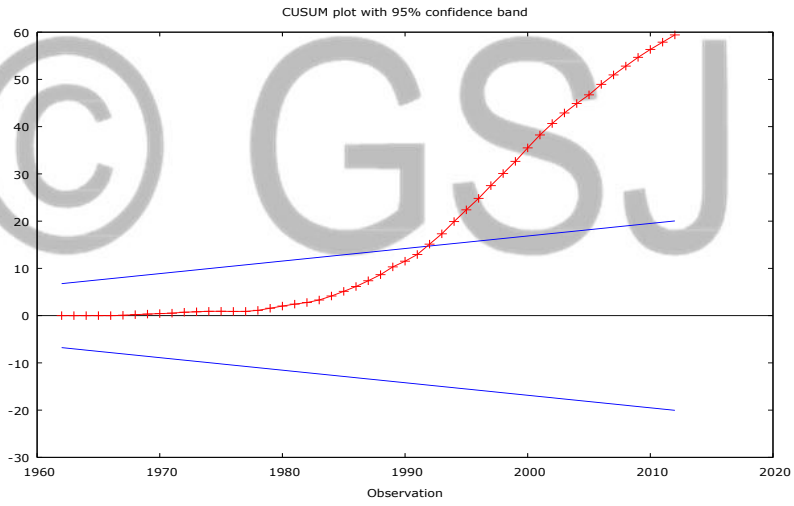

Figure 5 Plot of CUSUM

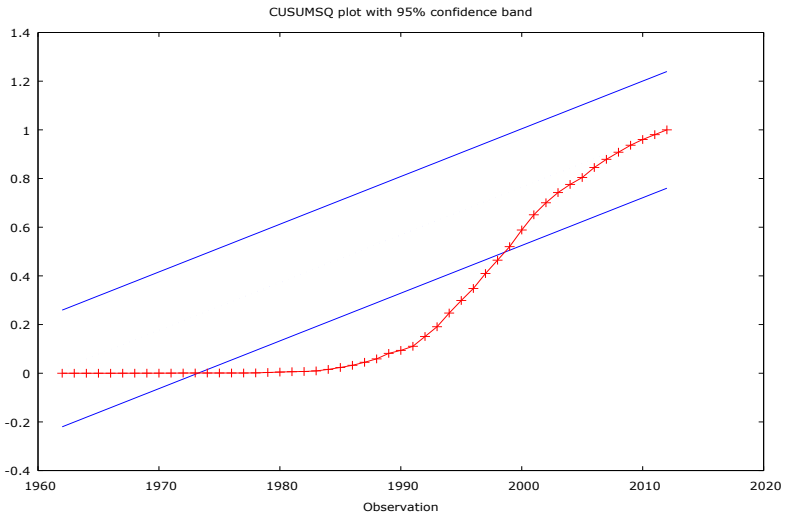

Figure 6 Plot of CUSUMSQ

4. Conclusions and Policy Implications

The study shows that monetary policy and the exchange rate are linked in the long run and short run. Changes in the exchange rate are explained by changes in monetary policy in the long run. The findings from the OLS results indicate that there is a positive effect of monetary policy on the exchange rate. The findings do not support that of previous studies by researchers such as Kearns and Manners (2005); Zettelmeyer (2000); Bawumia and Abradu-Otoo (2003); Nucu (2011); Ali, Mahmood and Bashir (2015) that reported a negative effect of monetary policy on exchange rate.

Given the importance of the monetary policy and exchange rate in an economy, the present study examines the monetary policy-exchange rate nexus for Ghana for the period 1968-2013, using annual time series data. The empirical examination was done by using the Johansen method, VECM method, and the OLS regression. The findings of the study indicate a significant stable long-run relationship between monetary policy and exchange rate. There is also a significant short-run link between monetary policy and exchange rate. The results of the OLS indicate a significant positive relationship between monetary policy and exchange rate. The results of the study suggest monetary policy during the period under consideration has led to an increase in the exchange rate. The policy implication is that monetary policy must be managed very well to ensure a stable exchange rate and growth.

Future study should investigate the current topic accounting for causality modelling, and structural breaks since the present study did not consider these issues. Multivariate analysis using other variables such as inflation, and interest rate should be considered in future studies.

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