



Gross Domestic Product Growth, Money Growth Exchange Rate and Inflation in Sierra Leone

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Abstract: GDP growth, money growth, exchange rate and inflation play critical role in the macroeconomic stability of an economy and have a direct effect on policy making process. This paper examines the relationship between exchange rate, GDP growth, money growth and inflation in Sierra Leone from 1980 to 2013 using descriptive statistics and regression methods for the data obtained from the world development indicators (WDI) data base. Inflation was the dependent variable while its potential macro elements were explanatory variables. The correlation result revealed that, there is an absence of multicollinearity among the variables in the model. The result of the long-run co-integrating relationship in the model shows that GDP growth has significant negative effect on inflation in Sierra Leone whereas exchange rate, foreign price level and money supply growth have a positive effect. Given the implication of these macroeconomic indicators, it is imperative on government to ensure that the liquidity specifications be broaden in order to incorporate foreign currency deposits held at commercial banks so as to establish efficient control over money supply. This study would be of great value to policy makers in facilitating macroeconomic stability.

Key words: Inflation; Exchange Rate; Co-integration Test; Sierra Leone

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INTRODUCTION

GDP Growth, Money Growth, Exchange Rate and Inflation are amongst the key economic indicators for measuring macroeconomic performance for any economy nation. These indicators are closely connected to the external sector and provide critical information with regards the stability of an economy. The external sector measures the performance of an economy with respect to the rest of the world. Increase in price level/inflation causes the demand of money to increase, which in turn causes the interest rate and then the higher interest rate causes intensification (Case and Fair, 1992). On the other hand, a reduction in consumption brought by an increase in interest rate enhances a decrease in output (Case and Fair, 1992). Sierra Leone is a British colonized country which gained independent in April; 1961 and shared boundary with Guinea to the north and extended to northeast and Liberia in the southeast and to the west of the Atlantic Ocean. Like many Sub-Saharan countries, Sierra Leone is part of the Least Developed Countries (LDC), and participates in Heavily Poor Countries (HIC) initiatives. The country, once an exporter of cocoa, coffee, piassava and diamond is now one of the least developed countries in the world. During this period, its annual economy growth was high as compared to many developed countries by standards. Moreover, the economy increased approximately by 4 percent in the early 1970s. However, the performance on the external balance of Sierra Leone has been poor since the 1970s, balance of payments problems is persistent, the country's economy began to fall exponentially as a result of the crude oil crises in the Middle East. Consequently, the country lost its international competitiveness in terms of real exchange rate- an indicator used in international trade to measure the competitiveness of a country as a result of political instability, unstable macroeconomic policies and adverse effects of peripheral shocks. Hence, the GDP growth was low and there was high inflation, high unemployment rate and huge budget deficits. Furthermore, the weakness of the country's economy was near collapsed in the 1980s. The nominal exchange rate depreciated uninterruptedly as a result of adverse effect of global financial crisis on diamond exports from 16 percent in 1980/81 to 5 percent in 1985/86 together with devaluation in the country's tax base. From 1991 to 2000- the ten year brutal armed conflict, with dramatic economic growth decline, the real GDP declined by -4.27 percent with 80 percent of the population lives in poverty. Sierra Leone, like many other countries launched the Structural Adjustment Program (SAP) and the floating exchange rate in 1986. These were aimed to increase the competitiveness of the country's export, as well as retaining a fixed exchange rate and nominal volatility to ensure a smooth, competitive and efficient financial sector to stimulate the development of the economy.

The aim of the present study is to contribute to the existing literature on the grounds of analyzing the association of exchange rate, GDP growth and monetary policies for inflation in Sierra Leone towards the transformation of the economy of the country so as to attain a middle income economy. Moreover, based on results of rigorous empirical studies about occurrence of the global financial crisis and its attendant repercussions, it is necessary for Sierra Leone to focus on economic policy.

1. Inflation and the monetary policy scheme in Sierra Leone

Inflationary exposure in Sierra Leone reached its highest level in 1987 hitting 178.7 percent before declining to 110.9 percent in 1990. There were further reductions in the 1990s compared

to the 1980s where inflation was on the high. Inflation was compromising in the first half of 2000s where it was a single digit until 2004 when it attained double digit of 14.2 percent before falling to 12.1 percent in 2005 and a further devaluation to 9.5 percent in 2006 and 11.7 percent in 2007. To reverse the deterioration in the economy since 1980, Sierra Leone like any other less developed Country in Africa embarked upon several transformations in the financial sector following the worsening economic performance and the systemic problems that encapsulated the financial sector during the 1980s. These rectifications embodied the liberalisation of interest rates and trade, removal of some foreign exchange controls, elimination of price controls, ratification of a volatile exchange rate, and confirmation of indirect controls of monetary policy based on market related instruments.

Monetary policy in Sierra Leone is controlled by the Bank of Sierra Leone (BSL) with market-based instruments. The primary goals and objectives is to facilitate sustainable price stability especially providing a low alternative indivisible digit inflation, rebuilding foreign reserves and downsizing inflationary pressures. The BSL achieves these goals and objectives by admonishing the domestic assets growth. At present, the main instrument of monetary policy is open market operations. Operations are however concentrated in the primary market for government securities. Reserves requirement is also employed as a monetary policy instrument. Reserve and liquidity ratios are used as prudential measures and because of the small size of the financial market, and the high liquidity of commercial banks there has been very little activity in the secondary market. Monetary policy is conducted within the framework of a monetary targeting regime. The operational target is Reserve money and is used for day-to-day (or week-to-week) policy to attain the ultimate between the central bank's ultimate policy goals and the operating target. Quarterly targets on Reserve Money are set within the framework of International Monetary Fund (IMF) supported and monitored programmes and these are consistent with programme targets on inflation and economic growth

REVIEW OF LITERATURE

The study conducted using data from 1960-90 obtained from Turkey to investigate on nonlinear three-stage least squares estimation revealed that unanticipated devaluations have positive effects on output but unanticipated devaluations do not exert any significant effect on output (Domac, 1997). Another study conducted to examine the relationship between output, money and real exchange rate using Korean quarterly data over the period 1971-1974. The data was tested using Johansen's co-integration and error-correction techniques and the results revealed that there exists a long run relationship between output, money and real exchange rate. They affirmed that real depreciations were unfolding in the long run and the most significant unfurling impact of real depreciations came into view with a lag of three quarters (Bahmani-Oskooee and Rhee, 1997). The study conducted on the impact of exchange rate depreciation on output and inflation in Nigeria using Quarterly data for the period 1970-1995 with an impulse response function revealed that expansionary impact of exchange rate depreciation on output in both the medium and long run but a contractionary effect in the short run (Odusola d Akinla, 2001). The use of error correction mechanism to examine the relationship between monetary growth, exchange rate and inflation in Ghana, found the existence of a long run equilibrium relationship between real income, inflation, exchange rate and money supply

(Mahamadu and Philip, 2003). The analysis on the dynamics of money supply, exchange rate and inflation in Nigeria using secondary data obtained from the International Financial Statistics from 1986Q1 to 2008Q4 using vector error correction mechanism integrate both the long run and the short run effect is predicted concurrently. The study confirms that there is significant long run relationship among the variables. Money supply and exchange rate have significant negative effect on inflationary pressure, although real output growth and foreign price changes have direct effects on inflationary pressure. Furthermore, the test of short term relationship of these variables on inflation; only money supply is the significant variable in support of the apriori theoretical expectation (T.O.Akinbobola, 2012). The use of Johansen multivariate cointegration, granger causality test and variance decompositions to find out the dynamic interactions among macroeconomic variables by using quarterly data from Pakistan over the period 1972Q1 to 2009Q4 found an existence of a stable long run equilibrium relationship among the macroeconomic variables from the cointegration test. The Granger causality tests tend to support the non neutrality of money in accordance with the Keynesians and the monetarists in the short run. Their findings show that inflation is not purely a monetary phenomenon rather structural factors play a key role in affecting in Pakistan (Faiz Bilquees et al. 2012). An investigation of Exchange rate volatility and Employment Growth in Ghana's manufacturing sector using OLS regression technique revealed that interest rate has a negative relationship; GDP has a positive relationship with employment growth (Mensa et al, 2013). Another study on the relationship between exchange rate and inflation in Zimbabwe using Granger causality test during the period 1980 to 2007 revealed that both the exchange rate and inflation have equilibrium condition and share a common trend in the long run and reveals that the order of causality in annual tests is normally bi-directional, from inflation rate to exchange rate conversely (Wellington Madesha et al 2013). An examination of the relationship between exchange rate and interest rate in Namibia using unit root tests, cointegration tests, impulse response and variance decomposition for the period 1993Q1 to 2012Q4 treasures that there is no cointegration among the variables and was unable to clear systematic relationship between interest rates and exchange rates. However, the variance decomposition revealed that the errors in the forecast of both the exchange rate and interest rate are dominated by itself (Johannes Payavali Sheefeni Sheefeni, 2014). An investigation on the impact of macroeconomic variables of GDP growth of Pakistan using correlation coefficient, regression analysis and Granger causality using annual data for the period 1980 to 2013 revealed that inflation and exchange rate have a unidirectional causality whilst exchange rate and Foreign Direct Investment (FDI) indicates significant impact on GDP growth. The study also confirms that FDI, Interest rate, exchange rate and inflation demonstrate significant impact on GDP growth (Umar Kibria et al, 2014).

METHODOLOGY DISCUSSION

The study adopts an econometric approach, data series were sourced from the world development indicators (WDI) data base for a period of 34 years (1980-2013). We used Ordinary Least Square (OLS) method to analyse the relationship between inflation, GDP growth, exchange rate, foreign price level and money supply. In order to predict the impact of the above mentioned variables in the Sierra Leone economy, the General Multiple linear Regression was adopted to take the following specification;

$$INF = F(GDP, EXR, FPL, MG) \quad (1)$$

From equation (1), the econometric form of the equation is specified in natural logarithm as;

$$\ln INF_t = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln EXR_t + \beta_3 \ln FPL_t + \beta_4 \ln MG_t + U_t \quad (2)$$

Where; INF = Consumer Prices Index Inflation, GDP = Gross Domestic Product, EXR = Exchange Rate, FPL = Foreign Price Level, MG = Money Supply Growth and U_t = Error Term
 β_0 is a constant and β_1 to β_4 are the parameters to be estimated.

ANALYSIS OF EMPIRICAL RESULTS AND DISCUSSION

The empirical investigation commences with an analysis of the descriptive/summary statistics of the variables under investigation. The mean was used as measure of central tendency, whereas the standard deviation is used as measure of dispersion. The results in table 1 show that all the variables have a positive mean and standard deviation with highest standard deviation recorded for Exchange rate and its lowest value recorded for Foreign Price level. Skewness and Kurtosis denotes the measures of Skewness and Peakedness respectively and the maximum and minimum values for each variable are also computed (table 1.). Both skewness and kurtosis are positive and that kurtosis curve for INF, GDP and FPL are leptokurtic.

In an attempt to detect the problem of multicollinearity in the model, a correlation matrix was done to determine the degree of correlation among the variables under investigation. Correlation explains the changes that occur in one variable due to change in other variable. If a high correlation is found between variables, it can lead to multicollinearity. The table below shows the result from the matrix.

The rule of thumb is that if multicollinearity among two variables is 80% and above, then it is a cause of concern. However, the current study does not show any severe case of multicollinearity between the variables as the highest value of correlation is 71% between inflation and money supply. This confirms the absence of multicollinearity among the variables in the model.

Table 1 Descriptive Statistics

	INF	GDP	EXR	FPL	MG
Mean	33.64	6.38	1521.04	3.54	34.92
Maximum	165.68	26.27	4349.16	13.51	88.40
Minimum	1.79	0.73	1.05	0.36	2.62
Std. Dv	37.01	5.74	1505.12	2.46	22.22
Skewness	1.99	1.97	0.55	2.60	0.90
Kurtosis	6.76	6.58	1.94	10.52	2.76
Jarque-Bera	42.40	40.08	3.32	118.42	4.68
Observations	34	34	34	34	34

Table 2 Correlation Matrix

Variables	INF	GDP	EXR	FPL	MG
INF	1.00	-0.12	-0.52	0.02	0.71
GDP	-0.12	1.00	0.37	-0.23	-0.24
EXR	-0.52	0.37	1.00	-0.47	-0.48
FPL	0.02	-0.23	-0.47	1.00	0.01
MG	0.71	0.24	-0.48	0.01	1.00

1. Unit Root Test Analysis

Under existing practice the unit root test is conducted to check the stationarity of data series. This step is very vital because if non-stationary variables are not identified and used in the model, it will lead to a problem of spurious regression, the results suggest that there is a statistically significant and meaningful relationships between and amongst the variables in the stated regression model where in actual fact all that exists is contemporaneous correlation rather than meaningful causal relationships. The Augmented Dickey-Fuller and the Phillips-Perron tests were carried out and the test results are presented in table 3.

Table 3 Results of the Test for Stationary: Using Augmented Dickey Fuller and Phillips-Perron Tests

Augmented Dickey-Fuller Tests					
Variable	Level/ Δ Level	Calculated ADF	ADF critical values	Included in tests equation	Conclusion
lnINF	Level	-3.1524	-4.2627	Intercept & trend	I(1)
	Δ Level	-6.8082	-4.2733***		
lnGDP	Level	-2.0564	-2.6369	None	I(1)
	Δ Level	-8.5726	-2.6392***		
lnEXR	Level	1.7648	1.7648	Intercept	I(1)
	Δ Level	-3.5900	-2.9571**		
lnFPL	Level	-4.2169	-4.4163	Intercept & trend	I(1)
	Δ Level	-6.1454	-4.4407*		
lnMG	Level	-3.4830	-4.2627	Intercept & trend	I(1)
	Δ Level	-7.8095	-4.2733***		
PHILLIPS-PERRON TESTS					
lnINF	Level	-2.9428	-4.2627	Intercept & trend	I(1)
	Δ Level	-11.7002	-4.2733***		
lnGDP	Level	-1.7897	-2.6370	None	I(1)
	Δ Level	-12.6302	-2.6392***		
lnEXR	Level	2.5806	-3.6463	Intercept	I(1)
	Δ Level	-3.2837	-2.9571**		
lnFPL	Level	-1.2051	-3.6220	Intercept & trend	I(1)
	Δ Level	-4.3138	-3.6329*		
lnMG	Level	-3.3964	-4.2627	Intercept & trend	I(1)
	Δ Level	-8.0871	-4.2733***		

Note: ***, ** and * indicates that the variable is stationary at the 1 %, 5% and 10% level of significance respectively.

The unit root test result reveals that all the variables in the model are non-stationary at their levels but become stationary at first differencing. This suggests the use of co-integration analysis since the concept of co-integration requires variables must be stationary after differencing at least once I (1).

2. Co-integration Test Analysis

The stationary linear combination is termed the co-integrating equation and can be infer as a long run equilibrium relationship between the variables. The common objective is to determine the most stationary linear combination of the time series variables under consideration. Consequently, Johansen and Juselius (1988, 1990) co-integration technique has been employed for the investigation of stable long run relationships between inflation, GDP growth, exchange rate, foreign price level and money supply growth in Sierra Leone by using both the Trace and Maximum-Eigen tests statistics. The results are presented in table 4 and 5.

Table 4 Unrestricted Co-integration Rank Test Result (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.758152	98.43549	69.81889	0.0001
At most 1 *	0.562171	53.01318	47.85613	0.0152
At most 2	0.420392	26.58354	29.79707	0.1122
At most 3	0.219840	9.130656	15.49471	0.3534
At most 4	0.036397	1.186445	3.841466	0.2760

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

Source: E-views output

Table 5 Unrestricted Co-integration Rank Test Result (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.758152	45.42231	33.87687	0.0014
At most 1	0.562171	26.42964	27.58434	0.0697
At most 2	0.420392	17.45288	21.13162	0.1517
At most 3	0.219840	7.944212	14.26460	0.3844
At most 4	0.036397	1.186445	3.841466	0.2760

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

Source: E-views output

The results of both the trace test (table 4) and the maximum-eigen test (table 5) indicate that co-integrating equation exists at the 5% significance level. Therefore the null hypothesis of no co-integrating equation is rejected. Consequently, it can be concluded that there is a significant long run relationship between the given variables. Since variables can either have long run or short run effects, then an error correction model (ECM) is used to disaggregate this effect.

Table 6 Result of the long run co-integrating relationship

Independent variables	Coefficients	Standard Errors	T-Statistics	conclusion
lnGDP	-1.0135	0.2318	-4.3723	significant
lnEXR	0.0023	0.0040	0.5750	insignificant
lnFPL	16.6826	2.7144	6.1460	significant
lnMG	2.0296	0.2393	8.4814	significant
constant	-620.0248

Source: computed by author from e-views output

The result of the long-run co-integrating relationship in the model shows that GDP growth has significant negative effect on inflation in Sierra Leone whereas exchange rate, foreign price level and money supply growth have a positive one.

3. Short run dynamics (ECM)

Table 7 Error Correction Model. Dependent variable dlnINF.

Variables	Coefficient	Standard Error	T-Statistics	Probability	VIF
C	2.2558	4.8802	0.4622	0.6476
dlnGDP	-0.5062	0.2031	-2.4920	0.0299	1.0588
dlnEXR	-0.0066	0.0226	-0.2916	0.7728	1.1329
dlnFPL	0.6636	0.2281	2.9095	0.0142	1.1033
dlnMG	0.3943	0.1898	2.0772	0.0474	1.1276
ECM(-1)	-0.9345	0.1523	-6.1372	0.0000	1.0771
R-squared	0.600395	Mean dependent var	0.129021		
Adjusted R-squared	0.526394	S.D. dependent var	30.15025		
S.E. of regression	20.74912	Akaike info criterion	9.065850		
Sum squared resid	11624.20	Schwarz criterion	9.337943		
Log likelihood	-143.5865	Hannan-Quinn criter.	9.157401		
F-statistic	8.113331	Durbin-Watson stat	1.988357		
Prob(F-statistic)	0.000089				

Source: computed by author from e-views output

The coefficient of GDP growth -0.5062 has a negative and significant impact on inflation. There is an inverse relationship between GDP growth and inflation. This implies that a 1% increase in the GDP growth leads to approximately 0.51% decrease in inflation in Sierra Leone. This outcome is in line with theories and previous studies that an increase in economic growth has the tendency to reduce the rate of inflation in an economy.

With regards to exchange rate, the sign of the coefficient reveals that an appreciation of the Leones will cause a decline in the rate of inflation in Sierra Leone. However, the relationship is insignificant for the study given that the probability value is greater than 5%.

Unlike GDP growth, the coefficient of foreign price level 0.6636 has a positive and significant impact on the rate of inflation. There is a direct relationship between foreign price level and inflation. This implies that a 1% increase in foreign price level can lead to approximately 0.66% increase in the rate of inflation in Sierra Leone. This finding is in conformity with theories

and findings from previous studies that there exists a positive relationship between them.

Similarly, the coefficient of money supply 0.3943 has a positive and significant impact on the rate of inflation. There is a direct relationship between money supply and inflation. This implies that a 1% increase in money supply can lead to approximately 0.39% increase in inflation in Sierra Leone. This finding is also in conformity with theories and findings from previous studies that there exist a positive relationship between money supply and inflation.

The coefficient of the error correction term indicates the speed of adjustment in eliminating deviation from the long run equilibrium. It shows how much time would be taken by the economy to reach at long run equilibrium. Its coefficient is statistically significant -0.9345. This shows that the speed of adjustment is approximately 0.93% implying that if there is a deviation from the equilibrium, approximately 0.92% of inflation is corrected annually as the variable moves towards restoring equilibrium. The adjusted R- squared value is 0.526394, implying that approximately 52.6% of the variation in the inflation rate is explained by the independent variables, which is an indication of a very good fit. The Durbin-Watson statistic is high suggesting that there is no first order autocorrelation. The overall equation is statistically significant as shown by the probability value of the F-statistic (0.008407).

CONCLUSION

This paper intended to find the link between inflation, exchange rate, GDP growth and money supply growth in Sierra Leone. The empirical and econometric analysis performed in this paper showed that there is existence of long run functional relationship between inflation as a dependent variable on one side, GDP growth, exchange rate, foreign price level and money supply growth as explanatory variables on the other side. Furthermore, results from the short run relationship indicated an inverse relationship between GDP growth and inflation. This implies that a 1% increase in the GDP growth leads to approximately 0.51% decrease in inflation in Sierra Leone. This outcome is in line with theories and previous studies that an increase in economic growth has the tendency to reduce the rate of inflation in an economy. With regards to exchange rate, the sign of its coefficient reveals that an appreciation of the Leones will cause a decline in the rate of inflation in Sierra Leone. However, the relationship is insignificant for the study given that the probability value is greater than 5%. Unlike GDP growth; the coefficient of foreign price level 0.6636 has a positive and significant impact on the rate of inflation. There is a direct relationship between foreign price level and inflation. This implies that a 1% increase in foreign price level can lead to approximately 0.66% increase in the rate of inflation in Sierra Leone. This finding is in conformity with theories and findings from previous studies that there exists a positive relationship between. Similarly, the coefficient of money supply 0.3943 has a positive and significant impact on the rate of inflation. There is a direct relationship between money supply and inflation. This implies that a 1% increase in money supply can lead to approximately 0.39% increase in inflation in Sierra Leone. This finding is also in conformity with theories and findings from previous studies that there exist a positive relationship between money supply and inflation. Therefore, a policy recommendation is that the liquidity specifications should be broadens to incorporate foreign currency deposits held at commercial banks to establish efficient control over money supply. Finally we look forward to future studies on GDP growth, inflation, Exchange rate, money growth issues with a view to further provoke policy discourse; such study could be the nexus between Monetary policy and economic growth for the Sierra Leone economy.

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