Fiscal Deficit and the External Sector Performance of Sierra Leone: 
A Simulation Approach

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Abstract

This paper investigates the effects of fiscal deficit on the external sector of Sierra Leone. The study utilized aggregate annual data from 1971 to 2005. Equations for money supply, price level, real exchange rate and the overall balance of payments were estimated simultaneously, using Three Stage Least Squares (3SLS). Counterfactual policy simulation was then performed. The result shows that fiscal restraint improves the external sector of Sierra Leone by reducing money supply and the price level. The result also points to the need for a sustained reduction in the budget deficit of Sierra Leone as this helps in achieving monetary restraint and low price level, which has real exchange rate depreciation and improvement in the balance of payments as ultimate external sector benefits. This requires sound fiscal policy from the point of view of both revenue generation and expenditure.

JEL Classification Codes: E62, F41, F47.

Keywords: Fiscal Deficit, Real Exchange Rate, Balance of Payments, Simulation.

Economic growth, low and stable price level and healthy external sector are key macroeconomic policy objectives of every economy. The importance of the external sector lies in the fact that every nation engages in trade and payments and the external sector performance measures the performance of an economy with respect to the rest of the world. In the light of this, the International Monetary Fund (IMF) gives both financial assistance and policy advice to countries that have experienced chronic balance of payments problem.

The real exchange rate, a measure of the competitiveness of an economy in international trade, depreciated in most developed economies at least in the last two decades, but appreciation of the real exchange rate was the common case in the developing

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economies. Hence, overvaluation of the real exchange rates of most developing countries, especially in sub-Sahara Africa, was the case in the 1980s and 1990s. This contributed to their poor performance on the balance of payments (Ghura and Grennes, 1993).

In Sierra Leone, the fiscal balance, trade balance and current account have been in deficit since the early 1970s. Moreover, net-foreign-assets which was positive over the period 1970-1975 was negative in all the years from 1976 to 2005. Furthermore, while the nominal exchange rate depreciated continuously from the early 1980s through the 2000s the real exchange rate appreciated continuously in the first half of the 1980s and was fluctuating between the second half of the 1980s and the end of the 1990s. It depreciated continuously over the period 2000 and 2005, a period of high budget deficit as a ratio of GDP but lower growth of money supply in comparison with the 1980s through the 1990s.

The interesting questions that therefore arise from these observations in Sierra Leone are: (i) Given the existence of both fiscal deficit and poor external sector performance as measured by real exchange rate depreciation, the trade balance, current account and net foreign reserves over two decades and the concern for external sector development, does fiscal deficit play a role in the external sector development of Sierra Leone? (ii) If fiscal deficit plays a role in the external sector development of Sierra Leone, what is the channel of transmission of fiscal deficit to the external sector of Sierra Leone? These questions are important to policy makers to the extent that their answers can help in providing solutions to the poor external sector performance of Sierra Leone.

The objective of this paper is therefore to investigate the effects of fiscal deficit on the external sector of Sierra Leone. The rest of the paper is organized as follows. Section 2 is a review of the literature on fiscal deficit and the external sector performance. In section 3, the empirical models are specified. Section 4 presents the empirical results and section 5 deals with conclusion and policy recommendation.

LITERATURE REVIEW

The theoretical literature on the effects of budget deficit on the external sector is mixed. The theory can be traced back to the Mundell-Fleming model (Fleming; 1962 and Mundell; 1963). The Mundell-Fleming model, which is an open-economy version
of the IS-LM model, posits that an increase in budget deficit increases consumer spending as it increases disposable income and hence, financial wealth. This increases import since expenditure increases on not only domestically produced goods but also on imported goods. However, an increase in the demand for import depreciates the exchange rate since it increases the demand for foreign currency. The depreciation of the exchange rate increases export. Since both import and export increase, the net effect on the trade balance is ambiguous.

According to the Keynesian absorption theory, an increase in budget deficit increases domestic absorption and import increases. Thus, the current account goes into deficit, from an initial equilibrium position. This is in contrast to the prediction of the Mundell-Fleming model, which predicts inconclusive effect.

According to the Ricardian Equivalence hypothesis, (Barro; 1989), shifts between taxes and budget deficits have no effect on real interest rate, investment and hence the current account. Thus, there is no link between budget deficit and external sector performance. The Ricardian equivalence considers consumers to be forward looking. They therefore save any increase in expenditure made by the government so that they pay their expected future taxes when government eventually taxes them. This implies that deficit and taxes are equivalent in their effect on consumption, investment and hence current account. Thus, the Ricardian equivalence implies that fiscal deficit has no effect on the external sector.

The empirical studies came to light when the United States experienced both trade deficit and budget deficit in the 1980s. The evidence has focused mostly on fiscal deficit and the trade balance or the current account. The methodology used includes the estimation of single equation using the Ordinary Least Squares (OLS), Two Stage Least Squares (2SLS), Vector Autoregression (VAR), Cointegration Technique, Macroeconometric Modelling Approach and Granger Causality test.

Evidence on the relationship between fiscal deficit and external sector is split. For example, Piersanti (2000) used the Granger-Sims causality technique to investigate the link between the current account deficits and budget deficits for seventeen OECD countries over the period 1970-1997. His study reveals that external sector performance is negatively correlated with budget deficits. Studies such as Volker (1984), Zaidi (1985),

Though the evidence is mixed, there is more support for the negative effect of fiscal deficit on the external sector (Saleh, 2003). This implies there is more evidence in favour of the twin-deficit problem than against it.

While early studies on the effects of budget deficit on external sector performance used partial equilibrium approach- that is, the single equation technique (for example, Eisner 1986), most studies have now focused on a macroeconomic framework since it captures both direct and indirect effects. Studies under this category include Mansur (1989) for Philippines, Egwaikhide (1995) for Nigeria, Tchokote (2005) for Cameroon, Soludo (1997) for Nigeria, Olopoenia (1991) for Nigeria and Bartoli (1989) for ten Latin American countries. However, though these studies examine the effects from the point of view of many equations, none of the studies captured the fiscal effects by considering the real exchange rate and the overall balance of payments.

The paper contributes to the empirical literature on the external sector effects of fiscal deficit by jointly considering the following issues:

- Previous literature concentrates on the trade balance and the current account as measures of the external sector performance. This treatment ignores the effect of budget deficit on the real exchange rate, which is the traditional measure of the competitiveness of an economy to international trade and the means of transmitting fiscal deficit to the trade balance and current account of an economy. Thus, an important channel of transmission of budget deficit to the external sector is left out in the literature.

- The possible effect of budget deficit on the overall balance of payments as a result of higher price level, which works through reduction in money demand, has also been neglected in the literature. This is taken into consideration in this paper.
The use of simulation technique, which captures the dynamic effect of fiscal deficit and takes into consideration both the direct and indirect effects of fiscal deficit, is underscored in this paper. This is not observable in equations which incorporate fiscal deficit variable explicitly as a regressor in an external sector equation.

Despite the huge literature on the effects of fiscal deficit on the external sector performance of both developed and developing countries, the author is not aware of any work in the case of Sierra Leone.

**EMPIRICAL MODELS**

**The Transmission of Fiscal Deficit to the External Sector**

Fiscal deficit affects the external sector through its impact on the monetary sector. The effect of fiscal deficit on the supply of money is direct. An increase in fiscal deficit increases the supply of money when the deficit is financed by means of seigniorage. Increase in money supply increases the price level, which in turn appreciates the real exchange rate and deteriorates the balance of payments. Thus, the effect of fiscal deficit on the real exchange rate and the overall balance of payments are indirect while the effect on money supply is direct as long as the deficit is financed by means of seigniorage. This implies that investigating the effect of fiscal deficit on the external sector requires a methodology that looks at these indirect effects, which do not require an explicit introduction of fiscal deficit into external sector equations. Hence, a money supply equation, a price equation, a real exchange rate equation and an overall balance of payments equation are specified and estimated for Sierra Leone. The basis of this is that for more than three decades Sierra Leone has relied more on seigniorage for deficit financing. The total effect of fiscal deficit on external sector indicators would therefore require simulation techniques once the various equations are estimated. For one thing, the dynamic effects of the deficit can be obtained. This approach is undertaken in this paper. Figure 1 shows the transmission of fiscal deficit to the external sector.
In Sierra Leone, fiscal deficit has been the case since the early 1970s, money supply growth and high inflation has also been common cases in the same period, the real exchange appreciated in most of the periods since 1970 and net foreign asset was negative most of the time in the same period. In determining the effects of fiscal deficit on the external sector of Sierra Leone, we therefore specify a money supply equation which explicitly has fiscal deficit as a regressor (following the Credit Counterpart model of money supply), a price equation which accounts for the effect of money supply on the price level and a real exchange rate model and a foreign reserve equation. Both the real exchange rate equation and the foreign reserve equation incorporate the role of the price level in determining the real exchange rate and foreign reserves respectively. While the effect of fiscal deficit on money supply is expected to be direct, its effects on the price level, the real exchange rate and foreign reserves are indirect as it is expected to work by increasing the money supply and then the price level.

**Specification of the Models**

**The Money Supply Equation**

The money supply equation is based on the Credit Counterpart Approach to money supply determination as it explicitly recognizes the role of fiscal deficits in money supply determination. The fundamental equation of the model is:

$$\Delta M = BDEF + NET \cdot \Delta GD_p + \Delta L_p$$  \hspace{1cm} (1)

Equation (1) is the fundamental equation of the credit counterpart approach to money supply determination. Though it remains an identity it provides a framework for
analyzing the dynamics of money supply. It reveals that money supply growth depends on fiscal deficit (BDEF), net external transactions of the government (NET), domestic debt management policy of the government (ΔGD), and change in bank lending to the private sector (ΔLp).

To the extent that the domestic financial sector of Sierra Leone is not developed, government debt to the private sector is not relevant in the money supply determination. Hence, it is left out in the empirical model. The empirical equation that is postulated to explain money supply (M*) behavior in Sierra Leone is therefore given as:

\[
\text{LnMs} = f (\text{LnBDEF, LnFR, LnLp})
\]

The signs below the variables on the right hand side of equation (2) are the effects of the variables on money supply.

Where, FR is foreign reserve and the other variables are defined as earlier. According to equation (2), an increase in budget deficit is expected to increase the money supply; an increase in foreign reserve (FR) implies a reduction in net foreign assets. Hence, the supply of money reduces. An increase in bank lending to the private sector increases the money supply.

**Price Equation**

The theoretical framework for modeling the price level is a simple model in which the price level is a weighted average of the price of tradable goods and non-tradable goods. The price of non-tradable goods depends on money market behaviour and the price of tradable goods depends on the exchange rate. This model has been applied in modeling the price level in other African countries, for example, Ubide (1997) for Mozambique, Rutasitara (2004) for Tanzania and Bawumia (2002) for Ghana. Moreover, Sierra Leone relies heavily on imports for its capital and intermediate goods as well as the staple food. Hence, increase in the price of import, which is a component of tradable goods, is important in price formation.

Under the above consideration, the structural form of the price equation is obtained as a function of domestic money supply (M*), income (y), nominal exchange rate (e).
and interest rate \((i)\). That is:
\[
p = f(M, y, e, i)
\] (3)

In order to account for inertia effect, previous price level is introduced as a regressor.

In linear form, the price equation is therefore given as follows:
\[
LnP_t = \lambda_0 + \lambda_1 LnM_{t-1} + \lambda_2 LnY_t + \lambda_3 Ln e_t + \lambda_4 Ln i_t + \lambda_5 Ln P_{t-1} + U_{2t}
\] (4)

\(\lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5 > 0\) and \(\lambda_2 < 0\)

### The Real Exchange Rate Model

The estimated real exchange rate model is based on Edwards (1989). According to this model, the real exchange rate is determined by the following equation:
\[
LnRER_t = \omega_0 + \omega_1 Ln(TOT)_t + \omega_2 Ln(GCN)_t + \omega_3 Ln(CAPCON)_t + \\
\omega_4 Ln(EXCHCON)_t + \omega_5 Ln(TECHPRO)_t + \\
\omega_6 Ln(I/GDP)_t + \Phi Ln(RER)_{t-1} + \\
\Omega(Z_t - Z^*_t) + \Phi (Ln e_t - Ln e_{t-1}) + U_{3t}
\] (5)

\(\omega_1 \geq 0, \omega_2 > 0, \omega_3 < 0, \omega_4 < 0, \omega_5 < 0, \omega_6 \geq 0, \Omega < 0\) and \(\Phi > 0\).

Where \(RER\) is real exchange rate, \(TOT\) is terms of trade \((TOT)\), \(GCN\) is government consumption as a ratio of GDP, \(CAPCON\) is control on capital flows, \(EXCHCON\) is exchange and trade controls, \(TECHPRO\) is technological progress, \((I/GDP)\) is capital accumulation as a ratio of GDP, \(e\) is nominal exchange rate, \((Z-Z^*)\) is inconsistent macroeconomic policy and \(U_3\) is an error term assumed to be identically and independently normally distributed.

A problem faced in the estimation of equation (5) is the determination of the components of inconsistent macroeconomic policy \((Z-Z^*)\). Excess supply of domestic credit \((EXCRE)\) measured as the rate of growth of domestic credit minus lagged rate of growth of real GDP is used by Edwards to represent inconsistent monetary policy\(^{24}\) while the ratio of fiscal deficit \((FD)\) to high powered money \((H)\) is used as a measure of inconsistent fiscal policy.

\(^{24}\)This measure of excess domestic credit assumes that the demand for domestic credit is unitary elastic with respect to income (Edwards 1989).
Many studies on developing countries have used only excess domestic credit in their real exchange rate models to account for inconsistent macroeconomic policies on the basis that fiscal deficits are mostly financed by seigniorage revenue (domestic credit creation) in most developing countries. This serves to control for possible multicollinearity between inconsistent fiscal policy and monetary policy variables, given that fiscal deficits are often financed by domestic credit expansion. However, the inclusion of inconsistent monetary policy variables to captures inconsistent macroeconomic policies in the real exchange rate model is justified in the literature (pioneered by Edwards, 1989) on the grounds that such policies lead to higher inflation, thus appreciating the real exchange rate. Though this treatment assumes that the channel via which inconsistent macroeconomic policies affects the real exchange rate is through its impact on the price level, excess domestic credit rather than the price level is used in previous real exchange rate models. This leaves out the indirect effect of monetary policy (through inflation) on the real exchange rate. To capture this indirect effect, it is therefore necessary to explicitly introduce the price level into the real exchange rate model.

Proxies are used for most of the variables in equation (5) because data is not available for them. In the case of technological progress, growth of real gross domestic product (Yg) has been used in most studies at least to test the Ricardo-Balassa effect. This proxy is adopted here in order to test the Ricardo-Balassa effect. This has been tested in most empirical works that estimate the dynamics of the real exchange rate. To the extent that it is difficult to find a proxy for government expenditure on non-tradable goods, total government expenditure as a ratio of GDP is used. Control on capital flow (CAPCON) is represented by capital flow (CAPFLO), which is calculated as net change in reserve minus trade balance (scaled by GDP). EXCHCON is represented by the closeness of the economy to international trade (CLOSE). The index of closeness is GDP divided by the sum of exports and imports. Hence, the empirical model explaining the dynamics of the real exchange rate is given as follows:

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25 The Ricardo-Balassa thesis states that improvement in technology, which is taken as increase in output, emanates from productivity growth in the tradable goods sector and this appreciates the equilibrium real exchange rate. Given that the variables that affect the equilibrium real exchange rate theoretically affect the actual real exchange rate, this variable is included in the short run real exchange rate model.
\[ \ln RER_t = \omega_0 + \omega_1 \ln (TOT)_t + \omega_2 \ln \left( \frac{G}{GDP} \right)_t + \omega_3 \ln (CAPFL)_t \]
\[ + \omega_4 \ln (CLOSE)_t + \omega_5 \ln (Y)_t + \omega_6 \ln I + \Phi \ln RER_{t-1} + \Omega \ln P_t + \Phi \left( \ln \left( \frac{1}{P_t} \right) \right) + \Omega \]

Where \( P \) is the price level, \( Y_g \) is growth of real output, and the other variables are defined as earlier.

The real effective exchange rate (REER) is used to estimate the real exchange rate because it is weighted by the trade shares of exporting partners (thus controlling for third country effect). Moreover, most studies that have estimated real exchange rate models have used the notion of real effective (multilateral) rather than real bilateral exchange rate. The real effective exchange rate is computed as follows:

\[ \text{REER} = \sum_{i=1}^{4} S_i \left( \frac{e ^ {CP} \left( \frac{P^*}{P} \right) \left( \frac{I^*}{I} \right)}{CP} \right) \] (7)

Where:
- \( \text{REER} = \) real effective exchange rate
- \( i = \) major export partner of Sierra Leone
- Four major export partners are considered. (Belgium, Germany, U.K and U.S with trade weight calculated to be 0.7, 0.15, 0.1 and 0.05 respectively)\(^{26}\).
- \( S_i = \) the weight of country \( i \) in the total exports of Sierra Leone.

**The Balance of Payments Equation**

Sierra Leone has been having budget deficit since the early 1970s, and it has mostly been financed by government borrowing from the banking sector. The result of this is monetary expansion, which has inflation as a consequence. This increases disequilibrium in the money market, with balance of payments deterioration as a consequence. Hence, the balance of payments is specified on the framework of the monetary approach to the balance of payments (MABP).

\(^{26}\) These weights were calculated from World Fact Book, using the period 1980 to 2005.
The MABP argues that disequilibrium in the balance of payments is a monetary phenomenon and not a real phenomenon. That is, balance of payments disequilibrium emanates from disequilibrium in the money market. This means that balance of payments disequilibrium is the result of divergence between growth of money demand and growth of domestic credit. It also stresses that the domestic component of money supply is related one-for-one in opposite direction with the balance of payments. Moreover, increase in factors that increase the demand for money improves the balance of payments, while increase in factors that decrease the demand for money deteriorates the balance of payments. In Sierra Leone, high inflation rate has been common in the last three and a half decade. This coexists with widespread parallel market for foreign exchange, thereby making the price level and nominal exchange rate important factors in the demand for money. By noting that the demand for money is affected traditionally by income (Y) and interest rate (i) and the fact that the price level (P) and the nominal exchange rate (e) do respectively affect the demand for money in a high inflationary economy with increased dollarisation and wide spread parallel market for foreign exchange, change in foreign reserve (FR) is given as:

$$\Delta FR = \Delta f(Y, i, P, e) - \Delta DC$$  \hspace{1cm} (8)

Where, DC is domestic credit. Equation (8) is the fundamental equation of the Monetary Approach to the Balance of Payments. The expression \(f(Y, i, P, e)\) captures the demand for money. The balance of payments function is therefore given as follows:

$$Ln\Delta FR_t = \eta_0 + \eta_1 LnY_t + \eta_2 Ln{i}_t + \eta_3 LnP_t + \eta_4 Ln{e}_t + \eta_5 LnDC_t + U_{4t}$$

where \(\eta_1, \eta_4 > 0\) and \(\eta_2, \eta_3, \eta_5 < 0\)

Data and Econometric Issues

Data for the study is obtained from the IFS CD-ROM 2007 for the period 1971 to 2005. All variables, with the exception of capital flow were transformed into natural logarithm. This enables us to interpret coefficients as elasticities. Appendix Table 1 shows the data sources and description.

The four equations belong to a system of simultaneous equations in the sense that a left hand side variable is a right hand side variable in another equation. Moreover, no equation has variables which are only right hand side variables, which leads to a recursive system. The application of the Ordinary Least Squares (OLS) therefore leads to biased
and inconsistent estimates of the coefficients. This leads to misleading inferences. When a system of equation is under identified, it is not possible to obtain the structural parameters by any of the simultaneous equation estimation techniques. Thus, no Econometric Software can obtain the structural parameters but when it is exactly identified the Two Stage Least Squares (2SLS) is recommended for estimation and in the case of over identification, the Three Stage Least Squares (3SLS) is recommended (Iyoha, 2004). However, the Three Stage Least Squares (3SLS) unlike the Two Stage Least Squares (2SLS) corrects for potential cross-equation serial correlation. Moreover, unlike the 2SLS, the 3SLS estimates all the equations as a system rather than one by one. On this note, the Three Stage Least Squares estimator was used to estimate the system of equations. All the exogenous variables were used as instruments.

When there are direct and indirect effects of a variable in a system of simultaneous equation, it is unreliable to use the coefficients to obtain the effect of a variable on any of the endogenous variables as these direct and indirect effects may cancel each other. In such a case, simulation is the appropriate technique of analysis. This method is adopted here. When simulation (and forecasting) is the tool of analysis following the estimation of a system, the emphasis is always on the ability of the model to simulate values that are close to the historical data but not the conventional t-statistics or R2 values, which are essential in building a structural model of an economy.27 This study adopts this technique. However, we maintained some degree of parsimony in estimating the model by deleting variables with t-statistics less than 1.5. Moreover, other macroeconometric models have been estimated whereby t-statistics which are lower than this value are maintained in the model (for example, Iyoha, 2004, Ekpo et al, 2003, and Olofin 1985).

**EMPIRICAL RESULTS**

**System Results and Interpretation**

Table 1 presents the results of the estimated system. The money supply equation shows that budget deficit and loan to the private sector have positive effects on the money supply of Sierra Leone while foreign reserve has negative effect on money

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27 This is emphasised in Pindyck and Rubinfeld, (1998).
This result is consistent with the prediction of the credit counterpart approach to money supply determination. Money supply is inelastic with respect to all the variables with loan to the private sector having the highest elasticity.

Table 1: Result of the Estimated System

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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</thead>
<tbody>
<tr>
<td>1. The Money Supply Equation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.777925</td>
<td>0.178614</td>
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<td>LnBDEF</td>
<td>0.222611</td>
<td>0.053556</td>
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<td>LnFR</td>
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<td>0.050286</td>
<td>-5.497999</td>
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<tr>
<td>LnLp</td>
<td>0.830645</td>
<td>0.064621</td>
<td>12.85406</td>
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<tr>
<td>R-squared</td>
<td>0.992658</td>
<td></td>
<td></td>
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<tr>
<td>Adjusted R-squared</td>
<td>0.991924</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.288560</td>
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2. The Price Equation

<table>
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<tr>
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<th>Coefficient</th>
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<th>t-Statistic</th>
<th>Prob.</th>
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<td>LnMt</td>
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<tr>
<td>LnY</td>
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<td>-10.18219</td>
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<td>LnP(-1)</td>
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<td>0.069758</td>
<td>4.796880</td>
<td>0.0000</td>
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</table>

R-squared 0.998817
Adjusted R-squared 0.998654
S.E. of regression 0.130890
3. The Real Exchange Rate Equation

<table>
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<th>Coefficient</th>
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<th>t-Statistic</th>
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<tbody>
<tr>
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<td>Ln(G/GDP)</td>
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<td>CAPFLO</td>
<td>1.195112</td>
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<td>LnP</td>
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<td>Lne</td>
<td>0.699574</td>
<td>0.098638</td>
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R-squared 0.770312
Adjusted R-squared 0.729296
S.E. of regression 0.151223

4. The Overall Balance of Payments Equation

<table>
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<th>Std. Error</th>
<th>t-Statistic</th>
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<td>3.243733</td>
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<td>Lni</td>
<td>-0.684754</td>
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R-squared 0.716641
Adjusted R-squared 0.677557
S.E. of regression 0.515450

The price equation shows that money supply, nominal exchange rate and previous year's price level have positive effects on the price level of Sierra Leone, while real income has a negative effect.

The real exchange rate model shows that nominal exchange rate and capital flow have positive effects on the real exchange rate of Sierra Leone while the price level, closeness of the economy to international trade and government expenditure have negative effects on the real exchange rate.

The overall balance of payments equation shows that nominal exchange rate and real income have positive effects on the balance of payments while the price level and interest rate have negative effects. The negative effect of interest rate on the overall balance of payments implies that the effect of interest rate on the balance of payments
of Sierra Leone is not through the Mundel-Fleming prediction but through the money-market effect. That is, an increase in interest rate reduces the demand for money and excess money supply increases. Hence, the balance of payments deteriorates. The elasticity of exchange rate is unity, implying that a 1% increase in the nominal exchange rate increases foreign reserve by 1%. While the overall balance of payments is elastic with respect to income, it is inelastic with respect to interest rate and the price level.

**Historical Simulation**

The R2 is a measure of the robustness of a model in a single equation (OLS) context. In the case of simultaneous equation modeling, the counterpart of this is historical simulation. It is an examination of how close the actual series for the endogenous variables are to the simulated values. The actual and simulated values of the four endogenous variables are shown in Figure 2. The Figure shows that for all the endogenous variables, the actual and simulated values are very close and the turning points of the actual series are well tracked by the simulated series. This shows that the model is a good predictor of the historical behaviour of the endogenous variables. This is also informed by the strong correlation coefficient between the actual and simulated series of each of the endogenous variables. Table 2 shows the correlation coefficients between the actual and simulated series of the four endogenous variables.

**Figure 2: Actual and Simulated Series of the Endogenous Variables**

![Figure 2: Actual and Simulated Series of the Endogenous Variables](image)

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28 According to the Mundell-Fleming model, an increase in interest rate increases capital inflow and the balance of payments improves via improvement in the capital account.
Evaluating the Forecasting Performance of the Model

To the extent that simulation is used to determine the effects of budget deficit on the real exchange rate and overall balance of payments, it is important to evaluate the forecasting performance of the model. This shows whether the system is appropriate for policy simulation. To do this, the Theil's inequality and its decomposition are used. When the Theil's inequality is closer to zero, the forecasting performance of the model is good. Moreover, both the bias and variance proportions of the decomposition of the Theil's inequality are expected to be small for a model with good forecasting ability, while the covariance proportion is expected to be large. This implies that the divergence between the actual and simulated series is due to difference in neither their means nor their variances but due to their imperfect covariance.

Table 3 shows the Theil's inequality and its decomposition for the four endogenous variables. The result shows that the Theil's inequality coefficients are very close to zero and both the bias proportion and the variance proportion are close to zero, while the covariance proportion is high for all the endogenous variables. This implies that the estimated model is good for policy simulation purpose.

Table 3: Theil's Inequality Coefficient and its Decomposition

<table>
<thead>
<tr>
<th>Endogenous Variable</th>
<th>Theil's Inequality</th>
<th>Decomposition of Theil's Inequality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Bias Proportion</td>
</tr>
<tr>
<td>Money Supply</td>
<td>0.023</td>
<td>0.021</td>
</tr>
<tr>
<td>Price Level</td>
<td>0.014</td>
<td>0.053</td>
</tr>
<tr>
<td>Real Exchange Rate</td>
<td>0.016</td>
<td>0.001</td>
</tr>
<tr>
<td>Foreign Reserve</td>
<td>0.118</td>
<td>0.039</td>
</tr>
</tbody>
</table>
Policy Simulation

In April 2000, Sierra Leone and five other countries in West Africa signed a declaration to form a monetary zone, called the West African Monetary Zone (yet to be established). One of the convergence criteria as outlined in the Accra Declaration of April 2000 was that each member country should maintain the ratio of budget deficit to GDP to 5% or less by the end of 2000. We therefore asked the question 'what would be the effect of this policy on money supply, price level, the real exchange rate and the balance of payments, had it been implemented and maintained in Sierra Leone earlier?' The year 1982 was chosen as the beginning of the policy simulation on the basis that in this year, the poor external sector performance of Sierra Leone became acute (judged by foreign reserve position and the trade balance) and the government adopted a dual exchange rate regime as a solution. In this experiment, we set the ratio of budget deficit (excluding grant) to GDP at 5% from 1982 to 2005 and obtained the budget deficit consistent with this ratio. The resulting money supply, price level, real exchange rate and balance of payments were obtained from the model results. The percentage deviations of the disturbed solutions from the base line solution for the four endogenous variables were then obtained.

Figure 3 shows the result of the policy simulation. Over the period 1982-2005, the actual ratio of budget deficit (excluding grant) to GDP in Sierra Leone was 12.4%. This is more than the 5% ratio maintained in the simulation experiment. Hence, a negative value of the percentage deviations in the figure implies that a reduction in budget deficit reduces the variable, while a positive percentage deviation implies that the variable increases as budget deficit is reduced.

Figure 3: Counterfactual Policy Simulation Results from Maintaining Budget Deficit-GDP Ratio at 5% from 1982 to 2005.
The result from Figure 3 shows that if fiscal operation in Sierra Leone had been such that budget deficit as a ratio of GDP was maintained at 5%, money supply and price level would have reduced while the real exchange rate and the balance of payments would have increased. Moreover, these effects would have been higher over the period 1999-2005. This is probably because over the period 1999-2005, the budget deficit in Sierra Leone was financed more from external sources than domestic sources due to inflow of resources for post-war reconstruction and rehabilitation. Hence, reduction in budget deficit in Sierra Leone depreciates the real exchange rate and improves the balance of payments. This effect occurs through reduction in money supply and consequent reduction in the general price level.


CONCLUSION AND POLICY IMPLICATION

The paper investigated the effects of budget deficit on external sector performance of Sierra Leone, using the real exchange rate and overall balance of payments as the external sector indicators. Models of money supply, price level, real exchange rate and the balance of payments were estimated by using aggregate annual data from the International Financial Statistics CD-ROM 2007 for the period 1971 to 2005. Counterfactual policy simulation was consequently done. The paper contributes to the empirical literature on the external sector effects of fiscal deficit in the following ways:

• Previous literature concentrates on the trade balance and the current account as measures of the external sector performance. This treatment ignores the effect of budget deficit on the real exchange rate, which is the traditional measure of the competitiveness of an economy to international trade and the means of transmitting fiscal deficit to the trade balance and current account of an economy. Thus, an important channel of transmission of budget deficit to the external sector is left out in the literature.
The possible effect of budget deficit on the overall balance of payments as a result of higher price level, which works through reduction in money demand, has also been neglected in the literature. This is taken into consideration in this paper.

The use of simulation technique, which captures the dynamic effect of fiscal deficit and takes into consideration both the direct and indirect effects of fiscal deficit, is underscored in this paper. This is not observable in equations which incorporate fiscal deficit variable explicitly as a regressor in an external sector equation.

The result shows that a reduction in budget deficit in Sierra Leone depreciates the real exchange rate and improves the balance of payments by reducing money supply and the general price level.

The result of this paper reveals important lesson for policy makers. There is need for a sustained reduction in the budget deficit of Sierra Leone as this helps in achieving reduction in money supply and low price level, which has real exchange rate depreciation and improvement in the balance of payments as ultimate external sector benefits. This requires sound fiscal policy from the point of view of both revenue generation and expenditure.
REFERENCES


Evan, P., 1988, “Do Budget Deficits Affect the Current Account?” Unpublished, Ohio State University, Ohio.


### Appendix Table 1: Data Sources and Description

<table>
<thead>
<tr>
<th>Variable</th>
<th>Symbol</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital flow</td>
<td>CAPFLO</td>
<td>Calculated as net change in reserve minus trade balance, Scaled by GDP</td>
<td>Calculated by author from International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Closeness to International Trade</td>
<td>CLOSE</td>
<td>Calculated as GDP divided by the sum of Export and Import</td>
<td>Calculated by author from International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Domestic Credit</td>
<td>DC</td>
<td>The sum of Net Domestic Credit to the government and Private Sector</td>
<td>International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Loan to the Private Sector</td>
<td>Lp</td>
<td>Domestic Credit to the Private Sector</td>
<td>International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Money Supply</td>
<td>M</td>
<td>Broad money supply; that is, narrow money supply plus quasi money</td>
<td>International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Nominal Interest Rate</td>
<td>i</td>
<td>Treasury Bill Rate</td>
<td>International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Output Growth</td>
<td>Yg</td>
<td>Percentage Change in Real GDP</td>
<td>Calculated by author from International Financial Statistics CD-ROM 2007</td>
</tr>
<tr>
<td>Real Exchange Rate</td>
<td>RER</td>
<td>Calculated as the real effective exchange rate-the trade weighted average of the bilateral real exchange rates between Sierra Leone and her trading partners</td>
<td>Calculated by author from IFS CD-ROM 2007 and World Fact Book with weights from 1980-2005</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>TOT</td>
<td>The ratio of price of export to price of import</td>
<td>Calculated by author from World Development Indicators CD-ROM 2007</td>
</tr>
</tbody>
</table>