Applied Economics and Finance; Vol. 10, No. 2; 2023
ISSN 2332-7294 E-ISSN 2332-7308
Published by Redfame Publishing

Openness and Monetary Policy in Small Developing Economies: Evidence from Sierra Leone

Saidu Swaray[1]

[1] Research and Statistics Department, Bank of Sierra Leone, P.O. Box 30, Siaka Stevens Street, Freetown, Sierra Leone

Correspondence: Saidu Swaray, Bank of Sierra Leone.

Received: March 31, 2023 Accepted: May 19, 2023 Available online: May 23, 2023

doi:10.11114/aef.v10i2.6140 URL: https://doi.org/10.11114/aef.v10i2.6140

Abstract

As a post-conflict and fragile state, Sierra Leone has witnessed increased liberalization and greater openness since the end of the civil unrest in 2002. This high degree of openness appears to be negatively affecting the country's balance of payments, with a substantial amount of foreign exchange earnings being spent annually the importation of essential commodities. Theoretically, openness may significantly contribute to weakening the effect of monetary policy on both output growth and exchange rate, but strengthens the effect on inflation. This study examines the implication of openness for the effectiveness of monetary policy in Sierra Leone. The autoregressive distributed lag technique was employed for quarterly data from the period 2002 to 2018. The results show that a higher degree of openness weakens the effect of monetary policy on both output growth and exchange rate, but strengthens the effect on inflation. The implication for policy is that, authorities should take into consideration the consequences of openness on the optimal monetary policy choice when taking monetary policy decisions.

Keywords: central bank, monetary policy, openness, ardl, output growth

JEL Classification: E58, E52, C33, C52

1. Introduction

There is growing consensus among central banks around the world that price stability is the key objective of monetary policy. However, the effect of openness on the economy tends to distort the power of the central bank in achieving this objective. This has necessitated the need for policymakers and academics to investigate the effect of openness on monetary policy in Sierra Leone. Sierra Leone is an open economy that is susceptible to the dynamics with activities with the outside world. The external sector of the country has grossly underperformed over the last three decades, as the country has been hit by chronic and persistent balance of payments crises owing partly to the country's over reliance on the importations for everything consumable. The country persistently faces deficits in the current account, trade balance and fiscal balance. (Morlai et al., 2012).

Additionally, the implication of openness for monetary policy has been attributed to both demand and supply sides effects (Berument et al., 2014). From the demand side perspective, openness affects monetary policy through relative changes in the demand for both local and foreign produced traded goods due to changes in real terms of trade via the response of the exchange rate to changes in monetary policy. The magnitude of this channel depends on expenditure switching between local and foreign produced traded goods, and the expenditure switching also depends on the elasticity of substitution between domestic and foreign-produced traded goods. The share of this elasticity tends to be higher the more open the economy and lower the less open the economy. In other words, when there is the rise in money supply without reciprocal increase in domestic output, there might be a corresponding increase in prices for non-tradable domestically produced goods. Under this circumstance, expenditure switching tends to favour tradable goods or imports. Hence, increasing the demand for imports will further exacerbate the trade balance (Bangura et al., 2015).

Presumably, for more open economies, this supply-side effect tends to reduce the impact of monetary policy on output growth and exchange rate but increases the impact on inflation. In other words, in more open economies, expansionary monetary policy tends to have a weaker effect on output growth and exchange rate but a stronger effect on inflation (Romer, 1993; Karras, 1999). Bangura et al. (2015) found that trade balance responds positively to money supply and domestic income in Sierra Leone in the long-run. The results found no evidence of the Marshall-Lerner condition as depreciation in the real exchange rate had no improvement on the trade balance in the long-run. However, evidence of the J-curve effect on trade balance emerged but in the short-run as a 1% depreciation of the real exchange rate in the

previous period exacerbated the trade balance by 0.5%. Hence the need to investigate the effect of openness on monetary policy in Sierra Leone using annual data from 2002 to 2018 is palpable. Previous studies on Sierra Leone such as Bangura (2022) investigated the trade openness-inflation relationship without paying attention to the effect of openness on monetary policy in Sierra Leone. This is how the current study departs from others

The rest of the paper is organized as follows. Section two reviews related literature. Section three presents methodology. Section four presents empirical findings and discussion. Section five concludes on proffers policy implications.

2. Literature Review

2.1 Theoretical Literature

The effect of openness on monetary policy in Sierra Leone is analyzed using the theoretical framework provided by Romer (1993) and Karras (1999) which has been widely employed by other researchers including Berument & Dogan (2003), Isik & Acar (2009) and Ekpo & Effiong (2017). According to theory, openness tends to weaken the effect of monetary policy on both output growth and exchange rate, but strengthens the effect on inflation (Romer, 1993; Karras, 1999). Romer (1993) employed a standard closed economy model of dynamic inconsistency theory of optimal monetary policy to predict that unexpected monetary policy shocks cause output and inflation to deviate from their potential levels. In this regard, policymakers tend to view the higher output as desirable, while inflation becomes undesirable. In other words, for more open economies, the effect of openness reduces the gains of output growth, but increases the amount of inflation for a given expansion of domestic output. In addition, openness increases the costs of local firms for every depreciation of the domestic currency. Furthermore, Romer (1993) predicts that the nexus between openness and inflation tends to be weaker in countries with political stability and independent central banks. Given that most central banks in low-income countries lack independence, with high degree of political instability, the openness-inflation nexus tends to be stronger, while the openness-output growth relationship tends to weaker. These have implications on monetary policy's potency to achieve its desired objectives. On the other hand, Karras (1999) hypothesized that expansionary monetary policy tends to inhibit temporary increases in output growth but has a permanent effect on domestic price build-ups. Whereas, contractionary monetary policy tends to exert a permanent decrease in output growth but a temporary decline in domestic price builds-up. Under this situation, the ability of changes in money supply to influence output growth tends to be weaker with openness, while the inflationary effect of changes in money supply tends to be stronger with openness. In the case of Sierra Leone, the ability of monetary policy to deliver its mandates might be difficult, given the high degree of openness, political instability and lack of autonomy of the central bank.

Furthermore, the theoretical underpinnings of the implication of openness on monetary policy has been hypothesized into two main strands. First is the hypothesis that the more open an economy the more it encounters a high inflation rate and low output growth (Romer, 1993). Second is the assumption that the impact of monetary policy on inflation and output growth to a large extent depends on the openness of the country (Karras, 1999). Other researchers have also based their theoretical foundation of the implication of openness for monetary policy effectiveness on either rule-based or discretionary monetary policy. Svensson (1997) argued in favour of a Taylor (1993) rule-based monetary policy in the form of inflation targeting where interest rate is adjusted based on the behaviour of output and inflation. Ball (1999) argued that targeting inflation in a closed economy might lead to optimal monetary policy. However, in an open economy, targeting inflation might be inimical to output growth, owing partly to the exchange rate effect on inflation via prices of imported consumer goods.

2.2 Empirical Literature

Empirically**,** Romer (1993) found strong evidence that the more open an economy the less inflation rate it encounters. He applied cross-sectional data to a basic open economy macroeconomy model of countries across regions and levels of development. The findings suggest that countries that are mostly open experience a lower rate of inflation while less opened or relatively closed economies have high inflation rates. These results support theoretical predictions that on average, inflation rates are somewhat lower in more open economies and higher in relatively closed economies. Karras (1999) found that as the economy becomes more open, the less the impact of monetary policy on output growth and the higher its effect on inflation. Annual data from 1953 to 1990 on thirty-eight countries were applied to a simple open economy macroeconomy model and the outcome of this study was in tandem with theoretical predictions that openness plays a critical role in enhancing the effectiveness of monetary policy in achieving its ultimate goals. Berument & Dogan (2003) found evidence that the effectiveness of monetary policy on output and inflation was influenced by the degree of openness of Turkey to international trade. The finding reveals negative relationship between the level of output and inflation and openness. In other words, the level of output declines with openness in Turkey.

Isik & Acar (2006) found that the interactive terms between openness and money supply were found to be negative and statistically significant when they investigated whether the effectiveness of monetary policy in propelling output growth was influenced by the level of openness of the country. They applied pooled panel data technique to annual data

covering 1990 to 2000 on forty-two countries consisting of twenty-two advanced and twenty least developing economies. Berument et al. (2007) investigated the level of openness and the effect of monetary policy on output growth and inflation in twenty-nine countries comprising developed and developing using quarterly data from 1957 to 2003. The estimated models reveal the differing impacts of openness on the effectiveness of monetary policy on output growth and inflation. Results further reveal that expansionary monetary policy in open economies negatively affects output growth and at the same time propels inflation. This result corroborates an earlier study by Berument & Dogan (2003) as well as the theoretical prediction that the degree of the output of a country to a large extent determines the effectiveness of monetary policy on output growth and inflation (also see Isik & Acar, 2006).

Isik & Acar (2009) investigated the effectiveness of the monetary policy on exchange rate based on the degree of openness of twenty developing countries using annual data from 1988 to 2000. Results of panel data application revealed that the more open the country the less the effectiveness of monetary policy exchange rate irrespective of whether the country is adopting a floating or fixed exchange rate system. Jin (2010) applied the VAR technique to individual countries by using annual data covering 1955 to 1995 to examine the effect of openness on economic growth for emerging East Asian countries. Key variables included in the VAR model are output growth, money supply, government purchases, foreign price shocks and openness as measure of the ratio of the sum of imports and export with respect to GDP. The impulse response functions and variance decomposition analysis show no evidence that trade openness impedes economic growth.

Cwik et al. (2011) use the new Keynesian DSGE and VAR models to examine the effect of openness on monetary policy transmission in the U.S. Quarterly data covering the period 1973 to 2006 was applied. The results confirm the theoretical prediction that the more a country opens up to international trade the less the effect of monetary policy shocks on prices and output. Brueckner & Lederman (2015) use rainfall and GDP growth rate per capita as an instrument for openness in SSA and GDP growth rates of developed economies as instruments for international trade openness in SSA to examine the effect of trade openness on economies in the SSA. Panel data was applied to the novel instrumental variable techniques to examine this relationship. The results show a negative impact of trade openness on economic growth but a positive effect of economic growth on trade openness. Coric et al. (2016) examined the effects of openness to international trade and finance on monetary policy transmission shock for 48 countries consisting of developed and developing. The SVAR technique was applied to real GDP growth, consumer price index, global oil price, federal funds rate of the United States of America, broad money, domestic interest rate and exchange rate. Results reveal the negative impact of trade openness on output growth.

Bangura et al. (2015) examined the implication of exchange rate dynamics on the trade balance in Sierra Leone using annual data from 1980 to 2011. The results reveal that trade balance was responsive to money supply and domestic income in the long-run. They found evidence of the J-curve effect in the short-run as a 1% depreciation of the real exchange in the previous period worsened the trade balance by 0.5%. There was however, no evidence of the Marshall-Lerner condition in the long-run as real depreciation of the exchange rate failed to improve the trade balance in the long-run. Lin et al. (2016) estimated the effect of openness to international trade on inflation using panel data for forty-six countries in SSA for the period 1985 to 2012. A causal negative relationship was found to exist between trade openness and inflation rate. Ekpo & Effiong (2017) examined the effectiveness of monetary in thirty-seven developing countries including Sierra Leone using annual data from 1990 to 2015. The panel data results found strong evidence of a positive relationship between high oil prices and output growth and a negative relationship between inflation and high oil prices. Chiaraah (2019) used the ARDL technique to examine the effectiveness of monetary policy on output and inflation with a high degree of openness of the Ghanaian economy using quarterly data from 2002 to 2016. The findings suggest that the monetary policy rate of Ghana was unable to effectively curtail the inflation rate but reduces output growth.

Recently, Bangura (2022) tested the Romer (1993) hypothesis using the ARDL technique to cointegration and found evidence that inflation tends to moderate with increased openness, while exchange rate and gross domestic product tend to exhibit positive and significant impact on inflation in Sierra Leone. This study seems to depart from Bangura's (2022) in the sense that, while Bangura (2022) only tested the Romer (1993) proposition, which posits an inverse relationship between inflation and openness, this study went further to test Karrass' (1999) hypothesis.

In sum, the bulk of the studies in this area seem to concentrate on developed economies with cross-country analyses. Cross-sectional analysis sometimes fails to account for individual specific effects, which tends to bias the results in favour of well developed economies. To the best of our knowledge, very little has been done on a case-by-case basis especially for developing economies. In the case of Sierra Leone, with unique characteristics such as import dependent, price takers and income inelastic in the international market, the use of cross-sectional analysis might disadvantage the country in this regard. Similarly, previous studies in this area used annual data. Annual data normally tend to prolong the true short-run dynamic impact of the policy compared to quarterly data that capture the short-run impact of policy

instantaneously. In this regard, this study contributes to the existing literature using quarterly data. Given that monetary policy decisions in Sierra Leone are normally taken every quarter, the delay in the short-run impact of the policy is duly taken care of with quarterly data. In addition, the study contributes to the extant literature with a country specific study and accounts for structural breaks in the data, which is a novelty especially in the case of Sierra Leone that has gone through a lot of macroeconomic shocks. Finally, to the best of our knowledge, previous studies failed to empirically examine the implication of openness on monetary policy in Sierra Leone.

3. Methodology

The implication of openness on output growth, inflation and exchange has been examined using the following empirical models. The empirical models are estimated using the autoregressive distributed lag (ARDL) technique (Pesaran et al., 2001). General speaking, estimating cointegration based on the residual test requires the researcher to know beforehand that the underlying explanatory variables in the model are integrated of order one by conducting unit root test. However, the power of the unit root test to establish this fact is normally weak as it might introduce an unnecessarily additional degree of uncertainty into the modelling framework. To circumvent this challenge, Pesaran, Shin, and Smith (2001) recommended the estimation of an error correction form of the underlying ARDL model in the explanatory variables under consideration in the model (Pesaran, 2015). Based on this suggestion, we establish cointegration by estimating the error correction form of the ARDL procedure. This approach has been considered appropriate and adequate because it incorporates sufficient number of lags in the model in a bid to capture the data generating process general to a specific modeling framework. The procedure also addresses the problem of endogeneity and autocorrelation once appropriate lag is included in the model. In addition, this procedure does need testing the variables beforehand to establish their order of integration because the test can still be conducted irrespective of whether the series is purely I (0), purely I (1) or mutually integrated. Hence, unit root test was conducted to ensure none of the series was integrated of an order higher than one. Equations (1), (2) and (3) present the empirical models of the study.

$$rgdpg_t = \chi_0 + \chi_1 ebola\_dum_t + \chi_2 rgdpg\_dum_t + \chi_3 m2g_t + \chi_4 gopg_t + \chi_5 (opn_t * m2g_t) + \kappa_t \quad (1)$$

$$\inf_t = \delta_0 + \delta_1 ebola\_dum_t + \delta_2 rgdpg\_dum_t + \delta_3 m2g_t + \delta_4 gopg_t + \delta_5 (opn_t * m2g_t) + \upsilon_t \quad (2)$$

$$exrg_t = \omega_0 + \omega_1 ebola\_dum_t + \omega_2 rgdpg\_dum_t + \omega_3 gopg_t + \omega_4 m2g_t + \omega_5 (opn_t * m2g_t) + \nu_t \quad (3)$$

Where RGDPG is growth rate of real gross domestic product, M2G is growth rate of money supply, GOPG is growth rate of global oil price, EXRG is growth in exchange rate, INF is the consumer price index inflation and OPN is openness indicator.

3.1 Measurement of Variables and Sources

Quarterly data on the above variables cover 2002 to 2018. The variables are measured in growth rates as follows.

$$m2g_t = (\frac{m2_t}{m2_{t-1}} - 1) * 100\%$$

$$\inf_t = (\frac{cpi_t}{cpi_{t-1}} - 1) * 100\%$$

$$rgdpg_t = (\frac{rgdp_t}{rgdp_{t-1}} - 1) * 100\%$$

$$exrg_t = (\frac{exr_t}{exr_{t-1}} - 1) * 100\%$$

The term (opn*m2g) is an interactive term between openness and the growth in money supply. Two dummy variables are included in the models to capture the twin shocks of the Ebola virus disease and fall in global prices of iron ore between 2014 and 2016. Three measures of openness indicator have been provided in the literature to include the sum of imports and export as a ratio of gdp, import as a ratio of gdp and openness as proxy for trade orientation (See Romer, 1993; Karras, 1999; Berument & Dogan, 2003; Isik & Acar, 2009; Ekpo & Effiong, 2017). The current study measures openness as (import +export)/gdp and has been widely used by several researchers in Sub-Saharan Africa (See Udegbunam, 2002; Ekpo & Effiong, 2017). In terms of a priori expectations, the coefficient of the interactive term between openness and money supply (χ_5) in equation (1) is expected to be negative and statistically significant in

order to showcase the effect of openness on real GDP growth (Karras, 1999; Isik & Acar, 2009). Similarly, the coefficient of the interactive term (δ_5) in equation (2) is expected to be positive and statistically significant to confirm the theoretical prediction that inflation rate tends to increase as the degree of openness rises (Berument & Dogan, 2003) and negative to show that inflation rate rises with increase in the level of openness (Romer, 1993). Finally, the coefficient of the interactive term (ω_5) and growth in the exchange rate in equation (3) is inconclusive. This coefficient is expected to be positive if we consider the impact of openness on the exchange rate to be robust and negative if we consider the impact of openness on the exchange rate to decline. Finally, data on export, import and global oil prices are compiled from the World Bank database, while exchange rate, broad money growth and real GDP growth rate are compiled in the Research Department at the Bank of Sierra Leone.

Accordingly, the autoregressive distributed lag (ARDL) model formulation of equations (1), (2) and (3) is presented as.

$$\Delta rgdpg_t = \chi_0 + \sum_{t=1}^{p} \chi_{1i} \Delta rgdpg_{t-i} + \sum_{t=0}^{p} \chi_{2i} \Delta m2g_{t-i} + \sum_{t=0}^{p} \chi_{3i} \Delta gopg_{t-i} + \sum_{t=0}^{p} \chi_{4i} (opn_{t-i} * \Delta m2g_{t-i}) + \omega_1 ebola\_dum_{t-1} + \omega_2 rgdpg\_dum_{t-1} + \omega_3 rgdpg_{t-1} + \omega_4 m2g_{t-1} + \omega_5 gopg_{t-1} + \omega_6 (opn_{t-1} * m2g_{t-1}) + \psi ect_{t-1} + \kappa_t \quad (5)$$

$$\Delta \inf_t = \delta_0 + \sum_{t=1}^{p} \delta_{1i} \Delta \inf_{t-i} + \sum_{t=0}^{p} \delta_{2i} \Delta m2g_{t-i} + \sum_{t=0}^{p} \delta_{3i} \Delta gopg_{t-i} + \sum_{t=0}^{p} \delta_{4i} (opn_{t-i} * \Delta m2g_{t-i}) + \lambda_1 ebola\_dum_{t-1} + \lambda_2 rgdpg\_dum_{t-1} + \lambda_3 \inf_{t-1} + \lambda_4 m2g_{t-1} + \lambda_5 gopg_{t-1} + \lambda_6 (opn_{t-1} * m2g_{t-1}) + \eta ect_{t-1} + \upsilon_t \quad (6)$$

$$\Delta exrg_t = \tau_0 + \sum_{t=1}^{p} \tau_{1i} \Delta exrg_{t-i} + \sum_{t=0}^{p} \tau_{2i} \Delta m2g_{t-i} + \sum_{t=0}^{p} \tau_{3i} \Delta gopg_{t-i} + \sum_{t=0}^{p} \tau_{4i} (opn_{t-i} * \Delta m2g_{t-i}) + \eta_1 ebola\_dum_{t-1} + \eta_2 rgdpg\_dum_{t-1} + \eta_3 exrg_{t-1} + \eta_4 m2g_{t-1} + \eta_5 gopg_{t-1} + \eta_6 (opn_{t-1} * m2g_{t-1}) + \xi ect_{t-1} + \nu_t \quad (7)$$

The variables in equations (5), (6) and (7) are defined as before and each of the ARDL equations presents both the long-run and short-run components of the model

4. Empirical Results and Discussion

The empirical results of the estimated models are presented and discussed accordingly, starting with descriptive statistics, unit root tests for stationarity and structural break.

4.1 Descriptive Statistics

It is generally believed that before using any data set for econometric analysis, it is fitting that you conduct summary statistics on each of the variables to observe preliminary characteristics of the data and the current study is no exception. Table 1 presents summary statistics on each of the variables.

Table 1. Descriptive Statistics of the Variables

Statistic	RGDPG	M2G	INF	GOPG	EXRG	OPN
Mean	1.410	5.015	4.866	-10.896	2.028	43.142
Median	1.331	4.889	2.374	-4.802	1.187	37.643
Maximum	8.197	18.946	18.783	744.223	13.058	80.529
Minimum	-13.511	-6.748	-1.323	-2604.8	-3.871	20.655
Std. Dev.	2.704	4.621	5.185	345.311	2.835	15.921
Skewness	-2.260	0.290	1.201	-6.140	1.419	0.656
Kurtosis	15.770	3.730	3.115	48.669	5.747	2.278
Jarque-Bera	519.949	2.466	16.389	6336.8	44.172	6.357
Probability	0.000	0.291	0.000	0.000	0.000	0.042
Sum	95.852	341.032	330.860	-740.98	137.877	2933.631
SumSq. Dev.	489.987	1430.7	1801.23	7989037	538.401	16983.07
Observations	68	68	68	68	68	68

Source: Author's Computation

Table 1 shows the mean, median, maximum, minimum, and standard deviation of each of the variables with sixty-eight observations. The key ingredients of the summary statistics are the Skewness, Kurtosis and Jarque-Bera results. A Skewness value of zero means the variable is normally distributed. The Table shows that only broad money growth meets this requirement, implying non-normality of the remaining variables. Also, a Kurtosis value of at least three means that the variable is normally distributed. The Table shows that all the variables meet this requirement, implying they are normally distributed. Finally, the Table shows that the probability values of the Jarque-Bera test indicate that almost all the variables are normally distributed. However, it is observed that the variables are widely dispersed from one another based on the values of skewness and the sum of squared deviations. This might be possible consequences of structural break in the data. The issue of possible structural breaks has been taken care of by conducting unit root tests with structural breaks (Perron, 1989).

4.2 Unit Root Test Result

Having presented descriptive statistics of the variables, stationarity tests were conducted on the series using the Augmented Dickey-Fuller and Phillips-Perron test techniques, with intercept only. Results of the stationarity test are depicted by Table 2.

Table 2. Results of Unit Root Test with Intercept Only

Variable	Augmented Dickey-Fuller Test		Phillips-Perron Test	
	Test-statistic	P-value	Test-statistic	P-value
Variables in their Level Forms				
Real GDPG	-4.0859	0.0019***	-4.1133	0.0018***
M2G	-9.7152	0.000***	-9.8883	0.0000***
GOPG	-7.7753	0.000***	-7.7752	0.0000***
CPI Inflation	-2.1877	0.2126	-2.3590	0.1572
EXRG	-4.9368	0.0001***	-4.9357	0.0001***
Openness	7.7753	0.0000***	-7.7752	0.0000***
Variables in their First Difference Forms				
CPI Inflation	-7.3965	0.0000***	-7.3965	0.0000***

Source: Author's Computation; where (***) & (**) denote significance at the 1% and 5% levels, respectively

From Table 2, with intercept only, both the ADF and PP results show that all the variables are stationary at levels except CPI inflation which was found to be stationary at first difference. Given that the ARDL procedure accommodates mixed series, I (0) or I (1), as long as none of the series is integrated of an order higher one to avoid spurious regression, we conducted unit root test on CPI inflation at first difference and found to be stationary after first difference.

4.3 Unit Root Test Result with Structural Break

In addition to the stationarity test using the ADF and PP techniques, the study further conducted a unit root test with structural breaks and regime shifts using the Perron (1989) technique. The rationale is that, a lot of policy shocks and regime shifts have taken place in Sierra Leone during the period under review, ranging from the civil unrest from 1991 to 2002; the conduct of democratic presidential and parliamentary elections in 2002, 2007, 2012 and 2018 that ushered in different political orientations; the Ebola Virus Disease (EVD) outbreak from 2014 to 2016 and the mudslide in 2017 that led to the death of over one thousand people in just fifteen minutes. The aforesaid episodes impact the time series data and tend to bias whatever results are generated in empirical research, as observed by the values of skewness and sum of squared deviation in Table 1. This is a novelty in this study, as all structural break dates in the data set covering the study period have been empirically identified. Appendix A1 presents results of the stationarity test with structural breaks with innovative outliers.

4.4 Lag Length Order Selection

Ouliaris, Pagan and Restrepo (2018) presented three techniques that determine the lag length of the econometric or VAR model. These include theoretical constructs, rule of thumb and some statistical criteria that off-set fit against the number of parameters to be fitted. We adopted the statistical criteria based on the Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ), while using log likelihood as a measure of fit. Appendix A2 presents the results of the lag order selection criteria. The result reveals that the models chose lag one based on the Schwarz Information and Akaike Information Criteria, respectively.

4.5 Long-run Estimates of the Autoregressive Distributed Lag Models

Three empirical models have been estimated with real GDP growth, inflation rate and growth in the exchange rate as the dependent variables, respectively. Tables 3 and 4 present the long-run and short-run estimates of the respective models. According to Table 3, in the long-run, when real GDP growth is the dependent variable in panel 1, the coefficient representing the interaction between openness and money growth has the expected sign and significance at

the 5% level. The coefficient indicates that an increase in openness by 1% decreases real GDP growth by 1.13%. This result conforms with Karras (1999), Berument & Dogan (2003) and Isik & Acar (2009).

Table 3. Long-run estimates

Variable	Coefficient	Standard-Error	Test-Statistic	Prob.-value
Panel 1: Real GDP growth is the dependent variable				
M2G	0.0551	0.1710	0.3222	0.7484
OPENNESS	-0.0113	0.0055	-2.0356	0.0462**
CONSTANT	0.7272	1.1902	0.6110	0.5435
F-stat: 6.675***	Autocorrelation ($\chi^2_{(2)}$ =0.5539): ; Hetero ($\chi^2_{(5)}$ =0.3066); Ramsey Reset (0.4466)			
Panel 2: Inflation rate is the dependent variable				
M2G	-0.1473	0.1264	-1.1655	0.2493
GOPG	-0.0089	0.0208	-0.4307	0.6685
OPENNESS	0.1908	0.0242	7.8889	0.0000***
F-stat: 4.9685**	Autocorrelation ($\chi^2_{(2)}$ =0.1004): ; Hetero ($\chi^2_{(13)}$ =0.9164); Ramsey Reset (0.8711)			
Panel 3: Growth in the exchange rate is the dependent variable				
M2G	0.1636	0.1010	1.6195	0.1118
GOPG	-0.0218	0.0163	-1.3385	0.1869
OPENNESS	-0.0070	0.0027	-2.5554	0.0138**
C	2.9344	1.3233	2.2176	0.0313**
F-stat: 6.8157***	Autocorrelation ($\chi^2_{(2)}$ =0.1286): ; Hetero ($\chi^2_{(14)}$ =0.2055); Ramsey Reset (0.0800)			

Source: Author's Estimation where (***) & (**) denote significance at the 1% & 5% level, respectively.

The implication is that, as the economy becomes more open, the effectiveness of monetary policy in propelling output growth reduces. Broad money growth is however positive but not significant. These results are not surprising in Sierra Leone because over the period under review, the country has had to grapple with double-digit inflation, chronic exchange rate depreciation and high import propensities thereby weakening the reserve position of the central bank in its attempts to defend the exchange rate.

Similarly, when the inflation rate is the dependent variable in panel 2, the coefficient denoting the interaction between openness and broad money growth is positive and statistically significant at the 1% level. The coefficient indicates that an increase in openness by 1% increases the inflation rate by 19.08%. This result is consistent with theoretical expectations and supports Karras' (1999) predictions that this coefficient should be positive in situations where a higher inflation rate is directly related to a high degree of openness but contradicts Romer's (1993) supposition that this coefficient should be negative to have any inverse relationship between inflation and openness. In other words, as the economy becomes more open, the rate of inflation decreases. Under this circumstance, monetary policy is considered to be effective. Again, the coefficients on broad money growth and global oil price are negative but not significant.

Finally, in panel 3, when growth in the exchange rate is the dependent variable, the coefficient denoting interaction between openness and money supply is negative and statistically significant at the 5% level as expected. The coefficient indicates that an increase in openness by 1% reduces growth in the exchange rate by 0.7%. This result is consistent with Isik & Acar (2009) and implies that the impact of changes in money supply on the exchange rate intensifies as the degree of openness increases. In other words, the negative coefficient is an indication that monetary policy becomes less effective in impacting the exchange rate with the level of openness in the economy. Also, the coefficients on broad money growth and global oil price are positive and negative respectively, but not significant.

Nonetheless, it is worthy to note that the validity of all three models in the long-run was tested using diagnostic tests and the results show that the three models passed the most relevant tests of autocorrelation, heteroscedasticity and Ramsey's Reset stability test as reported in Table 3. These tests guarantee the efficacy and suitability of the empirical models. Additionally, Table 3 shows that the Bounds test results of the three models exceed the critical values and are statistically significant at the 1% levels for panels 1 & 3 and the 5% significance level for panel 2.

4.6 Short-run Estimates of the Autoregressive Distributed Lag Models

Table 4 presents short-run estimates of the respective models. According to Table 4, when real GDP growth is the dependent variable in panel 1, the error correction term has the expected sign and statistically significance at the 1% level. The coefficient shows the speed of adjustment and indicates that about 30% of any long-run disequilibrium caused by previous quarters' shock can be corrected in the current period. Also, when the inflation rate is the dependent variable in panel 2, the coefficient depicting the interaction between openness and money supply is positive and statistically significant at the 1% level in the current period but negative and statistically significant at the 5% level in the previous period. Importantly, the speed of adjustment coefficient is negative as expected and statistically significant at the 1% level. The coefficient indicates that about 29% of any disequilibrium caused by previous quarters' shocks can be corrected in the current quarter.

Table 4. Short-run estimates

Variable	Coefficient	Standard-Error	Test-Statistic	Prob.-value
Panel 1: Real GDP growth is the dependent variable				
D(RGDPG(-1))	-0.1955	0.1008	-1.9397	0.0571*
D(OPENNESS)	-0.0008	0.0006	-1.4378	0.1557
ECM (-1)	-0.3030	0.0572	-5.2949	0.0000***
Panel 2:Inflation rate is the dependent variable				
C	1.1186	0.2915	3.8374	0.0004***
D(INF(-1))	0.3810	0.1206	3.1582	0.0027***
D(OPENNESS)	0.2409	0.0136	17.6734	0.0000***
D(OPENNESS(-1))	-0.0739	0.0319	-2.3169	0.0246**
ECM(-1)	-0.2920	0.0636	-4.5898	0.0000***
Panel 3: Growth in the exchange rate is the dependent variable				
D(GOP(-3))	-0.0751	0.0217	-3.4649	0.0011***
D(OPENNESS(-1))	0.0033	0.0008	4.1416	0.0001***
ECM(-1)	-0.5896	0.0971	-6.0713	0.0000***

Source: Author's Estimation where (***), (**) & (*) denote significance at the 1%, 5% & 10% level, respectively.

Finally, when growth in the exchange rate is the dependent variable in panel 3, the coefficient on the global oil price is negative and significant at the 1% level after three lagged periods. Nevertheless, the coefficient denoting the interaction of openness and money supply is positive and statistically significant at the 1% level lagged one period. Interestingly, the speed of adjustment coefficient is also negative as expected and statistically significant at the 1% level. The coefficient indicates that about 59% of any disequilibrium caused in previous quarters' shock is corrected in the current quarter by that amount. Apart from the long-run and short-run estimates of the ARDL models, the econometric properties of these models are also presented in Appendix A3. The statistics indicate the appropriateness and adequacy of the empirical models.

5. Conclusion and Policy Implications

The study empirically tested the theoretical predictions that openness tends to weaken the effect of monetary policy on both output growth and exchange rate, but strengthen the effect on inflation. In particular, the main objective was to investigate the implication of openness for the effectiveness of monetary policy in Sierra Leone using quarterly data from 2002 to 2018. To explore the implication of openness on monetary policy in Sierra Leone, we establish cointegration by estimating the error correction form of the ARDL model. This approach has been considered appropriate and adequate because it incorporates a sufficient number of lags in the model in a bid to capture the data generating process general to specific modelling framework. The procedure also addresses the problem of endogeneity and autocorrelation once appropriate lag is included in the model. The bounds test results show that a higher degree of openness of the economy weakened the effect of monetary policy on both output growth and exchange rate, but strengthened the effect on inflation as popularized by other researchers and collaborates with other empirical studies. In particular, considering the measurement of openness adopted in this study, in the case of Sierra Leone, a country with high import appetite, the lower the GDP in this relationship (i.e. import plus export as ratio of GDP), the high the ratio. Intuitively, a higher import exacts greater pressure on foreign currency demand. This creates further depreciation in the exchange rate. These higher import prices translate into higher domestic prices and cause inflation. However, with the country's low export propensity, foreign exchange earnings become low. Hence, any further increase in imports puts pressure on demand for foreign exchange earnings. This in turn creates an imbalance between demand and supply of foreign exchange earnings, and thus causes exchange rate depreciation.

In this regard, monetary policy as a demand management tool, does not have control over aggregate supply and given the higher import component in our CPI basket, monetary policy cannot react to cushion the effect of this higher import because the central Bank of Sierra Leone does not have the required policy instrument. Invariably, the effect of openness emanating from external shocks creates inflation and exchange rate depreciation. To ameliorate the effect of these shocks so that they don't affect the monetary policy of the central bank, the Bank of Sierra Leone should be able to absorb the second-round effect of the supply shock in order not to reemerge in demand shock that would further strengthen price pressure. The implication for policy is that, the Bank of Sierra Leone should tighten monetary policy by increasing the monetary policy rate. Increasing interest rate encourages capital inflow and thus stabilizes the exchange rate. Domestic assets now become attractive so economic agents tend to differ current consumption and undertake meaningful investment. This ultimately boosts aggregate demand and thus propels output growth. The Bank of Sierra Leone should also endeavor to develop policies that boost domestic capacity and build export via robust mining, manufacturing and mechanized agricultural activities.

References

Ball, L. (1999). Monetary policy rules for open economies. *International Finance, 2*(1), 63-83.

https://doi.org/10.1111/1468-2362.00019

Bangura et al. (2015). The impact of exchange rate dynamics on the trade balance in Sierra Leone: An ARDL cointegration approach. *Journal of Monetary and Economic Integration, 13*(1), 64-88.

Bangura, M. (2022). Trade Openness-Inflation Nexus in Sierra Leone: Testing Romer Hypothesis using ARDL Approach. *Journal of Economics and Public Finance, 8*(2), 161-178. https://doi.org/10.22158/jepf.v8n2p161

Bangura, M., Caulker, E. & Pessima, S. (2012). Exchange rate pass-through to inflation in Sierra Leone. A structural vector autoregressive approach. *Journal of Monetary and Economic Integration, 12*(1), 94-112.

Bank of Sierra Leone (2018). Half-yearly bulletin. Freetown: Bank of Sierra Leone.

Berument et al. (2007). Openness and the effectiveness of monetary policy: A Cross-country analysis. *International Economic Journal, 21*(4), 577-591. https://doi.org/10.1080/10168730701699018

Berument, H., & Dogan, B. (2003). Openness and the effectiveness of monetary policy: Empirical Evidence from Turkey. *Applied Economics Letters, 10,* 217-221. https://doi.org/10.1080/1350485022000015842

Brueckner, M., & Lederman, D. (2015). Trade openness and economic growth: Panel data evidence from Sub-Saharan Africa. *Economica, 82,* 1302-1323. https://doi.org/10.1111/ecca.12160

Chiaraah, A. (2019). Monetary policy and trade openness in Ghana. *Ghana Journal of Development Studies, 16*(2), 241-266. https://doi.org/10.4314/gjds.v16i2.12

Coric et al. (2016). Openness and the strength of monetary transmission: International evidence. *Acta Oeconomica, 66*(4), 639-659. https://doi.org/10.1556/032.2016.66.4.4

Cwik et al. (2011). Does trade integration alter monetary policy transmission? *Journal of Economic Dynamics and Control, 35,* 545-564. https://doi.org/10.1016/j.jedc.2010.11.006

Ekpo, A. H., & Effiong, E. L. (2017). Openness and the Effectiveness of Monetary Policy in Africa. *Munich Personal RepEc Archive*.

Isık, N., & Acar, M. (2006). Does the effectiveness of monetary policy on output depend on openness? *Journal of Economic and Social Research, 8*(1), 1-18.

Isık, N., & Acar, M. (2009). The role of openness on the effectiveness of monetary policy: Experience of developing countries in the 1990s. *Kırıkkale: Kırıkkale Üniversitesi.*

Jin, J. C. (2010). Openness and growth: An interpretation of empirical evidence from East Asian Countries. *The Journal of International Trade and Economic Development: An International and Comparative Review, 9*(1), 5-17. https://doi.org/10.1080/096381900362517

Karras, G. (1999). Openness and the effects of monetary policy. *Journal of International Money and Finance, 18,* 13-26. https://doi.org/10.1016/S0261-5606(98)00037-0

Korsu, R. D. (2009). Fiscal deficits and the external sector performance of Sierra Leone: A simulation approach. *Journal of Economic and Monetary Integration, 9*(1), 51-73.

Korsu, R. D. (2014). The inflationary effects of fiscal deficit in Sierra Leone: A simulation approach. AERC Research Paper 290, African Economic Research Consortium, P.O. Box 62882-City Square, Nairobi 00200, Kenya.

Lin et al. (2016). Romer was right on openness and inflation: Evidence from Sub-Saharan Africa. *Journal of Applied Economics, XX*(1), 121-140. https://doi.org/10.1016/S1514-0326(17)30006-5

Mansaray, M., & Swaray, S. (2013). Financial liberalization, monetary policy and money demand in Sierra Leone. *Journal of Monetary and Economic Integration, 63-87.*

Ouliaris, S., Pagan, A. R., & Restrepo, J. (2018). Quantitative macroeconomic modeling with structural vector autoregressions: An E-views Application. Oxford Bulletin of Economics and Statistics, 15-256.

Perron, P. (1989). The great crash, the oil price shock and the unit root hypothesis. *Econometrica, 57,* 1361-1401. https://doi.org/10.2307/1913712

Pesaran, M. H. (2015). Time series and panel data econometrics. Oxford University Press, Great Clarendon Street, Oxford, First Edition (Page 527). https://doi.org/10.1093/acprof:oso/9780198736912.001.0001

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289-326. https://doi.org/10.1002/jae.616

Rogoff, K. (1985). Can international monetary policy be counterproductive? *Journal of International Economics, 18,* 199-217. https://doi.org/10.1016/0022-1996(85)90052-2

Romer, D. (1993). Openness and inflation: Theory and evidence. *The Quarterly Journal of Economics, CVIII*(4), 869-903. https://doi.org/10.2307/2118453

Svensson, L. E. O. (1997). Inflation forecast targeting: Implementing and monitoring inflation targets. *European Economic Review, 41,* 1111-1146. https://doi.org/10.1016/S0014-2921(96)00055-4

Taylor, J. B. (1993). *Discretion versus policy rules in practice*. Carnegie-Rochester Conference Series on Public Policy. https://doi.org/10.1016/0167-2231(93)90009-L

Udegbunam, R. I. (2002). Openness, stock market development, and industrial growth in Nigeria. *An International Journal of Development Economics, 41*(1), 69-92. https://doi.org/10.30541/v41i1pp.69-92

Appendices

Appendix A1: Perron Unit Root with Break Test on the Variables

Variable	Augmented Dickey-Fuller Test-Statistic	Break Date	Break Dummy (P-value)	Intercept Dummy (P-value)
		Trend Specification: Intercept only		
Real GDPG	-7.0479	2015q1	0.0000***	0.9980
M2G	-10.7969	2009q4	0.0027***	0.1479
EXRG	-5.8001	2016q4	0.0000***	0.5028
GOPG	-19.9918	2015q4	0.0000***	0.5798
CPI Inflation	-15.2892	2007q4	0.0000***	0.0000***
Openness	-19.9918	2015q4	0.0000***	0.5798

Source: Author's Computation; where (***), (**) & (*) denote significance at the 1%, 5% and 10% levels, respectively

Appendix A2. Test for Optimal Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	349.245	NA	3.79e-09	-10.879	-10.467	-10.717
1	443.700	167.580	2.41e-10*	-13.635*	-12.915*	-13.353
2	446.506	4.708	2.96e.-10	-13.436	-12.406	-13.032
3	453.453	10.981	3.20e-10	-13.369	-12.031	-12.844
4	466.309	19.076*	2.87e-10	-13.494	-11.847	-12.847
5	468.550	3.109	3.66e-10	-13.276	-11.320	-12.508
6	472.814	5.501	4.42e-10	-13.123	-10.859	-12.234

Source: Author's estimation. Note: * denotes lag order selected by the criterion; LR-Log Ratio; FPE- Final Prediction Error, AIC-Akaike Information Criterion, SC-Schwarz Information Criterion and HQ-Hannan-Quinn Information Criterion.

Appendix A3. Test statistics of short-run estimates of the models

Test statistics of the short-run estimates of the three models			
	Panel 1	**Panel 2**	**Panel 3**
R-squared	0.3696	0.8672	0.7090
Adjusted R-squared	0.3496	0.8421	0.6541
S. E. of Regression	1.8917	1.0408	1.6442
Sum Squared Residual	225.4481	57.4078	143.2744
Log Likelihood	-134.1883	-87.3335	-116.6002
Durbin-Watson Statistic	1.8791	1.8978	1.8253
Mean Dependent Variable	-0.0543	-0.0017	-6.34E-05
S. D. Dependent Variable	2.3457	2.6191	2.7957
Akaike Info Criterion	4.1572	3.0729	3.9875
Schwarz Criterion	4.2568	3.4440	4.3586
Hannan-Quinn Criterion	4.1966	3.2191	4.1337

Source: Author's Estimation

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.