European Journal of Economic and Financial Research
ISSN: 2501-9430
ISSN-L: 2501-9430
Available on-line at: http://www.oapub.org/soc

DOI: 10.46827/ejefr.v8i1.1645 Volume 8 | Issue 1 | 2024

ESTIMATING EXCHANGE RATE PASS-THROUGH TO DOMESTIC PRICES; SIERRA LEONE EXPERIENCE

James L. S. Kallie,
Emmanuel Jam Kamara,
Alpha Kanu,
Joseph M. B. Heimoh[i]
Institute of Public Administration and Management,
University of Sierra Leone,
Sierra Leone

Abstract:
The study conducts an investigation that seeks to evaluate the nature of exchange rate pass-through on consumer prices in Sierra Leone. As a small, open economy, the country is susceptible to exogenous shocks. The exchange rate acts as a medium through which external shocks get transmitted to the real economy. Therefore, the general objective of the study is to assess the effect of the fluctuation of the exchange rate on domestic prices in Sierra Leone. More specifically, it sought to determine which type of exchange rate pass-through exists for Sierra Leone, using annual time series data between 1992 and 2022. The empirical analysis was based on a VECM model. The coefficient of the exchange rate (.5365) which is also significant at the 5% level of significance (p-value = 0.002), indicates that the exchange rate pass-through is incomplete in Sierra Leone. This means that a 1-unit depreciation of the Leone (increase in nominal exchange rate), leads to an increase in Sierra Leone consumer price by .5365 units or approximately 53.65%. This is an indication of indirect pass-through, where importers increase the price of imported goods to maintain their markup in the event of a nominal exchange rate depreciation. The recommendation to the finding is that since it was revealed that Sierra Leone has relatively high exchange rate shocks means that monetary authorities in Sierra Leone should pay more attention to the effects of EXR fluctuation on consumer prices. Measures such as the promotion of local production to substitute imported goods are key to addressing the effects of exchange rate variations.

JEL: F31, E31, C32, O24

Keywords: exchange rate pass-through, domestic prices, Granger causality test, Johansen cointegration test, Sierra Leone

[i] Correspondence: email jkaylsu@yahoo.com, emmanuelkaramajam@gmail.com, alsteve88@gmail.com, mbunduka87@gmail.com

Copyright © The Author(s). All Rights Reserved.

1. Introduction

Since the aftermath of the drop of the Bretton Wood system of the exchange rate policy, most developed and developing nations have moved their exchange rate regime to a floating exchange rate regime. For the past two decades, many emerging economies have tried to adopt a floating exchange rate regime by eliminating the fixed exchange rate regime. In the late 1970s, most countries try to abolish the fixed exchange rate regime in Favour of neoliberal market forces, since there is a failure of the macroeconomic, variable under the fixed exchange rate regime.

According to Edwards (2006), all the nations that had fixed exchange rate regimes and also operated under an open trade policy were trapped in a monetary policy dilemma. In a situation wherein the country allows the exchange to be fixed under free capital mobility, in this case, the monetary policy will not be effective. A country cannot have an independent monetary policy that is effective, fixed exchange rate, and free capital mobility (Yagei, 2000).

A country that has moved to a floating exchange rate and an open trade policy will have difficulties in addressing the external shocks since it has lost its power to determine the exchange rate. The exchange rate is one of the possible economic shocks. The volatility of the exchange rate creates uncertainty and raises the firm trading cost (Palley, 2004). According to Parsley (2010), the fluctuation of the exchange rate affects an economy through various channels such as its impact on exports, capital flows, and imports. According the economic theory, one of the key determinants of inflation is the exchange rate depreciation. The monetary policymakers are highly interested in understanding the role of each determinant of inflation. A better understanding of how exchange rate fluctuation affects domestic prices (exchange rate pass–through) assists in determining the optimal monetary policy mix to ensure price stability (Choudhri and Hakura 2006).

According to McCarthy (2006), a weaken role of demand management policy is as a result of the unanticipated change in the exchange rate by compromising the conduct of monetary policy and creating uncertainty regarding its effects on domestic price. Thus, the essence of the study is to empirically estimate the degree and speed of exchange rate pass–through in Sierra Leone. Once a nation has decided for its currency to be determined by the market forces of demand and supply, it automatically loses its own power in controlling the exchange rate fluctuation on the domestic price. In reality, inflation has been determined by the variation of the exchange rate. Therefore, the general objective of the study is to assess the effect of the fluctuation of the exchange rate on domestic price in Sierra Leone.

2. Literature Reviews

2.1 Theoretical Literature Review

Exchange rates are an essential component in determining economic policies, particularly in the context of rising international trade (Ozcelebi & Yildirim, 2011). This is because of

its impact on the real economy, especially the pass-through to local prices. Among other things, exchange rates determine the balance of trade between trading countries and hence, a weak policy could lead to trade deficits and also scare away foreign investors (Ravinder et al., 2011).

ERPT was founded and based on the Law of One Price (LOOP) as well as on Purchasing Power Parity (PPP). According to the LOOP theory, similar commodities should be priced similarly in different countries, while PPP hypothesizes that similar purchasing power in two economies should give rise to equilibrium in their currencies (Eckstein & Soffer, 2008). Consequently, if the LOOP holds, then the absolute PPP model of the exchange rate will hold too. The PPP hypothesis is based on several assumptions that include no barriers to trade, no transport costs, markets being perfectly competitive, baskets of goods is assumed to be identical in both countries and non-tradables not included. Since ERPT measures the responsiveness of market prices to variations in the exchange rate (Goldberg & Knetter, 1997), changes in the exchange rate that have no effect on the prices of local commodities are considered inconsistent with the LOOP. However, in a perfectly competitive market, it is postulated that supply as well as demand mechanisms often evoke a domestic price change to equalize domestic and foreign prices. If this happens, then ERPT ought to be complete at approximately a hundred percent over time.

Some of the empirical evidence is not convincing, for various reasons. As already mentioned, both hypotheses do not consider non-tradables in the determination of exchange rates. According to the Balassa-Samuelson effect (1964), differences in prices and wages as well as differences in PPP and exchange rates are explained by productivity differences in the production of tradable goods in different economies. Thus, any productivity differences between the two countries could lead to a collapse of the PPP hypothesis and hence impact the domestic prices of the importing country. Nevertheless, nominal shocks created by monetary policy fluctuations could result in ERPT to prices in tradable as well as non-tradable sectors in the long term (Eckstein & Soffer, 2008). Secondly, a variation in tax policies in different countries, as well as differences in trade restrictions and costs of transport, could lead to a collapse of the LOOP hypothesis. Thirdly, the LOOP could fail to apply due to the degree of competition in various markets. For example, in monopolistic markets, firms are price markers. This consequently leads to price variations in different markets, rendering the ERPT incomplete.

Dornbusch (1987) provided another perspective in his effort to identify the reasons for how and why an incomplete ERPT could arise. His model was based on the concept of the market structure in ERPT. The argument is that oligopolistic competition or imperfect substitute imports and local commodities have the potential to render ERPT incomplete. This is because firms opt to model pricing while consumers could potentially alter their consumption patterns, leading to either an increase or decline in the importation of goods.

Krugman (1987) described the phenomenon as “pricing-to-market” strategies that typically arise when exporters align export prices with the level of competition in key

target markets. Such scenarios arise in instances where local demand is highly elastic. Such strategies leave no room for profit margins, and it is possible to avoid the fluctuations in foreign currency prices occasioned by changes in exchange rates.

Previous research has established that there are two channels of ERPT to domestic prices, specifically, direct and indirect channels (Goldberg, 2005; Aliyu et al., 2009). In the case of the direct channel, it emerges when importers raise the prices of imported goods in their local currency to sustain their profit margins in the face of a depreciating domestic currency, attributable to a rise in the nominal exchange rate. Subsequently, consumers end up digging deeper into their pockets to acquire imported commodities. For countries like Eswatini which are highly dependent on imported inputs priced in foreign currency, it is possible for devaluation in the domestic currency to lead to an increase in production costs. This leads to higher prices as the costs are passed on to the consumer to keep profit margins high. Thus, devaluation in the exchange rate translates to higher local consumer prices.

The indirect channel is linked to the interplay between exchange rate fluctuations and their effect on local prices, based on factors such as total demand and wage levels. An exchange rate depreciation is linked to higher importation costs for domestic buyers. Subsequently, this leads to an increased demand for substitute commodities that are locally produced, thus increasing the likelihood of inflation. In addition, the demand for exports rises in the face of a depreciating exchange rate due to a decrease in the cost of domestic products to foreign importers. Therefore, a rise in the demand for local production both for exporting and local consumption, frequently causes domestic prices to rise. Moreover, a rise in the demand for local production is likely to increase the demand for labor, thus increasing wage rates. The rise in wages has the effect of pushing up domestic prices.

2.2 Empirical Review of Related Literature

Jia Ji (2022) analyzed the effect of exchange rate pass–through to domestic inflation in a pricing model in cooperating distribution chain structure, using a VAR framework model estimation technique over the period 1998 to 2020. From the finding, the result shows that there is an appreciation of the domestic currency that suppress local inflation at the first stage of production, and the exchange rate pass–through affect only an amount of an average degree on the consumer price. Because of this study, that is there is a relationship between the domestic price and the exchange rate pass–through, even though there is an effect on the import and export in the long run.

Eric Fisher (2010) studied the impact of inflation pass–through exchange rate on the US economy. The study uses a Johnson Cointegration technique for the annual period of 1994 to 2008. The findings reveal that the rise in the import price is a result of the changes in the exchange rate, but the degree of responsiveness of pass–through highly depends on local and international market structure and the exchange rate regime. In a nutshell, if the domestic market is purely monopolistic or if the international market is highly competitive then there would be a higher pass–through of exchange rate.

Van A. Pham (2019) examines the exchange rate pass–through into inflation in Vietnam. The study employed a vector autoregression (VAR) model for the period 2008 to 2018. The result shows that the transmission channel of the exchange rate shocks to domestic inflation is statistically significant and this is an incomplete pass–through of the exchange rate. From the findings, it further retreats that, in explaining the inflation fluctuation in the economy, the exchange rate is one of the important elements that is responsible for that fluctuation. Hence, the continuous appreciation or depreciation of the exchange rate will considerably affect inflation.

Zeliha Ozdogan (2022) assesses the effect of exchange rate shocks on the domestic price in Turkey. The research objective was to clarify certain aspects of the pass–through (ERPT) to the domestic price in Turkey. The vector autoregression (VAR) framework model was used for the period 1997 to 2022. The result shows that the exchange rate pass–through is not incomplete but also has demonstrated a different pattern during the flexible exchange rate regime. There was a significant drop in the exchange rate pass–through from 2001 to 2017 and it automatically bounced back dramatically after 2017 to a higher extent as a result of high exchange rate volatility and high inflation.

Shaidu J. M. & Aliyu Bashir (2018) examine the impact of the exchange rate pass–through to import and consumer prices in Nigeria. The study used an ARDL model for the period from 1986 to 2014. The finding shows that the ERPT to import price is incomplete and substantial, while the exchange rate pass–through from import price to inflation is low, it has a very slow speed and is nonlinear and incomplete.

In view of this paper, the external shocks of the exchange rate affect the domestic price in Sierra Leone with a specific reference to the empirical reviews. It is obvious that exchange rate shocks (exchange rate pass–through) are one important factor that is responsible for the continuous fluctuation of inflation, import price, and export price in the developing economy and Sierra Leone is not an exception to that theory.

3. Methodology

Concerning the methodology, the research employed a framework for regression equation. It basically starts with the unit root test, Johansen cointegration test, and Granger causality test, followed by the regression equation.

3.1 Unit Root Test

According to Wooldridge (2009), unit root analysis is overcritical to the establishment of a stationary or non-stationary series because of two major reasons. Firstly, a non-stationary series (with unit root) could lead to spurious regressions due to a violation of the independence assumption of OLS. Secondly, a unit root test is a prerequisite in cointegration analysis. A variable that is stationary at level means it is a covariance stationary process. Cointegration techniques are necessary if the time series contains unit roots at levels (Uddin, Alam, & Gow, 2016). If a variable becomes stationary after differencing once, then it is said to be integrated at order one. Sometimes a series may

become stationary after differencing more than once. If a series is differenced $d$times to be stationary, then such a series is generally said to be integrated of order d or (d).

Stationarity refers to constant variance and the mean of a variable over time. In stationary time series, the effect of a shock is temporary, and over time, the series returns to long-term mean values. Time series containing unit roots (non-stationary) have variances and means that depend on time. Therefore, the estimation of results started with the testing of stationarity properties of the variables. Both Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests were utilized.

This is based on the argument that while ADF uses parametric autoregression to approximate the ARMA structure of errors in the regression test, the PP test corrects for any heteroscedasticity and autocorrelation by direct modification of the test statistic (Phillips & Perron, 1988). From equations (1) and (2), the null hypothesis, $\delta = 0$ implies a unit root in the series while the alternative hypothesis, $\delta<0$. The null hypothesis is rejected if the calculated p-value is less than the significance level alpha = 0.05.

The ADF and PP tests were carried out from the OLS estimates of the model shown in equations (1) and (2), respectively.

$$\Delta Yt = \beta 0 + \alpha T + \delta Yt{-}1 + \Sigma \beta i \Delta Yt - 1ki = 1 + \mu t \quad (1)$$

$$\Delta Yt = \beta 0 + \alpha T + \delta Yt - 1 + \mu t \quad (2)$$

Where:
Yt is the variable of interest subjected to the unit root test,
$\beta 0$ is the intercept,
T is a linear time trend,
μt and is the error term that is identical and independently distributed with a mean zero and a constant variance.

3.2 Johansen Cointegration Test and Vector Error Correction Model

The essence of cointegration is to establish whether the same trend in consumer price index, gross domestic product, and exchange rate reflects in the long run or occurs randomly. The study developed an M-variable VAR model set up to test for cointegration. Variables, which are cointegrated, have coincident stochastic trends and would not drift away over time.

Stock and Watson (1993) reaffirm that a cointegration test is perceptive to the choice of lag length used. The primary aim of introducing the lags is to remedy the serial correlation. Hence, the issue may arise in deciding the lag length selection. According to Wooldridge (2009), there is no restriction in the lags length criteria. This study only focuses on five lag selection criteria, namely, Final Prediction Error (FPE), Likelihood Ratio (LR), Akaike Information Criteria (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC).

The M–variable VAR model can be expressed in the notation of a vector matrix, employed for cointegration testing.

$$W_t = \vartheta + A_1 W_{t-1} + \ldots + APW_{t-p} + \mu_t \quad (3)$$

Where:
W_t is M × 1 vector of endogenous variables,
ϑ is M × 1 vector of parameters,
μ_t is M × 1 vector of error term, and
$A_1 - A_p$ are (M × M)p matrices of parameters.

If there is long-term relationship, an error correction model can be derived from the AR model. Since each equation in VAR is an AR model, then it follows that VECM is VAR with cointegration restrictions (Xiaohua, 2018). Any VAR of lags p>1 can be expressed as VECM, similar to equation (4):

$$\Delta W_t = \vartheta + \pi W_{t-1} + \sum_{i=1}^{p-1} \gamma \Delta W_{t-1} + \mu_t \quad (4)$$

Where:
$\pi = \Sigma\, Ajj{=}pj{=}1 - IK$ (IK is a K × k identity matrix), and
$\acute{\Gamma} i = -\Sigma\, Ajj{=}pj{=}1$.

Both ϑ and μt in equations (3) and (4) are identical.

Assume the variables in W_t have a long-run relationship, then πWt−1~I(0), and thus, equation (4) becomes:

$$\Delta W_t = \alpha\beta W_{t-1} + \sum_{i=1}^{p-1} \gamma \Delta W_{t-1} + \mu_t \quad (5)$$

Where:
$\beta' Wt{-}1$ is the error correction term,
α *and* β is the coefficient of the error correction term.

Therefore, equation (5) is a VECM in compact form.

Fundamentally, the error correction model (ECM) denotes the process of adjustment between the short-run disequilibrium and the long-term relationship. Given the CPI (dependent variable), EXR, and GDP, the VEC models for the study were generated from the compact equation (5), as follows:

$$\Delta CPI_t = \alpha_0 + \sum_{i=1}^{p-1} \delta_i \Delta CPI_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta EXR_{t-j} + \sum_{k=1}^{p-1} \delta_k \Delta GDP_{t-k} + \rho ECT_t + \mu_{1t} \quad (6)$$

$$\Delta EXR_t = \sigma_0 + \sum_{w=1}^{p-1} w_i \Delta EXR_{t-1} + \sum_{o=1}^{p-1} w_o \Delta CPI_{t-j} + \sum_{q=1}^{p-1} w_q \Delta GDP_{t-k} + \emptyset ECT_t + \mu_{2t} \quad (7)$$

$$\Delta GDP_t = \emptyset_0 + \sum_{r=1}^{p-1} \theta_r \Delta GDP_{t-r} + \sum_{s=1}^{p-1} \theta_s \Delta EXR_{t-s} + \sum_{u=1}^{p-1} \theta_u \Delta CPI_{t-u} + \partial ECT_t + \mu_{3t} \quad (8)$$

Where:
Δ *i*s first difference operator,
p is the variables optimal lag length,
ρ, $\emptyset$ and τ are the coefficient of the error correction term,
$ECTt$ which denotes the speed of adjustment to long-run equilibrium.

$ECTt$ are residuals from the cointegrating equations.

The error correction term explains the short- and long-run dynamics among cointegrating variables. A negative and significant error term implies the presence of a long-term relationship. In the long-run, ECT_t =0, while in the short-run, it can assume a non-zero number. Finally, α_0, σ_0 & and $\emptyset_0$ are constants, and μ_{1t}, μ_{2t}, and μ_{3t} are stochastic error terms.

3.3 Granger Causality Test

According to Osei Assibey & Digkang (2020), the Granger causality test is only applied to the vector error correction model (VECM) short run estimation when the 1st difference of variable are been utilized. It is mandatory to involve the Granger causality test when there is an existence of cointegration in the model. The hypothesis of the test is that the lagged values of the endogenous variables do not explain the variation in the exogenous variable.

The equation can be expressed as follows:

$H_o^{EXR_t \rightarrow CPI_t}$: $\delta_1 = \delta_2 = \cdots = \delta_j = 0$ (i.e. EXR_t does not Granger cause CPI_t) (9)

versus

$H_1^{EXR_t \rightarrow CPI_t}$: $\delta_1 \neq \delta_2 \neq \cdots \neq \delta_j \neq 0$ (i.e. EXR_t Granger cause CPI_t) (10)

4. Empirical Results and Analysis

4.1 Descriptive Statistics

The study utilised descriptive statistics to obtain the statistical properties of the data used in the model. From the findings, the results reveal that the consumer price index has a mean of 17.4577, with a deviation of 18.03995. In addendum, the study also shows a min of -3.93416 which is negative and a maximum of 82.02358 for the study period. The result further shows that the exchange rate has an average mean of 115.3637 which deviated by 16.16722 in the study period. It also manifests the minimum and maximum value for exchange rates of 91.35220 and 142.8374 respectively. Since time series data were used for the study, skewness and kurtosis were used as a way of given an indication of the individual variables trend for the study period.

Kurtosis was used to measure the flatness of the distribution. From the result below, all the variables were found to be leptokurtic since their distribution had heavier tails than a normal distribution, given the positive values. Skewness, which shows the symmetry of the distribution around the mean of each variable, revealed that all the variables under study (CPI, exchange rate, and GDP), were positively skewed. This means that all these variables had long right tails.

The next section presents unit root analysis.

Table 4.1: Descriptive Statistics Result

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
CPI	17.4577	12.82645	82.02358	-3.93416	18.03995	2.334123	8.5753
EXR	115.3637	111.9213	142.8374	91.35220	16.16722	0.328902	1.82075
GDP	3.019670	4.104700	26.52413	-20.4910	9.268649	0.23934	4.70668
Observation	30	30	30	30	30	30	30

Source: EViews 12 output.

4.2 Unit Root Test

In view of the study, the VECM framework model was employed and applied both the Augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) unit root tests to determine the presence of unit roots in the individual variables. According to these tests, the null hypothesis of the presence of unit roots is rejected when the test statistic is greater than the critical values at 1%, 5%, and 10% levels of significance. The study considered trends and intercepts. The ADF and PP results for log-transformed variables are presented in Table 2 below. A BIC criterion was adopted to select the optimal lag length.

Table 2: ADF Test Results for Unit Roots

Variable	Optimal lag BIC	ADF test	PP test
Level			
CPI	1	-8.335032	-8.89682
EXR	0	-2.39679	-2.523929
GDP	0	-5.281606	-5.291573
First difference			
CPI	1	-4.810220***	-12.54405***
EXR	0	-5.59153**	-5.598047**
GDP	0	-8.604004***	-21.89484***

Note: ** and ** indicate levels of statistical significance at 1% and 5% respectively.

The study shows that exchange rate, consumer price index, and gross domestic product have a unit root test at both the ADF and PP test. This is a result of the overall t-statistics being less than the critical values as revealed in the table above. However, the study constraint on the first difference. The result shows that all the variables are stationary at first difference.

From the unit root tests, the three variables acquired stationarity properties at first differencing, I(1). Therefore, the study justified the adoption of VAR or VECM since all the variables are stationary at I(1). This actually means that VECM and VAR are ideal models.

4.3 Lag Selection Criteria

To identify the number of lags to be used in our VECM, the study adopted several criteria: Log-Likelihood (LL), Likelihood Ratio (LR), Final Prediction Error (FPE), the Akaike Information Criteria (AIC), the Hannan and Quinn information criterion (HQIC), and Schwarz's Bayesian information criterion (SBIC). The results for these criteria are shown in Table 4.3.

Table 4.3: Lag Length Selection Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1366.766	NA	6.780024	74.20359	74.46482	74.29569
1	-1156.618	340.7819	5.690020	64.79014	66.61875*	65.43481*
2	-1112.223	57.59294*	4.240020*	64.33638*	67.73237	65.53363

Source: EViews 12 output.

The result above reveals the following criteria, LR, FPE, AIC, HQIC and SBIC lag length criteria show that two lag should be considered (*). Lag length selection criteria suggest that a study should choose the number of lags indicated by most of the criteria. Since all five criteria recommended one lag, the study therefore considered one lag. Having established lag length, the study proceeded to the Johansen Cointegration test, discussed in following section.

4.4 Johansen Cointegration Test

Testing for the existence of cointegration from the dataset used in the regression, the study tested for the complete presence of the cointegration by using the trace statistic and the critical values at rank zero, as shown below.

H_o: There is no cointegrating vector in the dataset.

H_1: There is at least one cointegrating vector in the dataset.

Table 4.4: Johansen Test for Cointegration

Hypothesis	r= 0	r ≤ 1	r ≤ 2
λ_{trace}	53.05850	12.87548**	4.425896**
λ_{max}	40.18402	8.44950**	4.4258965**
Eigenvalue Cointegration Vector	0.964869	0.50546	0.308453

Note: **Statistically significant at 5%.
Source: EViews 12 output.

From the result shown above, it is obvious that there is at least a cointegration among all the variables. From the rank 0, H_o (null hypothesis) is that there is no cointegration between variables, while for the case of H_a (alternative hypothesis) there is a cointegration among variables. Hence at rank 0 (53.05850) wherein the trace statistic is greater than the 5% critical value of significance (49.6752), we reject the null hypothesis and failed to reject the alternative hypothesis. This shifts the investigation to maximum rank 1. At this point, the H0 is that there is one cointegrating equation whereas Ha shows that there is more than one cointegration. Since the trace statistic here (12.87548) is less than the critical value at the 5% level of significance (9.30987), a null hypothesis is accepted, implying that there is one cointegrating equation. The study further applied max statistics to obtain findings of trace statistics models. Results for the max statistic collaborated with those of the trace statistics. The presence of at least one cointegrating vector in our dataset set means that there is cointegration. At this point, we ignored the VAR model and applied the use of the VECM model, as it proved the most appropriate model for our dataset. The VECM results are presented in the following section.

4.5 VECM Regression Results

The study reveals that there is indeed a cointegration in the model since there is a negative coefficient of Error Correction Term (ECT) for both the consumer price index and the gross domestic product equation, it also shows that it is statistically significant. This indicates that there is an existence of both long-run and short-run relationships among variables in the model. From the table below, an estimated cointegration equation explaining CPI, EXR, and GDP is expressed as;

$$CPI_{t-1} = -0.67887 + 0.5365EXR_{t-1} - 0.47134GDP_{t-1} \quad (11)$$

The coefficient of the exchange rate (.5365) which is also significant at the 5% level of significance (p-value = 0.001), indicates that the exchange rate pass-through is incomplete in Sierra Leone. This means that a 1-unit depreciation of the Leone (increase in nominal exchange rate), leads to an increase in Sierra Leone consumer price by .5365 units or approximately 53.65%. This is an indication of indirect pass-through, where importers increase the price of imported goods to maintain their markup in the event of a nominal exchange rate depreciation (Goldberg, 2005; Aliyu, Yakub, Sanni & Duke, 2009).

However, the result implies that the exchange rate pass-through to CPI in the short run, as shown by the EXR lagged variable in Table 6. Nevertheless, the size of this coefficient (0.438) indicates that the exchange rate pass-through is relatively higher in the short-run than in the long-run. These results are consistent with several other studies (Chiparawasha, 2015; Nene, 2018). However, in Nene's case, ERPT was more pronounced in the long-run than in the short-run. This inconsistency in the short-run results can be attributed to the use of different models.

The statistical significance of the GDP variable indicates that changes in demand conditions affect consumer prices in Sierra Leone. This is a validation of the indirect effect of exchange rate changes to consumer prices in Sierra Leone. Therefore, these results imply the existence of both direct and indirect transmission mechanisms of exchange rate pass through to CPI in Sierra Leone.

Table 4.5: Estimated VECM (t-test)

Regression	Endogenous variables	C_{t-1}	P-value
1	ΔCPI_{t-1}	-1.776	0.0002
2	ΔEXR_{t-1}	-1.980	0.0012
3	ΔGDP_{t-1}	-1.665	0.1450

Table 4.6: Estimated VECM (Coefficients)

Variable	Coefficient of dependent variable CPI
ΔEXR_{t-1}	0.5365*** (0.3217)
ΔGDP_{t-1}	-0.47134** (0.2379)
Constant	-0.67889 (2.7285)

Key: *** 1%, and ** 5%, levels of statistical significance. Standard errors in brackets.

The following section analyses short-run causality among the variables.

4.6 Granger Causality

In this study, the Granger causality test was conducted as a way of analyzing the nature of causality among the variables in the study period. The table below shows that there is indeed a unidirectional causal link between the consumer price index and the gross domestic which runs from CPI to GDP. This actually indicates that in the short-run, changes in the consumer price index cause changes in economic growth as measured by GDP. Nevertheless, the results point it out that GDP causes CPI and EXR jointly. Similarly, there is a unidirectional causality relationship between CPI and EXR, and EXR causes CPI and GDP jointly. Regarding GDP, the study shows that GDP and EXR have a bidirectional relationship, which implies that in the short-run, variation in either variable causes change in the other.

Table 7 presents the results of the Granger causality test.

Table 7: Granger Causality Test

Hypothesis	$\chi 2$ for Granger Causality test	P-value	Direction of Causality
CPI does not cause GDP	2.496916	0.0000	CPI causes GDP
CPI does not cause EXR	1.411837	0.0012	CPI causes EXR
CPI does not cause GDP and EXR	3.861040	0.012	CPI causes GDP and EXR
GDP does not cause CPI	8.089123	0.4251	GDP does not cause CPI
GDP does not cause EXR	1.554487	0.0032	GDP causes EXR
GDP does not cause CPI and EXR	9.168518	0.0451	GDP causes CPI and EXR
EXR does not cause CPI	0.310077	0.8564	EXR does not cause CPI
EXR does not cause GDP	0.470287	0.oo65	EXR causes GDP
EXR does not cause CPI and GDP	0.891619	0.0045	EXR causes CPI and GDP

Source: EViews 12 output.

5. Conclusion and Policy Recommendations

For the past two decay, many emerging economies have tried to adopt a floating exchange rate regime by eliminating the fixed exchange rate regime. In the late 1970s, most countries try to abolish the fixed exchange rate regime in Favour of neoliberal market forces, since there is a failure of the macroeconomic variable under the fixed exchange rate regime. The country occasionally experiences sharp exchange rate depreciation, creating the need for continual analysis of the effects of exchange rates on domestic prices. It is on this basis that this study sought to carry out an exhaustive inquiry on the influence of exchange rate pass-through on domestic prices in Sierra Leone. This paper studied the pass-through of exchange rate changes to domestic prices under the common monetary area arrangement. More specifically, it sought to determine which type of exchange rate pass-through exists for Sierra Leone, using annual time series data between 1992 and 2022. The empirical analysis was based on a VECM model. The coefficient of the exchange rate (.5365) which is also significant at the 5% level of significance (p-value=0.002), indicates that the exchange rate pass-through is incomplete

in Sierra Leone. This means that a 1-unit depreciation of the Leone (increase in nominal exchange rate), leads to an increase in Sierra Leone consumer price by .5365 units or approximately 53.65%. This is an indication of indirect pass-through, where importers increase the price of imported goods to maintain their markup in the event of a nominal exchange rate depreciation (Goldberg, 2005; Aliyu, Yakub, Sanni & Duke, 2009).

The recommendation to the finding is that since it was revealed that Sierra Leone has relatively high exchange rate shocks means that monetary authorities in Sierra Leone should pay more attention to the effects of EXR fluctuation on consumer prices. Measures such as the promotion of local production to substitute imported goods are key to addressing the effects of exchange rate variations. Secondly, Sierra Leone monetary authorities should establish a partial monetary policy, such as a required reserve, credit controls, and open market operations, and should address bottlenecks in the supply chain and better manage local demand. However, the results of the study can act as a guide to other small economies that are working under similar arrangements.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

James L. S. Kallie is the current Head of Department of Procurement, Logostic & Supply Chain Management at the Faculty of Business Administration and Entreprenurship, University of Sierra Leone. He is aslso a Lecturer in the Department of Accountancy at the Institute of Public Administration and Management (IPAM) University of Sierra Leone. He is also the CEO of Storm Cursurtorm Research Institute Center Sierra Leone.

Emmanuel Jam Kamara is the Lecturer in the Department of Accountancy at the Institute of Public Administration and Management (IPAM) University of Sierra Leone.

Alpha Kanu is the current Head of Extra – Mural Freetown Campus. He is also a Lectrurer in the Department of Procurement, Logistic and Supply Cgain Management, University of Sierra Leone.

Joseph M. B. Heimoh is a Financial Management Consultant and a Lecturer in the Department of Accountancy at the Institute of Public Administration and Management (IPAM) University of Sierra Leone.

References

Aliyu, S.U.R., Yakub, M.A.U., Sanni, G.K., & Duke, O. (2009). *Exchange Rate Pass-Through in Nigeria: Evidence from a Vector Error Correction Model* (No. 25053). MPRA Working Paper No. 25053.

Aron, J., Farrell, G., Muellbauer, J.,& Sinclair, L. (2012). *Exchange Rate Pass-through to Import Prices, and Monetary Policy in South Africa*. South Africa Reserve Bank Working Paper No. WP/12/08.

Asteriou, D., & Hall, S. G. (2007). *Applied Econometrics: A Modern Approach using EViews and Microfit* (revised edition). New York: Palgrave Macmillan.

Bergin, P.R., & Feenstra, R.C. (2009). Pass-Through of Exchange Rates and Competition between Floaters and Fixers. *Journal of Money, Credit and Banking, 41*(1), 35–70.

Berner, E. (2010). *Exchange rate pass-through: new evidence from German Micro Data. Economics*. Working Paper, No. 2011-01, Kiel University

Beirne, J., & Bijsterbosch, M. (2009). *Exchange Rate Pass-through in Central and Eastern European Member States.* ECB Working Paper No. 1120 / December 2009.

Bongani, M. (2014). *Dissecting the South African Equity Markets into Sectors and States*. Saarbrücken: LAP Lambert Academic Publishing

Bussière M. (2007). *Exchange rate pass-through to trade prices: the role of non-linearities and asymmetries*. Working Paper Series No 822 / October 2007, European Central Bank.

Campa, J.M., & Goldberg, L.S. (2001). Exchange Rate Pass-Through into Import Prices: A Macro or Micro Phenomenon? *Review of Economics and Statistics, 54*(2), *346*–368.

Campa, J.M., & Goldberg, L.S. (2005). Exchange rate pass-through into import prices. *Review of Economics and Statistics*, *87*(4), 679–690.

Campa, J.M., Goldberg, L.S., & González-Mínguez, J.M. (2005). *Exchange-rate pass-through to import prices in the Euro area*. National Bureau of Economic Research Working Paper No. W11632, Massachusetts.

Central Bank of Eswatini (2019). *December Quarterly Review.*

Cheikh, N.B., & Louhichi, W. (2014). *Measuring the Impact of Exchange Rate Movements on Domestic Prices: A Cointegrated VAR Analysis*. FIW Working Paper No.131, Berlin.

Chiparawasha, F. (2015*). Exchange rate pass-through to domestic prices in South Africa*. Masters Dissertation. Cape Town, University of the Western Cape

Choudhri, K., & Hakura, P. (2001). *An Empirical Investigation of Exchange Rate Pass-Through in South Africa*. International Monetary Fund working paper No WP/02/165. Washington DC.

Dilla, S., Achsani, N.A., & Anggraeni, L. (2017). Do Inflation Targeting Really Reduced Exchange Rate Pass-through? *International Journal of Economics and Financial Issues, 7*(3), 444–452.

Dornbusch, R. (1987). Exchange Rates and Prices. *American Economic Association, 77*(1), 93–106.

Dwyer, J., Kent, C., & Pease, A. (1994). Exchange rate pass-through: Testing the small country assumption for Australia. *Economic Record*, *70*, (211), 408–423.

Eckstein, Z., & Soffer, Y. (2008*). Exchange rate pass-through implications for monetary policy: the Israeli case.* BIS Paper No 35.

Enders, W. (2003). *Applied Econometric Time Series.* New Jersey: Wiley.

Engle, R., & Granger, C. (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrica, 55*(2), 251–276.

McCarthy, J.F., 2006. *The fourth circle: A political ecology of Sumatra's rainforest frontier*. Stanford University Press.

Creative Commons licensing terms
Authors will retain copyright to their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s).Open Access Publishing Group and European Journal of Economic and Financial Research shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflict of interests, copyright violations and inappropriate or inaccurate use of any kind content related or integrated on the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a Creative Commons Attribution 4.0 International License (CC BY 4.0).