Academic Journal of Economic Studies
Vol. 6, No. 1, March 2020, pp. 93–109
ISSN 2393-4913, ISSN On-line 2457-5836

Assessing the Asymmetry of the Exchange Rate Pass-Through to Inflation in West African Commonwealth Countries

Ibrahim Abdulhamid Danlami[1], Sallahuddin Hassan[2], Mohamad Helmi Bin Hidthiir[3]

[1]Department of Social Sciences and Administration, School of Continuing Education, Bayero University Kano, Nigeria,
E-mail: iadanlami.sce@buk.edu.ng (Corresponding author)
[2,3]School of Economics Finance and Banking, Universiti Utara Malaysia

Abstract

The research investigated the exchange rate pass-through (ERPT) to inflation and its asymmetry in West African Commonwealth Countries (WACCs). The research employed Autoregressive Distributed Lag (ARDL) and Non-linear ARDL (NARDL) on WACCs data for a period 1980 – 2016. The results of the symmetry (ARDL) show that, during the short-run, there is no evidence of ERPT in Nigeria, though, after one-year ERPT has a disinflationary effect. Meanwhile, complete ERPT exists in Ghana, the Gambia, and Sierra Leone. In the long-run, complete ERPT exists in all the countries, the Gambia having the highest ERPT followed by Nigeria and Sierra Leone. Ghana has the lowest ERPT in the long run. The results of the asymmetry (NARDL) reveal that during the short run, in Nigeria, there is no evidence of ERPT based on the positive but positive ERPT that exists based on the negative shocks. Evidence of positive ERPT exists in the rest of the countries based on both the positive and negative shocks. On the other hand, the long-run asymmetric results reveal that both the positive and the negative shocks result in positive ERPT to inflation in all the countries. These imply that exchange rate fluctuations are inflation, and its stabilization is necessary to combat inflation in all the countries.

Keywords

ARDL, commonwealth, exchange rate, inflation, NARDL

JEL Codes: E30, E31, F31

Received: 09 January 2020 **Revised: 27 January 2020** **Accepted: 03 February 2020**

1. Introduction

The long-overdue issue that is still calling the attention of researchers and policymakers since the abolishing of the fixed exchange rate period in 1986 is the issue of Exchange Rate Pass-Through (ERPT) to inflation. This has been one of the major macroeconomic issues of recent times that constitute a serious problem to policymakers, mostly, of developing economies (Usman and Musa, 2018, Amoah and Aziakpono, 2018). The frequent devaluation of local currencies, which become the order of the day in most developing countries, could be associated with the rising prices of commodities that are featuring and disturbing the progress of their economies.

One of the significant sources of disparities, regarding societal welfare, between developed and developing nations, is the variations of the rates at which prices of commodities are increasing (inflation differences) that exist between them. Coleman (2010) pointed-out that closely associated with high inflation rates are developing economies, whereas closely associated with low inflation rates are developed economies. Many scholars maintained that the main cause of the high inflation rate is an excessive devaluation of local currencies of the concerned countries (Ebiringa and Anyaogu, 2014; Samuel and Nurina, 2015; Mawajje and Lwanga, 2016; Karagoz *et al*., 2015). Sek *et al*. (2015) maintained that high inflation rate brings to a halt and distorts the progress of economic growth and development of any country.

Numerous scholars asserted that for developing economies to make meaningful progress in respect of their quest to build up their economy, having and maintaining a single-digit inflation rate is necessary (Risso and Sanchez-Carrera, 2009, Phiri, 2012, Danlami *et al*., 2017). On the basis of this proposition, inflation rates of West African Commonwealth Countries (WACCs), which members are Nigeria, Ghana, the Gambia, and Sierra Leone, are observed for the period 1970 – 2016. It shows that, in the majority of the periods and the majority of the countries, the inflation rates are double-digit, beyond the needed target, as depicted in Figure 1 and Figure 2.

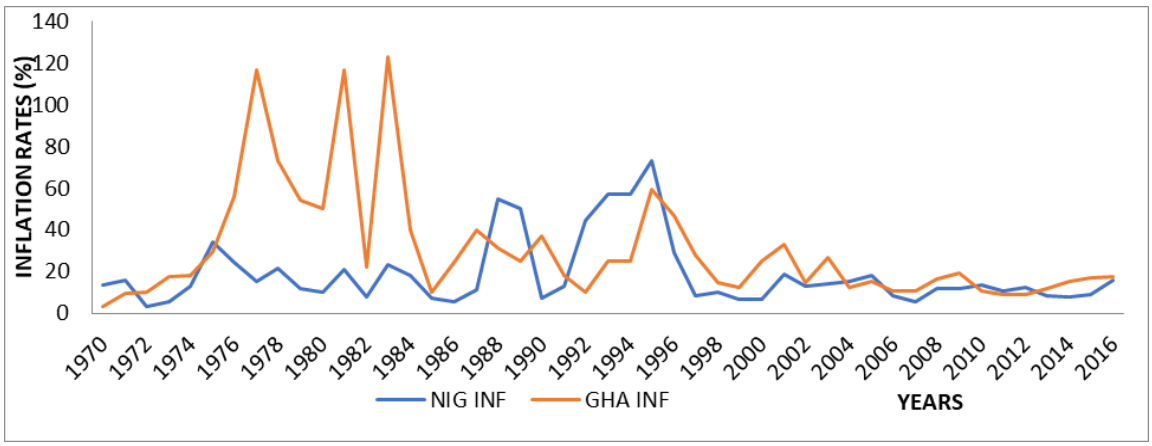

Figure 1. Inflation rates for Nigeria and Ghana, 1970 – 2016

Source: Danlami, 2019

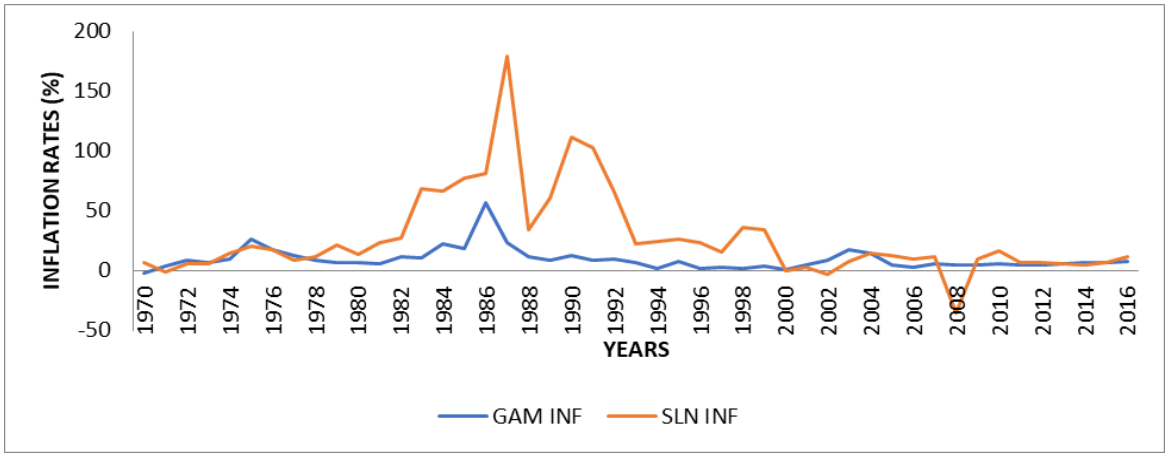

Figure 2. Inflation rates for the Gambia and Sierra Leone, 1970–2016

Source: Danlami, 2019

Following the observation of inflation rates, are the observations of exchange rates of WACCs for the same period, and their trends indicate that immediately after the abolishing the regime of fixed exchange rate in 1986, the countries' exchange rates started trending upward. This implies that the WACCs have continuously been devaluing their local currencies, as shown in Figure 3 to Figure 6. Could this be among the reasons why WACCs could not make and maintain a single-digit inflation rate?

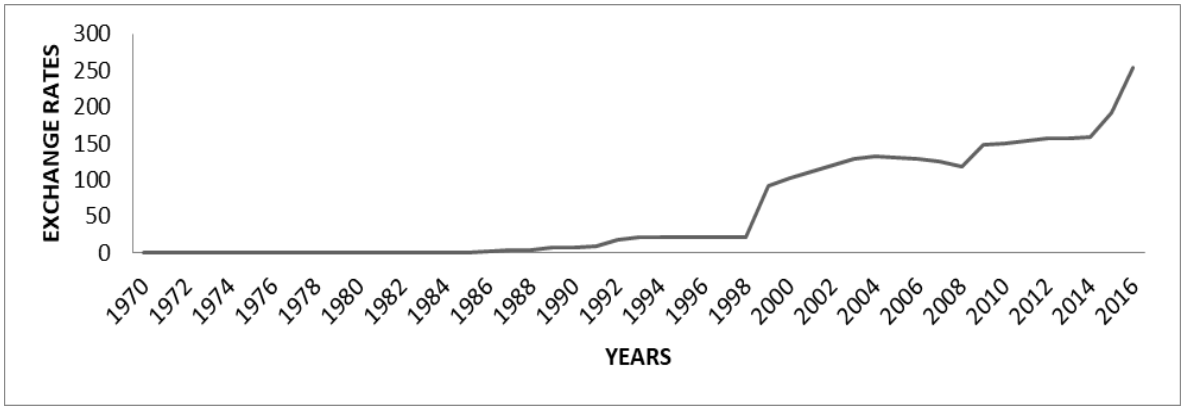

Figure 3. Nigerian Exchange Rates, 1970 – 2016

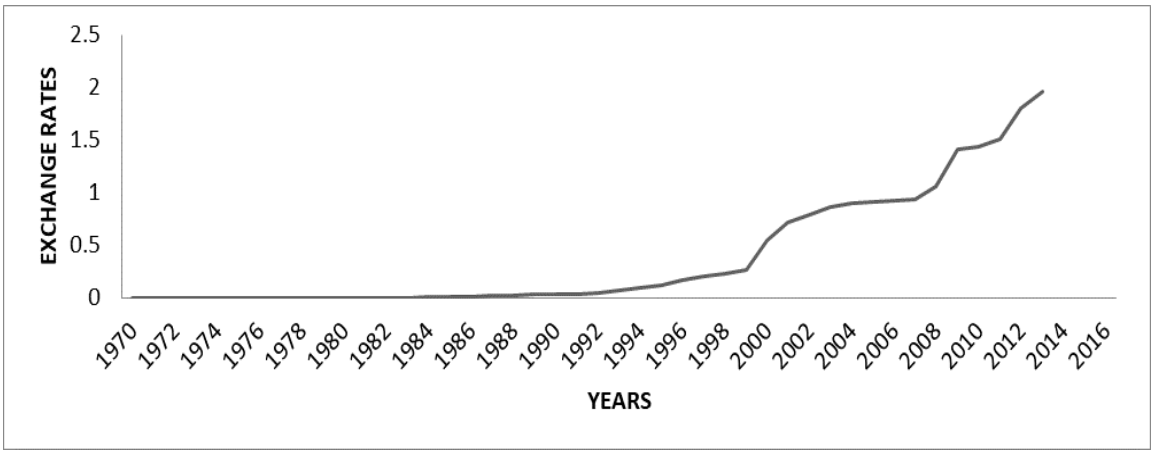

Figure 4. Ghanaian Exchange Rates, 1970 – 2016

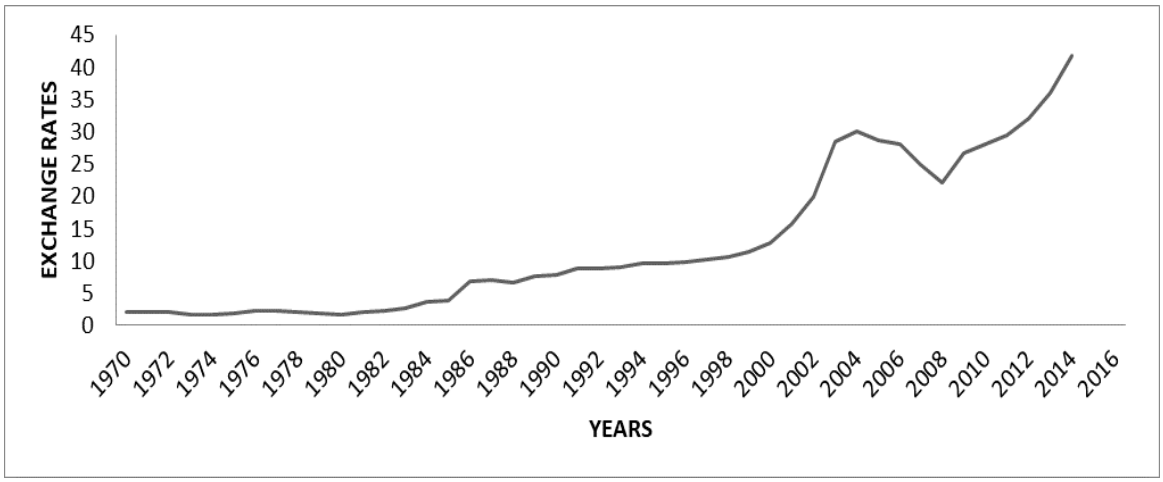

Figure 5. Gambian Exchange Rates, 1970 – 2016

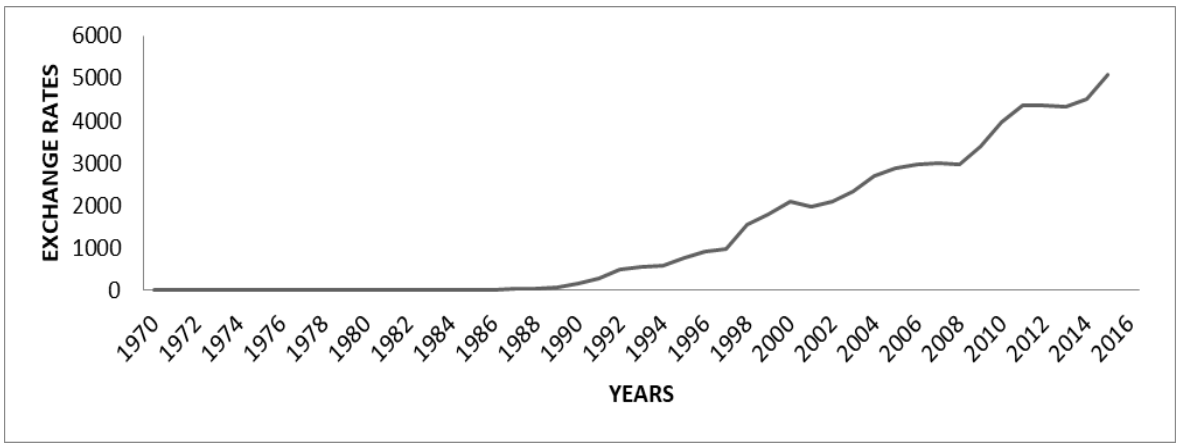

Figure 6. Sierra Leone Exchange Rates, 1970 – 2016

This paper intends to investigate the nature of *ERPT* to inflation of WACCs, in addition to investigating the existence of asymmetry or not in the process of the pass-through. This paper differs from previous ERPT researches in the sense that ERPT estimated using the methodology that in-cooperates some important variables that aid the process of ERPT to inflation (ARDL and NARDL). Also, most of the previous studies concentrated on ERPT to import prices as against inflation. In addition to this, the paper used a new cluster of study (i.e., WACCs) by which, before now, previous studies are lacking in this cluster. The remaining parts of the study consist; section two, which provides a detailed explanation of the research framework, while Section three of the paper presents the methodology employed by the paper. The findings and results obtained from the estimations as well as presentations the discussions on the basis of the research's findings are in section four. Lastly, Section five concludes the research.

2. Literature review

The basis of understanding ERPT to inflation is through comprehending the models of ERPT (Menon, 1997). The theoretical explanation of the ERPT can best be understood using the model developed by Campa and Goldberg (2005) on the basis of combined ERPT model and mark-up inflation theory. The theoretical explanation of ERPT is of two types; the first is when the exchange rate devaluation pass-through to import prices, while the second is when the exchange rate devaluation pass-through to inflation. Kennedy (2011) highlighted that the proponent of the markup theory, such as Ackley (1959), Duesenberry (1950), and Bronfenbrenner and Holzman (1963), maintained that in most countries, commodities are of two categories, depending on the process of setting their prices. The first category is those commodities whose prices are being set through a competitive bid, and the goods are being sold to the highest bidder. The second category, are those commodities by which one of the parties; either the seller or the buyer (in some cases, marketing boards) announce the price of the commodity (after taking consideration the average cost of the commodity) and the other party accept it. The calculation of the announced price involves cost plus margin, the margin added is the profit to the seller, and hence the set price is termed as markup price (Hagger, 1977). To this model, inflation is the continuous increase in some index of mark-up prices.

2.1. The Pass-Through to Import Prices

On the basis of markup model, Campa and Goldberg (2005) asserted that in trading between two countries; importing and exporting countries, exchange rate changes can be passed to the price of the trading commodity to either of the countries, consider Equation [1]:

$$I_p = E_c . E_p \quad (1)$$

Where I_p is import price, E_c is the exchange rate, and E_p is the export price.

After taking the log of both sides, Equation (1) will be transformed into Equation (2)

$$logI_p = logE_c + logE_p \quad (2)$$

The E_p consists of Marginal Cost *'MC'* and profit margin usually known as the mark up *'Ø'* from the exporting country and it is a certain percentage of the cost which is;

$$E_p = MC(1 + Ø) \text{ or } logE_p = logMC + logØ \quad (3)$$

Hence import price is:

$$logI_p = logE_c + logMC + logØ \quad (4)$$

The Ø also depends on the effect of the sector (λ_0), amount or volume of import of the importing country (nature of the demand of the commodity in the importing country *'MT'*) and E_c; accordingly, the *log*Ø can be presented in Equation (5).

$$logØ = \lambda_0 + \propto_1 logMT + \lambda_1 logE_c \quad (5)$$

Where *MT* is the amount of import of the importing country, $\lambda_1 logE_c$ is the level of adjustment of the import price to the exchange rate.

Therefore, Equation (5) can be presented in Equation (6)

$$logI_p = logE_c + logMC + \lambda_0 + \propto_1 logMT + \lambda_1 logE_c \quad (6)$$

and

$$logI_p = \lambda_0 + (1 + \lambda_1) logE_c + logMC + \propto_1 logMT \quad (7)$$

In Equation (7), $(1 + \lambda_1)$ represents the total pass-through of the exchange rate to import price. The size of the pass-through depends on the size of the λ, having $\lambda \geq 0$, implies the existence of a complete pass-through of the exchange rate to importer's price. On the other hand, having λ= -1 signifies that $(1 + \lambda)$= 0, and there is no pass-through, the exporter exhausts the exchange rate changes. This model has been used to measure ERPT by many studies, including Campa and Goldberg (2005) and Yanamandra (2015).

I_p can be changed with the change in any of the independent variables or both E_c, and MT, consequently, $\frac{\partial I_p}{\partial E_c} = \propto_2$, $\frac{\partial I_p}{\partial MT} = \propto_1$ by setting $1 + \lambda_1 = \propto_2$. Frisch (1983) highlighted the existence of differences in terms of price elasticities and elasticities of income for commodities. If the commodity of import is highly inelastic, the pass-through and the coefficient of import and export value will be positive, and both will be negative if the commodity is highly elastic.

2.2. The Pass-Through to Inflation

The theoretical explanation of ERPT to inflation is that; the major cause of inflation in developing economies is the excessive devaluation of their local currencies. The strategies of import substitutions and export promotions, which are being frequently implemented by developing countries, require excessive local currency devaluations. Lafleche (1996) simplifies the process of ERPT to inflation in Figure 7. The figure stressed that devaluation of local currencies in any country has double consequences; direct and indirect. The direct effect involved the rise in the cost and price of the importing commodity. While the indirect consequences through general, both cost-push and demand-pull inflation. The cost-push inflation arises when the demand of domestic products increases to substitute the high priced imported goods due to the devaluation of local currencies, and therefore, more labor is employed to produce it hence, result in the rise in the demand for more wages by the labor which pushes the cost of production upward. In addition to this, some machinery for productions of the local goods needs to be imported and, therefore, directly affected by the devaluation of the local currencies. On the other hand, the demand, the demand-pull inflation arises in quest and rise of the locally manufactured goods to substitute those that are being imported due to the upsurge in the prices of the imported commodities arises from the devaluations of the local currencies. Therefore, the result of local currency devaluation is inflation in general, due to the rise in prices of both imported goods and locally manufactured commodities (Lafleche, 1996; Gagnon and Ihrig, 2004; Jiang and Kim, 2013; Tandrayen-Ragoobur and Chicooree, 2013).

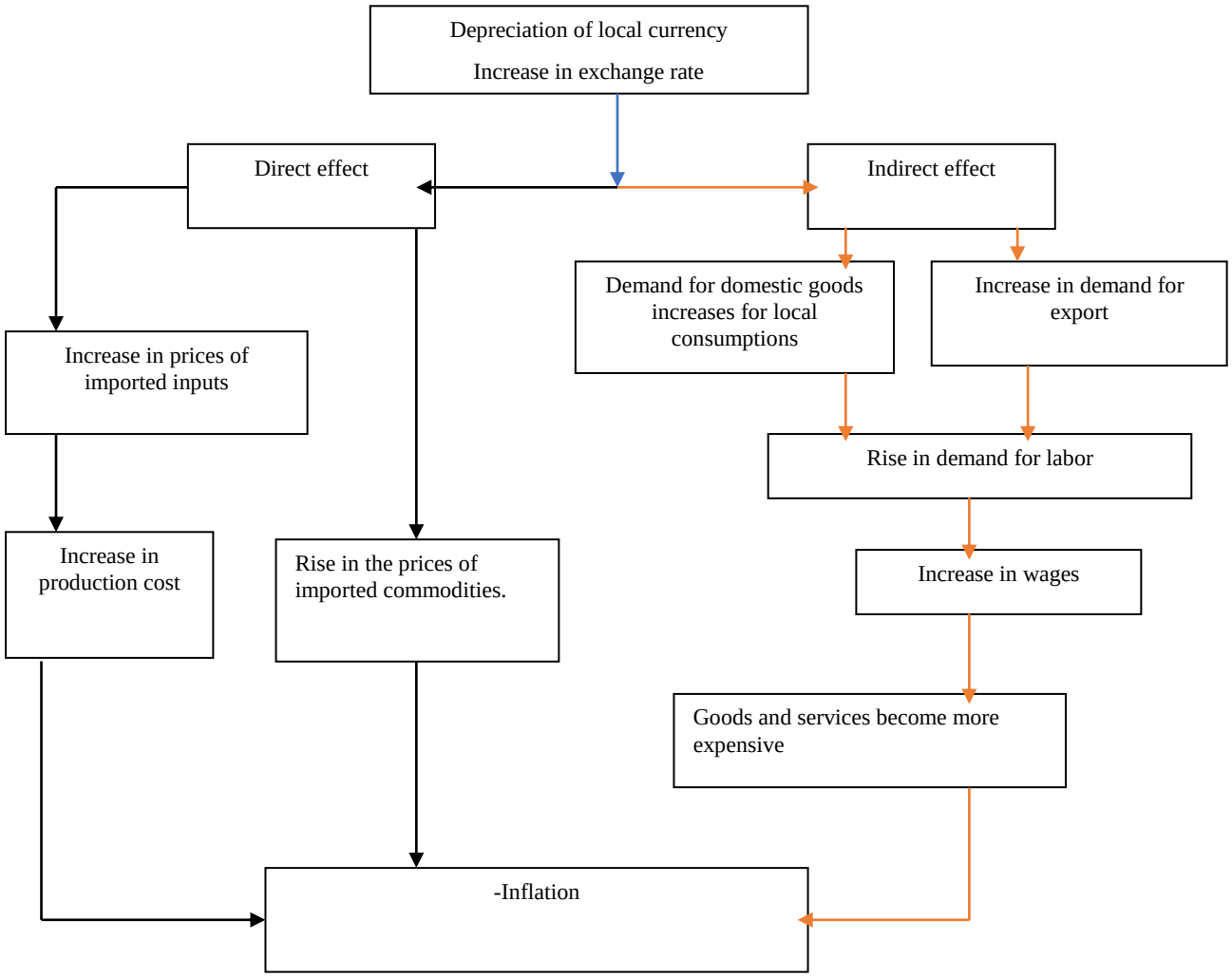

Figure 7. Process of Exchange Rate Pass-Through; Adapted from Lafleche (1996)

Adapting Amoah and Aziyakpono (2018), de-Mendonca and Tiberto (2017), Elahi, Salami and Masoomzadeh (2016), Adu and Marbuah (2011) and Faruqee (2006), the *ERPT* function for this study is expressed in Equation (8).

$$INF = f(EXC, BRAG, GDP, TB, GOV) \quad (8)$$

where: INF is the inflation rate, EXC is the exchange rate, BRAG is money supply, GDP is Gross Domestic products, TB is Trade Balance, and GOV is government expenditure.

3. Methodology of research

The section clarifies the data sources, econometric techniques, and specifies the model based on the objective of the research.

3.1. Source of data

The data exploited by this research is for the period 1980–2016. The data source is the World Bank's (WB) World Development Indicators (WDI). The rate of inflation is on consumer price, not for wholesale or producer price basis. The nominal exchange rate is the exchange rate of local currencies with United States Dollars (USD). Gross Domestic Products (GDP) as a measure of economic growth. Trade Balance is the difference between export and import (i.e. net export). Government expenditure is the total expenses (expenditure) by the government during a specific period, usually a year. All variables are in logarithms form for measurement uniformity and easy interpretations. Also, note that to measure ERPT change in the exchange rate is used, and the exchange rate was transformed to logarithm form before calculating the changes in exchange rate, which is the way to measure the pass-through as done by previous studies.

3.2. Econometric Techniques

Having ascertained that the variables of the study, are not in the same order of integration, after conducting a unit root test based on Augmented Dicky-Fuller (ADF), the study employs Autoregressive Distributed Lag Model (ARDL) and Non-linear ARDL (NARDL), as its econometric techniques. This is for painstakingly evaluating the long-run different from the short-run effects of the change in exchange rate on inflation (ERPT) and its asymmetric effects. The ARDL and NARDL methods of analysis are superior to other methods of analysis in the sense that they accommodate mixed stationary variables I(0) and I (1) but excluding I(2). The estimations are valid even for a small sample. Also, they are Robust to all forms of endogeneity problems (Jalil *et al*., 2013). The stages for the model estimations involve checking for stationarity as the first stage to determine the level of the variables' integration. Whereupon, the paper made a selection of lag length using the Akaike Information Criterion and Selection of the optimal model, which involves conducting post-estimation diagnostic checks to ascertain whether the models are prudent or not. General modeling of the ARDL is the next stage, from the results of the general modeling, the paper conducted the bound test for a long-run relationship. Establishing the existence of the long-run relationship necessitates the estimations of long-run relationships. They are followed by the estimation of short short-run relationships.

3.3. Model Specification

Presenting Equation (8) in an econometric form becomes:

$$INF_t = \propto_0 + \propto_1 EXC_t + \propto_2 BRAG + \propto_3 GDP_t + \propto_4 TB_t + \propto_5 GOV_t + \varepsilon_t \quad (9)$$

Where t = 1,…,37, $\propto_i$ (i = 0,1….5) are coefficients, ε is the error term with $\varepsilon_t \sim iid(0, \delta_t^2)$ as its properties. The study is interested in testing the coefficients of *EXC* ($\propto_2$), its size, sign, and whether it is statistically significant.

The ARDL function is presented in Equation (10)

$$\begin{aligned}\Delta INF_t = \propto_0 + \sum_{k=1}^{p} \propto_1 \Delta INF_{t-k} + \sum_{k=0}^{q_1} \propto_2 \Delta EXC_{t-k} + \sum_{k=0}^{q_2} \propto_3 \Delta BRAG_{t-k} \sum_{k=0}^{q_3} \propto_4 \Delta GDP_{t-k} \\ + \sum_{k=0}^{q_4} \propto_5 \Delta TB_{t-k} + \sum_{k=0}^{q_5} \propto_6 \Delta GOV_{t-k} + \emptyset_1 INF_{t-1} + \emptyset_2 EXC_{t-1} + \emptyset_3 BRAG_{t-1} + \emptyset_4 GDP_{t-1} \\ + \emptyset_5 TB_{t-1} + + \emptyset_6 GOV_{t-1} + \varepsilon_t \end{aligned} \quad (10)$$

Equations (11) and (12) represent the long-run and short-run Equations, respectively.

$$INF_t = \varepsilon_0 + \sum_{k=1}^{p} \varepsilon_1 INF_{t-k} + \sum_{k=0}^{q_1} \varepsilon_2 EXC_{t-k} + \sum_{k=0}^{q_2} \varepsilon_3 BRAG_{t-k} \sum_{k=0}^{q_3} \varepsilon_4 GDP_{t-k} + \sum_{k=0}^{q_4} \varepsilon_5 TB_{t-k} + \sum_{k=0}^{q_5} \varepsilon_6 GOV_{t-k} + \varepsilon_t \quad (11)$$

Where: ε_i (i = 1, …, 6) are the long-run coefficients.

$$\Delta INF_t = \propto_0 + \sum_{k=1}^{p} \propto_1 \Delta INF_{t-k} + \sum_{k=0}^{q_1} \propto_2 \Delta EXC_{t-k} + \sum_{k=0}^{q_2} \propto_3 \Delta BRAG_{t-k} \sum_{k=0}^{q_3} \propto_4 \Delta GDP_{t-k} + \sum_{k=0}^{q_4} \propto_5 \Delta TB_{t-k} + \sum_{k=0}^{q_5} \propto_6 \Delta GOV_{t-k} + \nu_0 ECT_{t-1} + \varepsilon_t \quad (12)$$

Where: $\propto_i$ (i = 1…6) are the short-run coefficients and ν_0 is the speed of adjustment towards long-run Equilibrium; *ECT* is the error correction term.

Following the framework developed by Shin, Yu and Greenwood-Nimmo (2011), NARDL stressed the non-linear effects of an independent variable on the dependent variable, by segregating its positive effect from the negative effect. Here, the amount of increase in the independent variable could cause a certain percentage of positive or negative change in the dependent variable. At the same time, a decrease in the independent variable could cause a different percentage change, either positive or negative change on the dependent variable. This implies that the coefficient estimated for the positive shocks of the independent variables differs from that estimated for the negative shocks of the variable.

The NARDL function is presented in Equation (13)

$$\Delta INF_t = a_0 + \sum_{k=1}^{p} a_1 \Delta INF_{t-k} + \sum_{k=0}^{q_1} (a_2^{+\prime} \Delta EXC_{t-k} + a_2^{-\prime} \Delta EXC_{t-k}) + \sum_{k=0}^{q_2} a_3 \Delta BRAG_{t-k} + \sum_{k=0}^{q_3} a_4 \Delta GDP_{t-k} + \sum_{k=0}^{q_4} a_5 \Delta TB_{t-k} + \sum_{k=0}^{q_5} a_6 \Delta GOV_{t-k} + \beta_1 INF_{t-1} + \beta_2 EXC_{t-1} + \beta_3 BRAG_{t-1} + \beta_4 GDP_{t-1} + \beta_5 TB_{t-1} + \beta_6 GOV_{t-1} + \varepsilon_t \quad (13)$$

Where; a_i and β_i (i = 1, …, 6) are coefficients, $a_2^{+\prime}$ and $a_2^{-\prime}$ are the asymmetric positive and negative coefficients, respectively.

4. Discussions of findings and results

Presentations of the results and findings of the study are in this section, which started by offering the result of unit root tests followed by the research's findings.

The Unit Root Test Results: The unit root tests results presented in Table 1 shows that the variables in all the countries are mixed stationary; some are stationary at level while some are stationary at first difference, this justifies the usage of ARDL and NARDL as the right methodology for analyzing the data. The unit root test conducted is constructed based on the Augmented Dickey-Fuller (ADF) test. The results for LINF were obtained after the fourth lag in all the countries except Sierra Leone, where the automatic lag selection was used to the maximum of two lags.

Table 1. The Result of Unit Root Test

	Nigeria		Ghana		The Gambia		Sierra Leone	
Variable	Level	1st Difference	Level	1st Difference	Level	1st Difference	Level	1st Difference
LINF	-1.95	-3.58**	-2.04	-5.99***	-1.95	-3.08**	-1.82	-6.56***
	(0.30)	(0.01)	(0.27)	(0.00)	(0.31)	(0.04)	(0.37)	(0.00)
CLEXC	-5.09***	-9.08***	-3.53**	-9.04***	-4.69***	-9.60***	-6.56***	-6.25***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LBRAG	-2.18	-3.45*	0.34	-5.42***	-2.38	-6.33***	-0.55	-4.93***
	(0.49)	(0.06)	(1.00)	(0.00)	(0.38)	(0.00)	(0.98)	(0.00)
LGDP	-2.52	-5.81***	-1.58	-4.79***	-1.43	-5.50***	-2.02	-5.39***
	(0.31)	(0.00)	(0.78)	(0.00)	(0.83)	(0.00)	(0.57)	(0.00)
LTB	-4.37***	-6.39***	-2.75*	-7.96***	-1.58	-4.36***	-2.19	-7.01***
	(0.00)	(0.00)	(0.08)	(0.00)	(0.48)	(0.00)	(0.21)	(0.00)
LGOV	-0.57	-6.00***	-2.58	-4.84***	-4.10***	-5.77***	-2.93	-8.09***
	(0.86)	(0.00)	(0.29)	(0.00)	(0.00)	(0.00)	(0.17)	(0.00)

Note: "*" "**" "***" indicates significant at ten percent, five percent and one percent, respectively.

Selection of Lag Length: Using Akaike Information criterion (AIC), ARDL (6, 2, 0, 2, 1, 2), ARDL (1, 1, 2, 1, 2, 2), ARDL (2, 1, 0, 1, 1, 0) and ARDL (1, 0, 1, 0, 0, 0) are selected for Nigeria, Ghana, the Gambia and Sierra Leone, respectively. Whereas, for the NARDL, NARDL(1, 2, 3, 2, 0, 2, 2) and NARDL(1, 2, 2, 2, 1, 2, 2) are for Nigeria and Ghana, as well as NARDL(2, 1, 1, 0, 1, 1, 0) and NARDL(1, 1, 0, 0, 0, 0, 0) are for the Gambia and Sierra Leone, respectively.

Optimal Model: Table 2 and Table 3 present the outcomes of the post-estimation diagnostic checks of the ARDL and NARDL models, respectively. The results reveal that the estimated models, in all the countries and both ARDL and NARDL models, are free from serial correlation, estimated error terms are normally distributed, and having constant variance (the desired homoskedastic as against heteroskedastic). Similarly. Ramsey reset test results show that all the models have no specification error, as the probabilities in all the tests are greater than five percent.

Table 2. Post-Estimation Diagnostic Checks of the ARDL ERPT Model

Countries	Normality: Jarque-Bera	Serial Correlation	Heteroskedasticity	Ramsey Reset Test
Nigeria	1.38	0.96	0.24	2.21
	(0.50)	(0.51)	(0.99)	(0.17)
Ghana	1.07	0.10	0.36	1.50
	(0.59)	(0.91)	(0.97)	(0.24)
The Gambia	1.44	1.09	1.00	0.20
	(0.49)	(0.31)	(0.48)	(0.66)
Sierra Leone	0.07	0.54	0.33	0.22
	(0.96)	(0.47)	(0.93)	(0.65)

Table 3. Post-Estimation Diagnostic Checks of the Asymmetry NARDL ERPT Model

Countries	Normality: Jarque-Bera	Serial Correlation	Heteroskedasticity	Ramsey Reset Test
Nigeria	1.26	2.24	0.99	2.19
	(0.53)	(0.16)	(0.52)	(0.17)
Ghana	0.02	2.69	0.98	0.41
	(0.99)	(0.11)	(0.52)	(0.53)
The Gambia	1.32	2.21	0.75	0.12
	(0.52)	(0.14)	(0.69)	(0.73)
Sierra Leone	0.81	1.78	0.63	0.63
	(0.67)	(0.20)	(0.74)	(0.44)

Note: The parenthesis represents the probability

Also, Table 4 and Table 5; indicate that multicollinearity is not severe in the estimated models; for both ARDL and NARDL models, with the coefficients of the Variance Inflation Factor (VIF) that are less than five.

Table 4. VIF Test Results for Multicollinearity for the ARDL ERPT Model

Nigeria		Ghana		The Gambia		Sierra Leone	
Variable	Coefficient Variance	Variable	Coefficient Variance	Variable	Coefficient Variance	Variable	Coefficient Variance
LINF(-1)	0.02	*LINF(-1)*	0.02	*LINF(-1)*	0.03	*LINF(-1)*	0.01
LINF(-2)	0.04	*CLEXC*	0.11	*LINF(-2)*	0.02	*CLEXC*	0.06
LINF(-3)	0.05	*CLEXC(-1)*	0.08	*CLEXC*	0.81	*LBRAG*	0.22
LINF(-4)	0.04	*LBRAG*	0.80	*CLEXC(-1)*	0.69	*LBRAG(-1)*	0.21
LINF(-5)	0.03	*LBRAG(-1)*	1.35	*LBRAG*	0.02	*LGDP*	0.11
LINF(-6)	0.03	*LBRAG(-2)*	0.69	*LGDP*	0.52	*LTB*	0.03
CLEXC	0.22	*LGDP*	0.25	*LGDP(-1)*	0.48	*LGOV*	0.14
CLEXC(-1)	0.24	*LGDP(-1)*	0.30	*LTB*	1.93	*C*	--
CLEXC(-2)	0.14	*LTB*	0.37	*LTB(-1)*	1.64		
LBRAG	0.02	*LTB(-1)*	0.45	*LGOV*	0.19		
LGDP	0.27	*LTB(-2)*	0.51	*C*	--		
LGDP(-1)	0.35	*LGOV*	0.17				
LGDP(-2)	0.14	*LGOV(-1)*	0.18				
LTB	0.15	*LGOV(-2)*	0.09				
LTB(-1)	0.13	*C*	--				
LGOV	0.16						
LGOV(-1)	0.15						
LGOV(-2)	0.13						
C	--						

Table 5. VIF Test Results for Multicollinearity for the NARDL ERPT Model

Nigeria		Ghana		The Gambia		Sierra Leone	
Variable	Coeff. Variance	Variable	Coeff. Variance	Variable	Coeff. Variance	Variable	Coeff. Variance
LINF(-1)	0.05	LINF(-1)	0.04	LINF(-1)	0.03	LINF(-1)	0.01
CLEXC_POS	0.27	CLEXC_POS	1.03	LINF(-2)	0.03	CLEXC_POS	0.26
CLEXC_POS(-1)	0.67	CLEXC_POS(-1)	0.99	CLEXC_POS	1.59	CLEXC_POS(-1)	0.25
CLEXC_POS(-2)	0.59	CLEXC_POS(-2)	0.79	CLEXC_POS(-1)	4.12	CLEXC_NEG	0.07
CLEXC_NEG	1.22	CLEXC_NEG	1.21	CLEXC_NEG	3.88	LBRAG	0.07
CLEXC_NEG(-1)	0.90	CLEXC_NEG(-1)	0.28	CLEXC_NEG(-1)	1.40	LGDP	0.23
CLEXC_NEG(-2)	0.27	CLEXC_NEG(-2)	0.25	LBRAG	0.10	LTB	0.03
CLEXC_NEG(-3)	0.17	LBRAG	0.82	LGDP	0.72	LGOV	0.18
LBRAG	1.34	LBRAG(-1)	1.04	LGDP(-1)	0.57	C	--
LBRAG(-1)	5.12	LBRAG(-2)	0.50	LTB	2.68		
LBRAG(-2)	1.43	LGDP	0.25	LTB(-1)	2.14		
LGDP	0.32	LGDP(-1)	0.29	LGOV	0.24		
LTB	0.32	LTB	0.91	C	--		
LTB(-1)	0.26	LTB(-1)	0.41				
LTB(-2)	0.22	LTB(-2)	0.47				
LGOV	0.19	LGOV	0.16				
LGOV(-1)	0.24	LGOV(-1)	0.21				
LGOV(-2)	0.15	LGOV(-2)	0.08				
C	--	C	--				

Similarly, Figure 8 to Figure 15 show that the estimated ARDL *ERPT* models are dynamically stable in either CUSUM or CUSUM of square or combinations of the two, as the estimations are within the ridgeline below the upper ridgeline and above the lower ridgeline.

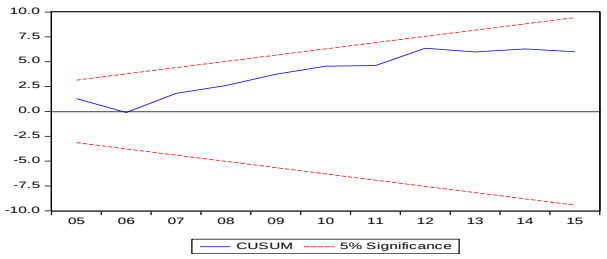

Figure 8. Nigerian ERPT CUSUM

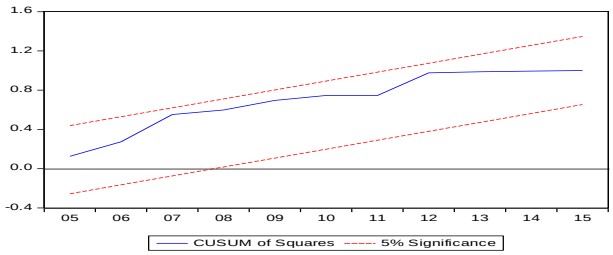

Figure 9. Nigerian ERPT CUSUM of Squares

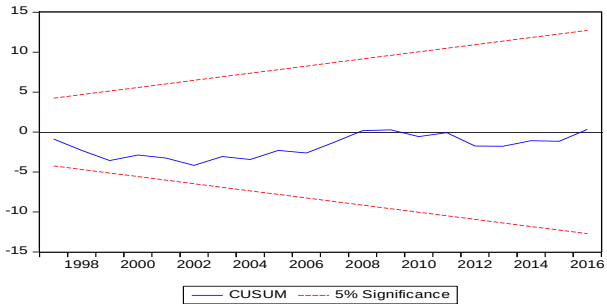

Figure 10. Ghanaian ERPT CUSUM

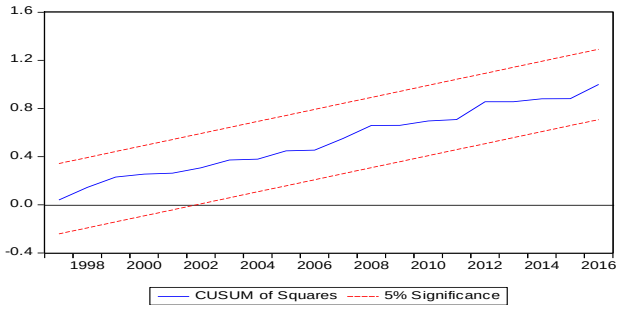

Figure 11. Ghanaian ERPT CUSUM of Squares

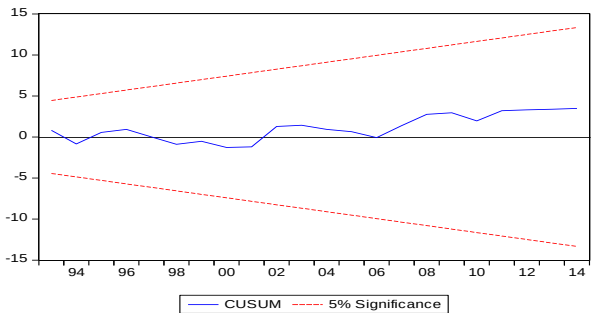

Figure 12. The Gambian ERPT CUSUM

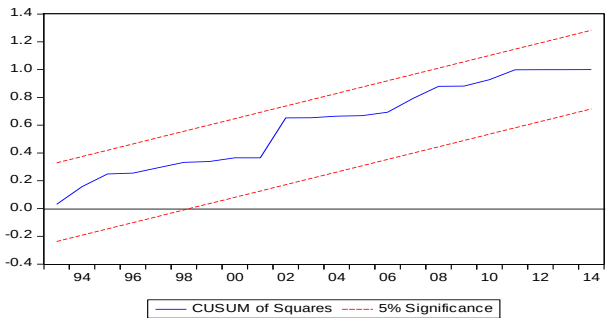

Figure 13. The Gambian ERPT CUSUM of Squares

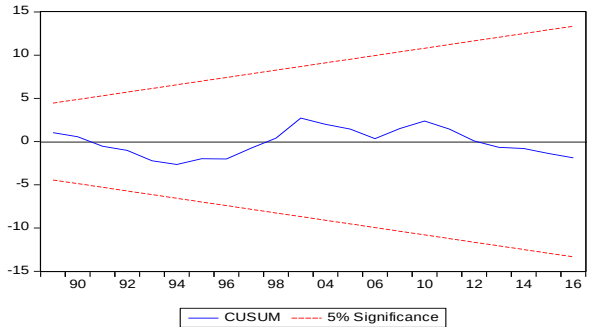

Figure 14. Sierra Leone ERPT CUSUM

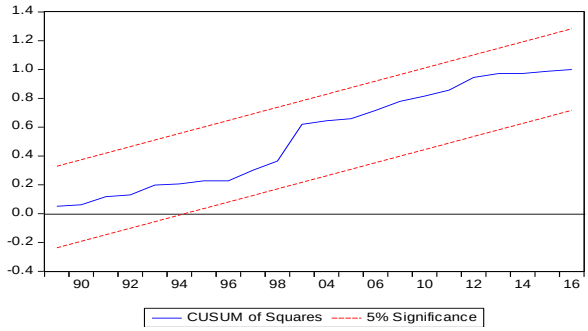

Figure 15. Sierra Leone ERPT CUSUM of Squares

Also, Figure 16 to Figure 23 show that the estimated NARDL *ERPT* models are dynamically stable in either of CUSUM or CUSUM of square or combination of the two, as the estimations are within the ridgeline, below the upper ridgeline and above the lower ridgeline.

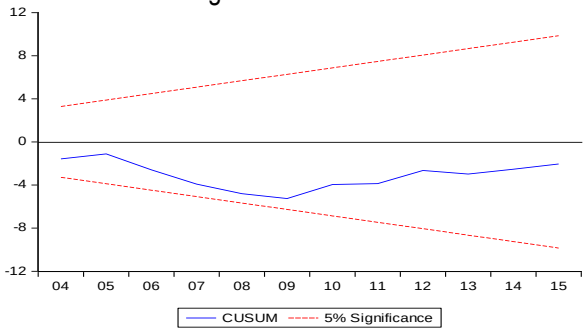

Figure 16. Nigerian ERPT CUSUM

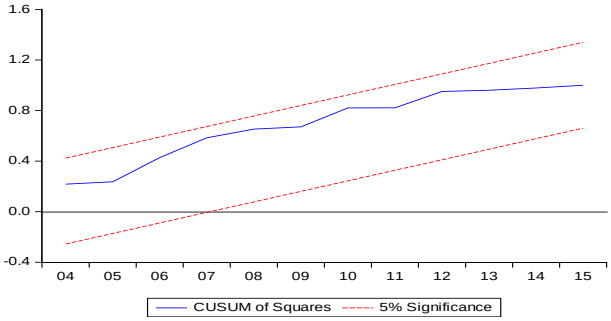

Figure 17. Nigerian ERPT CUSUM of Squares

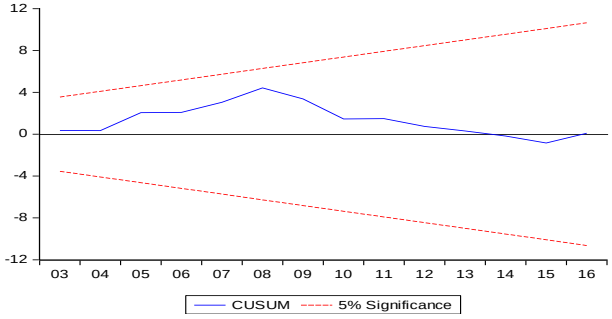

Figure 18. Ghanaian ERPT CUSUM

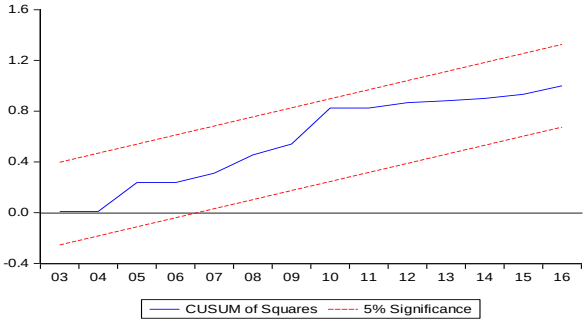

Figure 19. Ghanaian ERPT CUSUM of Squares

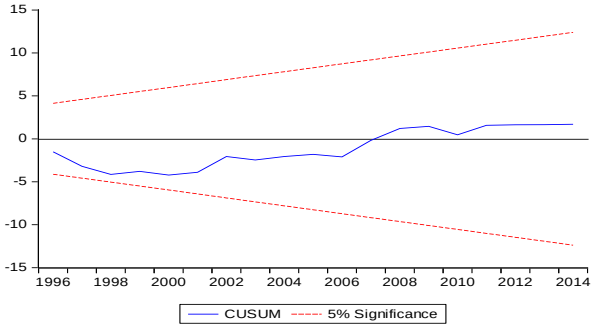

Figure 20. The Gambian ERPT CUSUM

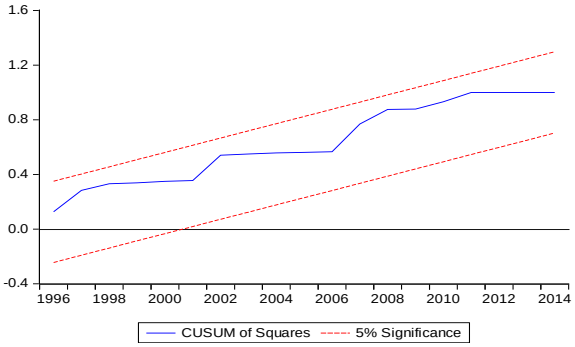

Figure 21. The Gambian ERPT CUSUM of Squares

General Modelling of the ARDL for the ERPT: Given the selected lag length and the confirmation that the estimated *ERPT* models are optimal, this section presents the general modeling of the ARDL for the ERPT of WACCs. The presentations of Table 6 and Table 7 are the general modeling of both ARDL and NARDL models, which are subsequently used for bound test of long-run relationships, and it is also used for testing the presence of asymmetry in the NARDL model.

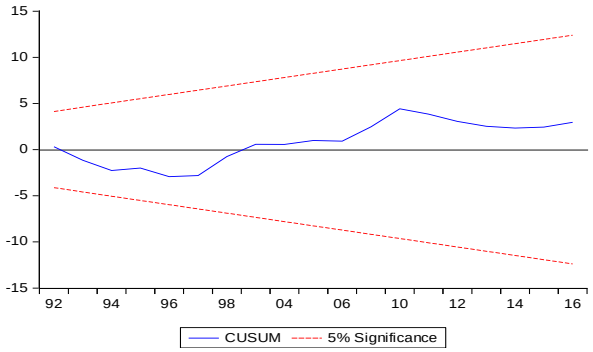

Figure 22. Sierra Leone ERPT CUSUM

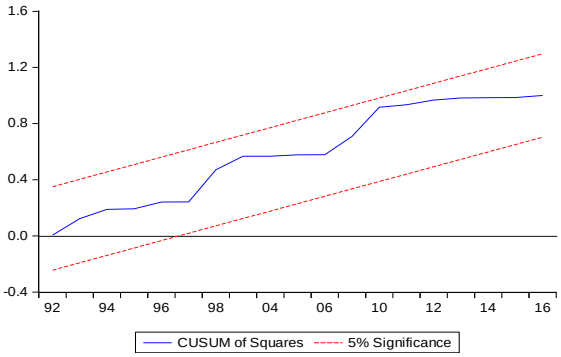

Figure 23. Sierra Leone ERPT CUSUM of PT of Squares

Table 6. General Modelling of the ARDL for ERPT of WACCs

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
	0.84***	0.14	-0.19	0.23**
LINF(-1)	(0.00)	(0.36)	(0.25)	(0.03)
	-0.37*	--	0.40**	
LINF(-2)	(0.09)		(0.01)	--
	0.34	--	--	--
LINF(-3)	(0.16)			
	0.01	--	--	--
LINF(-4)	(0.97)			
	-0.20	--	--	--
LINF(-5)	(0.25)			
	-0.47**	--	--	--
LINF(-6)	(0.01)			
	0.11	1.59***	2.92***	1.77***
CLEXC	(0.82)	(0.00)	(0.00)	(0.00)
	1.77***	-0.52*	1.93**	--
CLEXC(-1)	(0.00)	(0.08)	(0.03)	
	1.91***			
CLEXC(-2)	(0.00)	--	--	--
	-0.03	-0.98	0.21	-0.80
LBRAG	(0.87)	(0.29)	(0.18)	(0.10)
	--	2.70**	--	0.65
LBRAG(-1)		(0.03)		(0.17)
	--	-1.73*	--	--
LBRAG(-2)		(0.05)		
	-0.33	0.12	0.10	-1.44***
LGDP	(0.54)	(0.81)	(0.89)	(0.00)
	-0.56	-1.12*	-0.26	--
LGDP(-1)	(0.36)	(0.05)	(0.76)	
	1.09**		-1.30*	
LGDP(-2)	(0.02)	--	(0.08)	--
	-0.66	0.15	-3.13**	0.54***
LTB	(0.12)	(0.81)	(0.03)	(0.00)
	-1.33***	1.12	2.43*	
LTB(-1)	(0.00)	(0.11)	(0.07)	--
	-1,35***	-1.35*		--
LTB(-2)	(0.00)	(0.07)	--	
	-0.51	0.14	0.37	1.48***
LGOV	(0.23)	(0.73)	(0.40)	(0.00)
	0.64	0.07	--	--
LGOV(-1)	(0.13)	(0.88)		
	-1.19**	0.70**		--
LGOV(-2)	(0.01)	(0.03)	--	
	-0.96	6.76*	13.80*	8.66***
C	(0.83)	(0.07)	(0.09)	(0.00)
R^2	0.93	0.81	0.85	0.96
Adjusted R^2	0.81	0.67	0.75	0.94

Note: "*" "**" "***" are as noted in Table 1.

Table 7. General Modelling of the NARDL for ERPT of WACCs

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
	0.08	0.40**	-0.20	0.10
LINF(-1)	(0.72)	(0.06)	(0.30)	(0.53)
	—	—	0.40**	—
LINF(-2)			(0.04)	
CLEXC_POS	-0.64	3.35**	2.81**	1.82***
	(0.24)	(0.01)	(0.04)	(0.00)
CLEXC_POS(-1)	1.77*	-0.85	2.53	0.72
	(0.05)	(0.41)	(0.23)	(0.17)
CLEXC_POS(-2)	2.81***	1.92**	—	—
	(0.00)	(0.05)		
CLEXC_NEG	3.04**	3.02**	3.42	1.56***
	(0.02)	(0.02)	(0.10)	(0.00)
CLEXC_NEG(-1)	2.55**	0.10	1.67	—
	(0.02)	(0.86)	(0.18)	
CLEXC_NEG(-2)	0.01	-0.75	—	—
	(0.99)	(0.15)		
	0.55	—	—	—
CLEXC_NEG(-3)	(0.21)			
	-2.13	-1.90**	0.14	-0.58**
LBRAG	(0.90)	(0.05)	(0.67)	(0.04)
	6.89**	3.14**	—	1.03**
LBRAG(-1)	(0.01)	(0.01)		(0.04)
	-3.39**	-1.66**	—	—
LBRAG(-2)	(0.01)	(0.03)		
	1.11**	0.51	0.07	-0.92*
LGDP	(0.07)	(0.32)	(0.94)	(0.07)
	—	-1.40**	-1.33**	—
LGDP(-1)		(0.02)	(0.09)	
	0.39	-0.31	-3.37**	0.38*
LTB	(0.51)	(0.75)	(0.05)	(0.06)
	-0.45	0.75	2.46	—
LTB(-1)	(0.39)	(0.26)	(0.11)	
	-0.88**	-1.97**	—	—
LTB(-2)	(0.09)	(0.01)		
	-0.22	0.42	0.34	1.32**
LGOV	(0.62)	(0.32)	(0.50)	(0.01)
	-0.63	-0.53	—	—
LGOV(-1)	(0.22)	(0.26)		
	-1.10**	0.98**	—	—
LGOV(-2)	(0.02)	(0.00)		
	-13.33**	7.27**	17.71	9.95***
C	(0.05)	(0.07)	(0.27)	(0.00)
R^2	0.8903	0.8728	0.7998	0.9612
Adjusted R^2	0.7260	0.7093	0.6733	0.9449

Note: "*" "**" "***" are as noted in Table 1.

Bound Test for Cointegration: Bounds tests have been conducted, based on both the ARDL and the NARDL estimations. The results of the ARDL estimations indicated the presence of long-run relationships amongst the variables using Pesaran Shin and Smith's critical values, in all the countries, as the *F*-statistics values of 5.68 and 9.83 for Nigeria and Ghana, respectively, are higher than the corresponding critical value of I(0) 3.41 and I(1) 4.68 at one percent level. Also, the *F*-statistics values of 6.39 and 5.32 for the Gambia and Sierra Leone, respectively, are higher than the corresponding critical values of I(0) 3.41 and I(1) 4.68 at one percent level.

The NARDL estimations also indicated the presence of long-run relationships among the variables based on the Pesaran Shin and Smith's critical values, in all the countries. Starting with Nigeria, the Bound test result shows the presence of a

long-run relationship at one percent with the value of F-statistic 5.48 over the critical values of I(0) 3.15 and I(1) 4.43 at one percent based on Pesaran Table. Similarly, in Ghana, a long-run relationship exists at one percent with an F-statistics value of 6.73 above the critical values of I(0) 3.15 and I(1) 4.43 at one percent. In the same vein, the long-run relationship has been confirmed in the Gambia at five percent, having the value of F-Statistic of 4.40 over the critical values of I(0) 2.45 and I(1) 3.61 at five percent. Finally, the long-run relationship of the *ERPT* for Sierra Leone is also established at one percent, with the value of F-statistics 7.30 over the critical values of I(0) 3.95 and I(1) 4.43 at one percent.

The Test for Asymmetry: In addition to the Bound test, the test for asymmetry is conducted using the general model of the NARDL presented in Table 7. The test is conducted based on the Wald test by restricting the estimated coefficients of both the positive and negative shocks of the exchange rate and equate them to zero as the null hypothesis, which indicates that the model is symmetric, rejecting the null signifies the existence of asymmetry. The results show that there exists an asymmetric relationship between exchange rate shocks and inflation in all the countries. The Wald test estimated the F-statistic values of 4.43 (probability; 0.01), 4.79 (probability; 0.01), 3.20 (probability; 0.04), and 18.31 (probability 0.00), for Nigeria, Ghana, the Gambia, and Sierra Leone, respectively. The null hypothesis of non-asymmetry is rejected at five percent in all countries except Sierra Leone, where the null hypothesis was rejected at one percent, as shown in the probability values.

The Long-Run Results: The results of the long-run for the *EPRT ARDL* model, presented in Table 8, reveal the existence of positive *ERPT* in all the countries. The table reveals that all coefficients of the exchange rate (*CLEXC*) for all the countries are statistically significant at a five percent level of significance in Nigeria, Ghana, and the Gambia, while that of Sierra Leone, it is statistically significant at one percent level. It means that a change in CLEXC is positively affecting inflation (LINF) in all the countries. For instant, a one percent change in CLEXC causes a 4.43 percent change in the LINF in the same direction in Nigeria. This is in accord with the findings of Ogundipe and Samuel (2013) and Usman and Musa (2018) studies from Nigeria.

Similarly, in Ghana, a one percent change in the CLEXC rate leads to a change in the LINF in the same direction, by 1.24 percent. This result is in accord with the findings of Adu and Marbuah (2011) in Ghana and the result of the asymmetry of Amoah and Aziakpono (2018), though, contrary to their findings on non-asymmetry in the same country. Moreover, in the Gambia, a one percent change in the CLEXC causes a 6.14 percent change in the LINF in the same direction. This result is similar to that of Mawajje and Lwanga (2016) in Uganda and Jobarteh (2016) in the Gambia. Also, a one percent change in the LEXC in Sierra Leone leads to a 2.29 percent change in LINF in the same direction in the country. This result is in accord with the findings of Campa, Goldberg and Gonzalez-Minguez (2005) in the Euro area and the finding of Bangura, Caulker and Pessima (2016) in Sierra Leone.

This implies that the *ERPT* to inflation during the long run of WACCs is complete having a coefficient value of more than one percent. The *ERPT* is higher in the Gambia which having the biggest coefficient, followed by Nigeria, then Sierra Leone, Ghana has the least *ERPT* among the WACCs. The completeness of the WACCs *ERPT* to inflation could be as a result of the fact that WACCs and other developing African nations are highly depended on the importation of most of the goods and services for consumption and daily usage.

Furthermore, the insignificant effect of the money supply is in all the countries except Sierra Leone, where, surprisingly, it has a disinflationary effect. Nevertheless, GDP is significant, with an anticipated disinflationary effect, in explaining the change in inflation in all the countries except Nigeria. Whereas, the trade balance is insignificant in explaining the fluctuations of the *LINF* in Ghana and the Gambia, and it is statistically significant in Nigeria and Sierra Leone, but in Nigeria, it has a disinflationary effect while in Sierra Leone it has an inflationary effect. Finally, government expenditure is significant in explaining inflation rate fluctuations in all the countries except in Nigeria.

The findings of the study are also in accord with the theoretical arguments of *ERPT* theory, as the theory postulated that the rise in general prices, especially in developing countries, is majorly caused by the excessive devaluation of local currencies in such countries. That is to say, an increase in the CLEXC (devaluation of local currencies in WACCs) depreciates their legal tender and leads to the increase in prices of imported goods and more pressure of the demand of the locally produced goods, consequent to increase in the general prices of commodities (inflation).

The outcomes of the long-run results for *EPRT NARDL* model presented in Table 9, reveals the existence of positive *ERPT,* on both the positive and negative shocks of the CLEXC in the majority of the countries. The positive and negative shocks of the CLEXC are inflationary in Nigeria, the Gambia, and Sierra Leone, while in Ghana, it is only the positive shock that is inflationary as the negative shock is insignificant.

Table 8. The ERPT ARDL Long-Run Results

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
CLEXC	4.43**	1.24**	6.14**	2.29***
	(0.04)	(0.02)	(0.01)	(0.00)
LBRAG	-0.03	-0.02	0.26	-0.19***
	(0.88)	(0.78)	(0.19)	(0.00)
LGDP	0.23	-1.17**	-1.51**	-1.86***
	(0.72)	(0.03)	(0.01)	(0.00)
LTB	-2.35*	-0.09	-0.89	0.70***
	(0.05)	(0.91)	(0.52)	(0.00)
LGOV	-0.04	1.05*	0.46	1.92***
	(0.91)	(0.09)	(0.43)	(0.00)
C	-1.12	7.84*	17.46**	11.23***
	(0.84)	(0.05)	(0.03)	(0.00)

Note: "*" "**" "***" are as noted in Table 1.

Changes in either the positive shocks or the negative shocks of the CLEXC by one percent leads to; the change in LINF by either 4.28 or 6.69 percent for CLEXC_POS and CLEXC_NEG as the case may be (in the same direction) in Nigeria; while in the Gambia the changes in LINF will be by 6.68 and 6.36 percent, respectively. Similarly, in Sierra Leone, the changes of LINF will be by 2.81 and 1.73 percent. It only in Ghana that the CLEXC_POS changes lead to the changes in LINF by 7.42 percent, while CLEXC_NEG is insignificant. This implies that exchange rate fluctuations are inflationary, more especially, devaluation of currency in all the countries; hence, exchange rate stabilization is necessary to avoid inflation in WACCs.

Table 9. The ERPT NARDL Long-Run Results

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
	4.28**	7.42*	6.68**	2.81***
CLEXC_POS	(0.04)	(0.08)	(0.03)	(0.00)
	6.69***	3.96	6.36*	1.73***
CLEXC_NEG	(0.00)	(0.12)	(0.05)	(0.00)
	1.48**	-0.70	0.17	-0.64**
LBRAG	(0.02)	(0.18)	(0.69)	(0.05)
	1.20	-1.49	-1.58**	-1.02*
LGDP	(0.10)	(0.13)	(0.03)	(0.09)
	-1.03	-2.57	-1.14	0.42**
LTB	(0.43)	(0.36)	(0.52)	(0.04)
	-2.12***	1.46	0.42	1.46**
LGOV	(0.00)	(0.22)	(0.52)	(0.02)
	-14.50**	12.18**	22.15	11.01***
C	(0.06)	(0.03)	(0.17)	(0.00)

Note: "*" "**" "***" are as noted in Table 1.

The Short-Run Results: Offered in Table 10 is the short-run result of the *EPRT* to inflation. The table reveals that during the short run, the coefficients of the *CLEXC* are statistically significant at one percent level, in all the countries except Nigeria, where the coefficient is statistically insignificant. It means that the CLEXC is positively affecting the LINF in Ghana, the Gambia, and Sierra Leone, whereas it has no significant effect in Nigeria. For instant, a one percent increase in CLEXC in Ghana during the short run leads to a 1.59 percent change in the LINF in the same direction. Similarly, a one percent change in the CLEXC in the Gambia and Sierra Leone results in a 2.92 and 1.77 percent change in their LINF, respectively, in the same direction. The result also reveals that the speeds of adjustments towards long-run equilibrium (ECT) are statistically significant in all the countries. The *ECT* is significant at five percent in Nigeria, and it is significant at one percent in the rest of the countries. It means that the speed at which short-run changes or adjust toward long-run equilibriums are 86 percent, for Nigeria and Ghana, and 79 percent and 77 percent for the Gambia, and Sierra Leone, respectively. The speeds of adjustments, towards the long-run equilibriums in all the countries, are relatively fast. It is faster in Nigeria and Ghana, followed by the Gambia, then Sierra Leone.

The short-run outcomes of the NARDL results presented in Table 11 reveals that the *ERPT* exist in all the countries. Starting with Nigeria, negative ERPT exists for the positive shocks of the change in exchange rate (CLEXC), but it is only significant after the first year. This signifies that an increase in the positive shocks of the CLEXC by one percent results in a decrease in the rate of inflation (LINF) by 2.81 percent after one year in the short run.

Table 10. Short-Run Results of the ARDL ERPT Estimations

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
D(LINF(-1))	0.69**	--	-0.40**	--
	(0.01)		(0.01)	
D(LINF(-2))	0.33	--	--	--
	(0.24)			
D(LINF(-3))	0.67**	--	--	--
	(0.03)			
D(LINF(-4))	0.68**	--	--	--
	(0.01)			
D(LINF(-5))	0.47**	--	--	--
	(0.01)			
D(CLEXC)	0.11	1.59***	2.92***	1.77***
	(0.82)	(0.00)	(0.00)	(0.00)
D(CLEXC(-1))	-1.91***	--	--	--
	(0.00)			
D(LBRAG)	-0.03	-0.98	0.21	-0.80
	(0.88)	(0.29)	(0.18)	(0.10)
D(LBRAG(-1))	--	1.73*	--	--
		(0.05)		
D(LGDP)	-0.33	0.12	0.10	-1.44***
	(0.54)	(0.81)	(0.89)	(0.00)
D(LGDP(-1))	-1.09**		1.21	--
	(0.02)	--	(0.10)	
D(LTB)	-0.66	0.15	-3.13**	0.54***
	(0.12)	(0.81)	(0.03)	(0.00)
D(LTB(-1))	--	1.35*	--	--
		(0.07)		
D(LGOV)	0.51	0.14	0.37	1.48***
	(0.23)	(0.73)	(0.40)	(0.00)
D(LGOV(-1))	1.19**	-0.70**	--	--
	(0.01)	(0.03)		
ECT(-1)	-0.86**	-0.86***	-0.79***	-0.77***
	(0.01)	(0.00)	(0.00)	(0.00)

Note: "*" "**" "***" are as noted in Table 1.

Meanwhile, negative shocks of the CLEXC have a positive effect on LINF, having a coefficient of 3.05 that is significant at five percent. This denotes that an increase in the negative shocks of the CLEXC by one percent results in a 3.05 percent increase in LINF in the short run. In Ghana, the short-run result shows that both the positive and negative shocks of the CLEXC have a positive effect on LINF (existence of complete and positive ERPT from both negative and positive shocks of the CLEXC). The positive shocks are more inflationary than the negative shocks (3.35 and 3.02 percent). On the other hand, in the Gambia, it is only the coefficient of the positive shocks of the CLEXC that is significant at five percent, which implies the existence of complete and positive *ERPT* as a one percent increase in the CLEXC_POS by one percent results in 2.81 percent increase in LINF. The short-run results of Sierra Leone confirm its long-run results, as both the negative and positive shocks of the CLEXC have a positive influence on inflation. Specifically, one percent positive shocks of the CLEXC lead to a 1.82 percent increase in the LINF, whereas one percent negative shocks of the CLEXC lead to a 1.56 percent increase in the LINF, and they are significant at one percent level. The speeds of adjustments towards long-run equilibrium are all significant, and they are very fast as in less than two short-run periods, the economy reaches the long run. In Nigeria, it adjusts at 92 percent at every period of the short-run while it adjusts at 60 percent in Ghana, 80 percent in the Gambia, and 90 percent in Sierra Leone.

Table 11. Short-Run Results of the NARDL ERPT Estimations

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
D(LINF(-1))	--	--	-0.40**	--
			(0.04)	
D(CLEXC_POS)	-0.64	3.35**	2.81**	1.82***
	(0.24)	(0.01)	(0.04)	(0.00)
D(CLEXC_POS(-1))	-2.81***	-1.92*	--	--
	(0.00)	(0.05)		
D(CLEXC_NEG)	3.05**	3.02**	3.42	1.56***

Countries: -	Nigeria	Ghana	The Gambia	Sierra Leone
Variables	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)	Coefficient (Probability)
	(0.02)	(0.02)	(0.10)	(0.00)
D(CLEXC_NEG(-1))	-0.01	0.75	--	--
	(0.99)	(0.15)		
D(CLEXC_NEG(-2))	-0.55			
	(0.21)			
D(LBRAG)	-2.13*	-1.90*	0.14	-0.58**
	(0.09)	(0.05)	(0.67)	(0.04)
D(LBRAG(-1))	3.39**	1.66**	--	--
	(0.01)	(0.03)		
D(LGDP)	1.11*	0.51	0.07	-0.92*
	(0.07)	(0.32)	(0.94)	(0.07)
D(LTB)	0.39	-0.31	-3.37**	0.38*
	(0.51)	(0.75)	(0.05)	(0.06)
D(LTB(-1))	0.88*	1.97**	--	--
	(0.09)	(0.01)		
D(LGOV)	-0.22	0.42	0.34	1.32**
	(0.62)	(0.32)	(0.50)	(0.01)
D(LGOV(-1))	1.10**	-0.98***	--	--
	(0.02)	(0.00)		
	-0.92***	-0.60**	-0.80***	-0.90***
ECT(-1)	(0.00)	(0.01)	(0.00)	(0.00)

Note: "*" "**" "***" are as noted in Table 1.

5. Conclusions

The study evaluates *ERPT* to inflation in WACCs using; ARDL to measure the symmetric nature and NARDL to measure the asymmetric nature of the *ERPT* to inflation. The symmetric short-run results show that there is no evidence of *ERPT* in Nigeria, but complete *ERPT* exists in Ghana, the Gambia, and Sierra Leone. The speeds of adjustments towards long-run equilibrium are very fast, in all the countries, as the economies reach long run in less than two short-run periods. Meanwhile, complete *ERPT* to inflation exists in all the countries during the long run with the highest *ERPT* to inflation in the Gambia, followed by Nigeria then Sierra Leone. Ghana has the least *ERPT* to inflation in the long-run. Similarly, the asymmetric short-run results indicate that positive shock has no immediate effect; hence there is no evidence of ERPT to inflation based on positive shocks of the exchange rate (CLEXC_POS). The negative shocks result in positive *ERPT* to inflation in the country. Meanwhile both the positive and negative shocks indicate the existence of positive *ERPT* to inflation in the rest of the countries. The speeds of adjustments towards the long-run equilibriums of the asymmetry are similar to that of symmetry by reaching the long-run in less than two short-run periods. On the other hand, the long-run asymmetric results reveal that both the positive and negative shocks result in positive *ERPT* to inflation in all the countries. This study recommends that policymakers should provide an enabling environment with the necessary facilities for the full operation of businesses – both services and manufacturing industries to be operating internally. Without this, import substitution strategies and export promotion policies will not effectively work in reducing the demand for and enhancing the supply of foreign exchange, thereby enforcing more pressure on local currency devaluation as exchange rate stability is a necessary means of curbing inflationary pressures in all WACCs countries.

References

Ackley, G. (1959). Administered prices and the inflationary process. *The American Economic Review*, 49(2), 419-430.

Adu, G. & Marbuah, G. (2011). Determinants of inflation in Ghana: An empirical investigation, *South African Journal of Economics (SAJE),* 79(3) 251 – 269.

Amoah, L., & Aziakpono, M. J. (2018). Exchange rate pass-through to consumer prices in Ghana: is there asymmetry? *International Journal of Emerging Markets*, 13(1), 162 - 184

An, L. & Wang, J. (2012). Exchange Rate Pass-Through: Evidence Based on Vector Autoregression with Sign Restrictions, *Open Economies Review,* 23(2), 359 – 380.

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), 93 – 123.

Blackburne, E. F., & Frank, M. W. (2007). Estimation of nonstationary heterogeneous panels. *Stata Journal*, *7*(2), 197 - 208.

Bronfenbrenner, M., & Holzman, F. D. (1963). Survey of inflation theory. *The American economic review*, 53(4), 593-661.

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society. Series B.* 37(2), 149 - 192.

Campa, J. M., Goldberg, L. S., & González-Mínguez, J. M. (2005). *Exchange-rate pass-through to import prices in the Euro area* (No. 219), Federal Reserve Bank of New York Staff Reports.

Coleman, S. (2010). Inflation persistence in the Franc zone: Evidence from disaggregated prices. *Journal of Macroeconomics*, 32(1), 426 - 442.

Danlami, I. A. (2019). Inflation persistence in West African Commonwealth Countries. *Academic Journal of Economic Studies,* 5(3), 80 – 89.

Danlami, I. A., Hidthirr, M. H. & Hassan, S. (2017). Dynamic of inflation in developing economies: A quest for conceptual frame-work. *IOSR Journal of Humanities and Social Science,* 22(10), 53 – 59.

de-Mendonça, H. F., & Tiberto, B. P. (2017). Effect of credibility and exchange rate pass-through on inflation: An assessment for developing countries. *International Review of Economics & Finance*, 50, 196 - 244.

Duesenberry, J. (1950). The mechanics of inflation. *The Review of Economics and Statistics*, 32(2), 144-149.

Ebiringa, O. T. & Anyaogu, N. B. (2014). Exchange rate, inflation and interest rates relationships: an Autoregressive Distributed Lag Analysis. *Journal of Economics and Development Studies, 2(2),* 263 – 279.

Elahi, N., Salimi, F., & Masoomzadeh, E. (2016). Investigating asymmetric effects of monetary shocks on the exchange rate and trade balance, with an Emphasis on inflation targeting. *Procedia Economics and Finance*, 36, 165-176.

Faruqee, H. (2006). Exchange rate pass-through in the euro area. *IMF staff papers*, 53(1), 63-88.

Frisch, H. (1983). *Theories of Inflation,* Cambridge University Press, Cambridge.

Gagnon, J. E., & Ihrig, J. (2004). Monetary policy and exchange rate pass-through. *International Journal of Finance & Economics*, 9(4), 315 – 338.

Gujarati, D. N. & Porter, D. C. (2009). *Basic Econometrics,* McGraw-Hill International Edition, McGraw-Hill, Boston and New York.

Hagger, A. J. (1977). *Inflation Theory and Policy,* The Macmillan Press Limited, London and Basingstoke.

Jalil, A., Tariq, R., & Bibi, N. (2013). Fiscal deficit and inflation: New evidence from Pakistan using a bounds testing approach, *Economic Modeling,* 37, 120 – 126.

Jiang, J., & Kim, D. (2013). Exchange rate pass-through to inflation in China. *Economic Modelling*, 33, 900 – 912.

Karagoz, M., Demirel, B. & Bozdag, G. (2016). *Pass-Through Effect from Exchange Rates to the Price in the Framework of Inflation Targeting Policy: A Comparison of Asia-Pacific, South America and Turkish Economies.* Proceedia – Economic and Finance 38(2016) 438 – 455.

Kennedy, M. M. J. (2011). *Macroeconomic Theory,* Asoke K. Ghosh, PHI Learning Private Limited, M – 97, Connaught Circus, New Delhi-110001.

Koenker, R. & Bassett, G. (1982). Robust Tests for Heteroscedasticity Based on Regression Quantiles, *Econometrica,* 50(1), 43 – 61.

Lafleche, T. (1996). *The Impact of Exchange Rate Movements on Consumer Prices*., Bank of Canada Review, Winter, 1996-1997, 21-32.

Leigh, D., & Rossi, M. (2002). *Exchange rate pass-through in Turkey.* IMF Working Paper, WP/02/204, available at www.imf.org retrieved on 28/12/2016.

Mawajje, J. & Lwanga, M. M. (2016). Inflation dynamics and agricultural supply shocks in Uganda, *African Journal of Economic and Management Studies,* 7(4) 547 – 567.

Ogundipe, A. A., & Samuel, E. (2013). Exchange rate pass-through to consumer prices in Nigeria. *Journal of Business Management and Applied Economics, 2(4) 1 - 10*.

Phiri, A. (2012). Threshold effects and inflation persistence in South Africa, *Journal of Financial Economic Policy,* 4(3) 247 – 269.

Risso, W. A. & Sanchez-Carrera E. J. (2009). Inflation and Mexican economic growth: long-run relation and threshold effects. *Journal of Financial Economic Policy* 1(3) 246 – 263.

Samuel, H. & Nurina, S. (2015). *Analysis of the Effect of Inflation, Interest Rates and Exchange Rates on Gross Domestic Product (GDP) in Indonesia.* Proceeding of International Conference on Global Business, Economics, Finance and Social Sciences (GB15_Thai Conference) Bangkok, Thailand, 20 – 22.

Savoie-Chabot, L., & Khan, M. (2015). *Exchange rate pass-through to consumer prices: Theory and recent evidence* (No. 2015-9). Bank of Canada Discussion Paper.

Sek, S. K., Teo, X. Q. & Wong, Y. N. (2015). *A Comparative Study on the Effects of Oil Price Changes on Inflation. 4th World Conference on Business, Economics and Management, WCBEM*. Proceedia Economics and Finance 26 (2015), 630 – 636.

Shin, Y., Yu, B. and Greenwood-Nimmo, M.J. (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. In William C. Horrace and Robin C. Sickles (Eds.), *Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications*, 281 - 314. New York (NY): Springer Science & Business Media.

Tandrayen-Ragoobur, V., & Chicooree, A. (2013). Exchange rate pass-through to domestic prices: Evidence from Mauritius. *Journal of Economic Research*, 18(1), 1 – 33.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, 66(1-2), 225-250.

Usman, O. & Musa, M. S. (2018). Revisiting Exchange Rate Pass-Through to Consumer Price Inflation in Nigeria: A Cointegrated Vector Autoregressive Approach, *Academic Journal of Economic Studies,* 4(1), 60 – 67.

Yanamandra, V. (2015). Exchange rate changes and inflation in India: What is the extent of exchange rate pass-through to imports? *Economic Analysis and policy*, *47(2015)*, 57- 68.