Asian Journal of Economics, Business and Accounting

22(22): 223-236, 2022; Article no.AJEBA.88734
ISSN: 2456-639X

Exchange Rate Regimes, Import Prices and Foreign Reserve Holdings in Africa

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJEBA/2022/v22i2230725

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/88734

Original Research Article

Received 25 May 2022
Accepted 29 July 2022
Published 06 September 2022

ABSTRACT

In this study, we examined dynamic interaction between exchange rate regimes, import prices and foreign reserve holdings in developing countries. Monthly data for the study were obtained on five African countries from 1980M1 to 2020M12. Recognizing that our sample of nations may not be homogenous due to unobserved characteristics of the individual countries such as, economic size, or differences in financial strength, we modelled reserve holding following P-ARDL specifications of Pesaran, Shin & Smith (1995) which recognizes the MG and PMG modeling in error correction configurations. The Hausman test reveals that MG was more efficient compared to PMG. To check robustness of our MG estimates, we had an alternative GMM specification. The GMM estimation was also necessitated to overcome simultaneity biases and endogeneity problems that characterized OLS estimation of our P-ARDL model. Findings showed that exchange rate regime is a significant positive contributor to the volume of reserve holdings while import prices negatively influences reserve holdings. Relatively, study reveals negative contributions of cost of holding reserves, and inflation towards declining reserve holding in selected countries of Africa is highly significant in both SR and LR. Nevertheless, significant heterogeneity exists amongst countries as regards speed of adjustment following disturbances in SR reserve holding to LR convergence. Nigeria had the fastest speed of 61% compared to Angola, Kenya, South Africa, and Egypt with 49%, 20%, 50%, and 19% respectively. Differences in economic strength, economic size (GDP), government factor, political size, financial depth, etc. of countries could have accounted for the

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difference in adjustment speed. Our MG estimates were found robust to a GMM specification. The study concludes that there is a dynamics interaction between exchange rate regime, import prices and foreign exchange reserves holding. We so recommended that African countries should strategically implement policies to reduce their inflation rates, dependence on import, effectively manage exchange rate regime so that they can achieve higher volume of external reserve holdings that will lead to a reduction in their import prices.

Keywords: Exchange rate regimes; import prices; foreign reserve holdings; African countries.

JEL Classification: C4, D56, M20.

1. INTRODUCTION

Exchange rate is a key relative price that connects the domestic and global markets for goods and assets. It is an indication of a country's competitiveness in a pure market with the rest of the world, and hence a vital anchor that supports the maintenance of both domestic and external macroeconomic balances (Aliyu, 2008). Exchange rate fluctuations have the potential to damage a country's export competitiveness and hurt economic agents' revenue and the balance of payments. As a result, producers' and/or exporters' perceptions of risk will indicate the probability of revenue unpredictability. As a result, future output and export will diminish as traders become risk-averse, especially if such uncertainties/risks are regarded to be time changing, unpredictable, and irregular. In the absence of appropriate hedging measures, the damage could be more severe (Balogun, 2007).

Exchange Rate Regimes (ERR) of any country represents a reflection of the choices made by countries at the time of their independence as well as a reflection of the trends in exchange rate arrangement for the advancement of macro-economic aggregates leading to a sustained economic development of such countries. According to Obadan [1], since early globalization and emergence of financial crises represents the two developments that have pointed exchange rate system implemented by countries. Nevertheless, despite the monumental benefit of globalization, bulky capital flows have resulted in currency and financial crises (Ben Romdhane et al., 2022; Loukil et al., 2019; Ben Romdhane et al., 2019).

Even when exchange rates are fixed most time, monetary authorities still proceed to adjust same for purpose of ensuring avoidance of unwarranted volatility which is synonymous with floating exchange rate, as well as to prevent comparative depreciations (IMF, 2013). From the fore-going it is evident that a country needs FER to conduct trade and other economic activities especially imports and to determine the price to pay for its imports at any point in time a country needs to put in place are desirable exchange regime.

According to Essein, Uyaebo & Omotosho (2017), a successful exchange rate policy should ease external and internal balances within the economy. However, currency and financial crisis of the 1990s have migrated to the polar exchange regimes (flexible or fixed exchange rates) of developing nations. This is because intermediate regimes between the two polar regimes are considered untenable since there these nations are indeed confronted with the dilemma of impossible trinity (Obadan, 2009). Today, experts cannot claimed to completely ascertain workable exchange rate regime for developing West African Countries especially when empirical results have shown mixed outcome about the relationship between ERR and International reserves which then gives the country a desirable trading (import) situation. The management of ERR in developing countries have been difficult especially where developing countries do not operate free float ERR.

It so becomes desirous to ascertain ERR that could furnish optimal exchange reserves for the best possible trading relations for developing countries, this is because a currency misalignment can result into a host of macroeconomic draw-back for developing countries especially on the country's employment level, trade competiveness and inflationary level of the country. The study therefore has as objectives to estimate the impact of import prices and exchange rate regime on volume of foreign reserves holding among selected developing African countries. This research has section two as conceptual review, theoretical review, empirical review and gaps in previous works.

Section three involves, the theoretical framework, model specification, the estimation techniques and the data source. Section four takes care of data presentation and analysis while finally, section five is made up of summary of findings, conclusion and policy recommendations.

2. REVIEW OF LITERATURE

Various forms of ERR opened to different countries ranged from flexible ERR to fixed ERR with a host of other ERR falling in a continuum between the two extreme [1]. Different types of ERR have different pros and cons to both choices [2]. A number of researchers have identified FERH as one very important determinant [3]. Adegboye, Efuntade & Efuntade [4] basis analysis on econometric estimations examine the relationship between external research holdings and trade in Nigeria (1981-2017). The result shows that exchange rate amongst other variables had positive impact on external. According to a World Bank report [5], international trade activities depend largely on external reserves, however, the report noted that despite the benefits of foreign trade on external reserve, the high import dependent prevalent among developing countries has made it a constraint on FERH because it constitutes a leakage to external reserve.

To Sanusi, Meyer & Hassan [6] FERH in Southern African countries is determined on basis of floating ERR. The findings supported work of Calvo & Reinhast [7] that most developing economies do not operate a floating ERR as they claim, instead vary their reserves to even out exchange value of home currencies whenever financial crises visit. To Olomola & Ajayi [8], volatilities in exchange rates adversely influnce FERH of West African countries. The analysis was driven by panel ARDL technique.

At a disaggregated level, Olayungbo & Akinbobola (2011) found that FERH significantly influence nominal and real interest rate in Nigeria on the short-run. In their study for Pakistan (1973 – 2008), Tariq, Haq, Jan, Jehangir & Aamir [9] found that FERH in Pakistan was informed by real exchange rate depreciation. Using Reinhart & Rogoffs new exchange rate arrangement Choi & Back [10] found that ERR and FERH are related in an inverted U relationship. What this means in effect is that FERH are smaller under hard pegs and freely floating regimes. Gopinath, Itshoki & Rigobon (2007) estimated 0.25 as the average long-run exchange rate pass-through when imported items are not priced in dollars while if priced in dollars, it is 0.95. Abrishami & Mehrara [11] reported parallel market exchange rate as main determinant of import demand.

To Nteegah & Okpoi [12], oil and non-oil export had positive consequence on reserves as against oil-non-oil imports that disrupts FERH in Nigeria. From the foregoing analysis one may conclude that lower prices for crude oil and other primary agricultural products which are the major export earner for most developing countries leads to the depletion of their FERH, making their economies to be vulnerable as trades who make use of foreign exchange for their FERH and imports will have a short supply leading to a possible increase in the prices of imports. It means that lower FERH leads to increase in the prices of imports.

2.1 Gaps in Reviewed Literature

Unlike previous studies, this study uses both the Panel ARDL and the Panel GMM simultaneously out to capture the simultaneous impact of ERR, and import prices on FERH in developing countries which no other researcher had adopted in accordance with our facts. These is the gap the study sets out to fill.

3. METHODOLOGY

Our methodology is purely econometrical which entails stating our research hypothesis which conjectures theoretical foundation, econometric model specification, obtaining data, estimating parameters, testing theory, and using estimated model for policy discussion. The study submits to mercantilist theoretical foundation of the relationship between ERR, import prices and FERH is the mercantilist theory which states that countries amass reserve holdings to strengthen exchange rate for trade purpose and also gain advantage in international competitiveness. The theoretical postulations of Olomola & Ajayi [8], Gurd [3] and Aizenman et al [14], it is discovered that ERR has a positive relationship with FERH, this is because every country intends to operate an that will ensure stability in its macroeconomic variables including FERH, hence in this analysis we expect in ERR > 0. In line with theories on the relationship between import price and FERH such as Nteegah & Okpoi [12] and Abdulateef & Waheed [15], import prices have a direct negative relationship with FERH, this is because the higher the FERH the more stable the prices of import while a scarcity of FERH leads to

higher import prices because exporters would seek for alternative measures in getting foreign currency. In line with Choi, & Beak [10] interest rate on the other hand is exhibiting a negative relationship with FERH in line with the findings of Ken [16].

3.1 Mean Group (MG) and Pooled Mean Group (PMG) models

In our model specification, we recognized our sample, namely, Nigeria, South Africa, Egypt, Kenya and Angola may not be homogenous due to unobserved characteristics of the individual countries such as, political factor, environmental factor, economic size, differences in growth or development, financial strength, geographical location, security factor, or governance factor as the case maybe. Hence, we recalled the P-ARDL model based on the specification of Pesaran, Shin & Smith (1995) we specify our FERH equation as follows;

$$\ln FERH_{i,t} = f(\ln ERR_{i,t},\ \ln IMP_{i,t},\ \ln COST_{i,t},\ \ln INF_{i,t}) \quad (1)$$

Empirical formulation of equation (1) becomes as given in equation (2).

$$\ln FERH_{i,t} = \phi_i + \Phi_i \ln FERH_{i,t-1} + \alpha_2 \ln ERR_{i,t} + \alpha_5 \ln IMP_{i,t} + \alpha_4 \ln COST_{i,t} + \alpha_5 \ln INF_{i,t} + e_{it} \quad (2)$$

According to Pesaran et al. (1995), MG model solves any unforeseen biases due to heterogeneous slopes by generating mean values of LR parameters from ARDL equation for each of the countries. Accordingly, MG estimator for each country is given by:

$$\beta_i = \frac{\alpha_i}{1-\Phi_i} \quad (3)$$

MG estimators for panel of all countries becomes:

$$\beta = \frac{1}{N}\sum_{i=1}^{N}\beta_i \quad (4)$$

$$\phi = \frac{1}{N}\sum_{i=1}^{N}\phi_i \quad (5)$$

The PMG was also implemented to ascertain LR and SR effects of predictors on reserve holdings in the selected Africa countries. Thus, in line with Loayza & Ranciere (2006) specification of lagged ARDL (p,q) model in the error correction, equation (2) is subsequently structured into a PMG-ARDL framework as follows:

$$\Delta \ln FERH_{i,t} = \upsilon_{1,it} - \beta_1(\ln FERH - \alpha_0 - \alpha_1 \ln ERR - \alpha_2 \ln IMP - \alpha_3 \ln COST - \alpha_4 \ln INF)_{t-1}$$
$$+\sum_{i=1}^{p-1}\phi_{1,j}\Delta \ln FERH_{1t-i} + \sum_{i=1}^{q-1}\phi_{2,j}\Delta \ln ERR_{1t-i} + \sum_{i=1}^{q-1}\phi_{,j}\Delta \ln IMP_{1t-i} + \sum_{i=1}^{q-1}\phi_{4,j}\Delta \ln COST_{1t-i} + \sum_{i=1}^{q-1}\phi_{5,j}\Delta \ln INF_{1t-i} + \mu_{1t} \quad (6)$$
$$\Delta \ln ERR_{2i,t} = \upsilon_{2,it} - \beta_2(\ln ERR - \alpha_0 - \alpha_1 \ln FERH - \alpha_2 \ln IMP - \alpha_3 \ln COST - \alpha_4 \ln INF)_{t-1} +$$
$$\sum_{i=1}^{p-1}\varphi_{1,j}\Delta \ln ERR_{2t-i} + \sum_{i=1}^{q-1}\varphi_{2,j}\Delta \ln FERH_{2t-i} + \sum_{i=1}^{q-1}\varphi_{3,j}\Delta \ln IMP_{2t-i} + \sum_{i=1}^{q-1}\varphi_{4,j}\Delta \ln COST_{2t-i} + \sum_{i=1}^{q-1}\varphi_{5,j}\Delta \ln INF_{2t-i} + \mu_{2t} \quad (7)$$
$$\Delta \ln IMP_{3i,t} = \upsilon_{3,it} - \beta_3(\ln IMP - \alpha_0 - \alpha_1 \ln ERR - \alpha_2 \ln FERH - \alpha_3 \ln COST - \alpha_4 \ln INF)_{t-1}$$
$$+\sum_{i=1}^{p-1}\gamma_{1,j}\Delta \ln IMP_{3t-i} + \sum_{i=1}^{q-1}\gamma_{2,j}\Delta \ln ERR_{3t-i} + \sum_{i=1}^{q-1}\gamma_{3,j}\Delta \ln FERH_{3t-i} + \sum_{i=1}^{q-1}\gamma_{4,j}\Delta \ln COST_{3t-i} + \sum_{i=1}^{q-1}\gamma_{5,j}\Delta \ln INF_{3t-i} + \mu_{3t} \quad (8)$$
$$\Delta \ln COST_{4i,t} = \upsilon_{4,it} - \beta_4(\ln COST - \alpha_0 - \alpha_1 \ln ERR - \alpha_2 \ln IMP - \alpha_3 \ln FERH - \alpha_4 \ln INF)_{t-1}$$
$$+\sum_{i=1}^{p-1}\eta_{1,j}\Delta \ln COST_{4t-i} + \sum_{i=1}^{q-1}\eta_{2,j}\Delta \ln ERR_{4t-i} + \sum_{i=1}^{q-1}\eta_{3,j}\Delta \ln IMP_{4t-i} + \sum_{i=1}^{q-1}\eta_{4,j}\Delta \ln FERH_{4t-i} + \sum_{i=1}^{q-1}\eta_{5,j}\Delta \ln INF_{4t-i} + \mu_{4t} \quad (9)$$
$$\Delta \ln INF_{5i,t} = \upsilon_{5,it} - \beta_5(\ln INF - \alpha_0 - \alpha_1 \ln ERR - \alpha_2 \ln IMP - \alpha_3 \ln COST - \alpha_4 \ln FERH)_{t-1}$$
$$+\sum_{i=1}^{p-1}\rho_{1,j}\Delta \ln INF_{5t-i} + \sum_{i=1}^{q-1}\rho_{2,j}\Delta \ln ERR_{5t-i} + \sum_{i=1}^{q-1}\rho_{3,j}\Delta \ln IMP_{5t-i} + \sum_{i=1}^{q-1}\rho_{4,j}\Delta \ln COST_{5t-i} + \sum_{i=1}^{q-1}\rho_{5,j}\Delta \ln FERH_{5t-i} + \mu_{5t} \quad (10)$$

Where FERH is reserves holding, ERR is exchange rate regime, IMP is imports expenditure, INF is inflation rate, and COST is cost of holding reserves, Δ is difference symbol, υ_{it} is panel error of model; η_i is individual country effects. The operational P-ARDL model for this analysis is specified in logarithm transformation to reduce the nuisance factor in the unit of measurement and to linearize the variable function. To check robustness of our P-ARDL estimates, we had an alternative GMM specification. Accordingly, equation (1) was successively structured following GMM framework.

$$\ln FERH_{i,t} = \phi \ln FERH_{i,t-1} + \gamma \ln IMP_{i,t} + \lambda \ln COST_{i,t} + \rho \ln INF_{i,t} + \eta_i + \varepsilon_{it} \quad (11)$$

Introducing differenced values of variables, our specification in (2) becomes.

$$\Delta \ln FERH_{i,t} = \phi \Delta \ln FERH_{i,t-1} + \gamma \Delta \ln IMP_{i,t} + \lambda \Delta \ln COST_{i,t} + \rho \Delta \ln INF_{i,t} + \Delta \upsilon_{it} \quad (12)$$

The GMM estimation was also necessitated to overcome simultaneity biases and endogeneity problems that characterized OLS estimation of our P-ARDL model and report efficient results amidst limited time dimension.

3.2 Data

We sourced data from various Financial Statistics of IMF, together with World Bank database. The study used the monthly data, 1980M1 to 2020M12 on import prices, and reserve balances. This gives a total of 2400 panel observations for five countries covered in our study, namely, Nigeria, South Africa, Egypt, Kenya and Angola. Exchange rate regimes had coded data based on dummies. The data were pooled consisting of both cross sectional and time series of selected developing countries in Africa. We transformed our variables into logarithm using the following command, genr lFERH = log(FERH), genr lIMP = log(IMP), genr lINF = log(INF), genr lCOST = log(COST). The paper utilized E-views (10) econometric package for the estimation of both models. After conducting stationary test and our series were found as I (1), we proceeded to estimate the P-ARDL having ascertained optimum lag of the model and also conducted causality test in place of correlation analysis.

4. RESULTS AND DISCUSSION

The estimates of the summary statistics are as reported in Table 1.

4.1 Test of Stationary of Variables

The test for presence or otherwise of non-stationarity of variables of our model is carried-out using IPS, Bretiung weighted t, and LLC test. Table 2 report results.

Some of the variables such as import and inflation were stationary at order “0” while the others such as foreign reserve holdings and GDP were stationary at order 1, as the PP and ADF test statistics values are greater than the critical value at 5% with the respective probabilities less the 0.05 at 5% level.

Table 1. Statistical report on variables

Statistic	FERH	COST	IMP	INF	ERR
Mean	28.42565	238.6697	54.88575	38.24696	102.6842
Median	30.08650	242.8515	51.66950	9.350000	79.84800
Maximum	57.58900	568.5000	123.5590	2230.000	640.0000
Minimum	2.416000	25.82600	8.329000	3.220000	5.433000
Std. Dev.	16.35431	151.5088	32.58230	248.2189	123.3549
Skewness	-0.025600	0.176265	0.339275	8.767916	2.207854
Kurtosis	1.691290	1.667261	2.100314	77.92267	8.744830
Jarque-Bera	5.717810	6.334905	4.232880	19736.37	175.0052
Probability	0.057331	0.042111	0.120460	0.000000	0.000000
Sum	2274.052	19093.58	4390.860	3059.757	8214.738
Sum Sq. Dev.	21129.61	1813439	83866.90	4867398	1202099
Observations	900	900	900	900	900

Sources: Authors

Table 2. Stationary test results

Variable	Level			Difference		
	IPS	b. t-stat	LLC	IPS	b. t-stat	LLC
FERH	0.568	-2.084	-5.678**	-10.279***	-14.568	-20.4785***
IMP	-4.592**	1.4710	0.495	-29.482	-17.475***	-14.5784
ERR	1.028	0.579	-0.625	-18.461***	-12.242	19.5894***
INF	-2.901	1.0584	-1.458	-40.572***	-16.589***	15.0279***
COST	2.566	5.860**	-6.970	-15.460***	-10.845	12.4970**

*** and ** denotes significant at 1% and 5% significance level, respectively.

Sources: Authors

4.2 Co-integration of Variable

Table 3 shows co-integration output. The co-integration result clearly indicates LR relationship between exchange rates, import prices and reserve.

The results shows that ERR, imports, income growth and cost of holding reserves all granger causes reserves holdings. However, a bi-causality link exists between reserves and ERR, between reserves and imports, and between reserves and cost of holding same.

The matrix illustration of the D-H causality results is given as follows. The results indicates strong causality from ERR to reserves and FERH to ERR- bi-causality between the two, and also a bi-directional causality between INF and IMP, uni-direction causality from ERR to COST of holding reserves, also, same uni-directional causality from COST to reserves holding is obtained at 5% sig. level.

The optimum lag selected by information criteria is 1 (Appendix A). Given that our variables are co-integrated, the LR ARDL estimated equations are in Table 5.

All variables in the LR estimates are significant and possess the right sign. The LR estimates for reserve holdings shows that all variables are positively significantly influenced by exchange rate regime, opportunity cost of holding reserves, income growth, and imports. However, importation and opportunity cost have adverse effects on the level of reserves holdings at 5% significance level. At this point, we estimated SR Granger causality relations based on block exogeneity assumption. The results are as shown in Table 4.

Table 3. Results of co-integration (Pedroni)

Pedroni				
Common AR coefficients				
Measures	**Statistic**	**Prob.**	**Weighed Statistic**	**Prob.**
v-Statistic	0.622516	0.0008	0.726345	0.008
Rho Statistic	2.180990	0.0004	1.385251	0.000
PP-Statistic	1.455113	0.0002	0.560221	0.003
ADF-Statistic	-1.628660	0.0007	0.711855	0.007
Individual AR coefficients				
rho-Statistic	2.286387	0.9889		
PP-Statistic	1.243930	0.8932		
ADF-Statistic	1.684157	0.9539		
Kao				
Measure	t-statistic			Prob.
ADF	-11.76768			0.000

Sources: Authors

Table 4. Dumitrescu Hurlin (D-H) panel causality results

Null Hypothesis	W-Stat	Z bar-Stat	Prob.
ERR does not homogenously cause FERH	12.478***	6.5896**	0.001
FERH does not homogenously cause ERR	19.291	5.7829**	0.001
COST does not homogenously cause FERH	24.458***	6.8469**	0.002
FERH does not homogenously cause COST	1.7639	0.7892	0.6125
IMP does not homogenously cause FERH	16.469***	4.592	0.003
FERH does not homogenously cause IMP	9.482***	7.678***	0.000
INF does not homogenously cause FERH	5.7287**	3.9817	0.002
FERH does not homogenously cause INF	8.518***	6.7982***	0.000
ERR does not homogenously cause COST	1.2900	-0.298	0.457
COST does not homogenously cause ERR	1.5720	1.051	0.782
ERR does not homogenously cause IMP	14.778***	4.782	0.004
IMP does not homogenously cause ERR	2.049	1.456	0.657
ERR does not homogenously cause INF	5.6789**	4.589	0.001
INF does not homogenously cause ERR	12.582***	6.279**	0.008
COST does not homogenously cause IMP	20.467***	7.528***	0.000
IMP does not homogenously cause COST	16.549***	6.279**	0.000
COST does not homogenously cause INF	10.890***	5.428**	0.001
INF does not homogenously cause COST	9.712***	2.782	0.020
IMP does not homogenously cause INF	40.578***	25.684***	0.000
INF does not homogenously cause IMP	21.478***	20.289***	0.000

***, ** denotes significant at 1%, 5% significance level, respectively.

Sources: Authors

Table 4a. Matrix tabulation of D-H causality results

Variables	$\ln FERH_{i,t}$	$\ln ERR$	$\ln COST$	$\ln IMP$	$\ln INF$
$\ln FERH_{i,t}$	0	$\Rightarrow$	0	$\Rightarrow$	$\Rightarrow$
$\ln ERR$	$\Rightarrow$	0	0	$\Rightarrow$	$\Rightarrow$
$\ln COST$	$\Rightarrow$	0	0	$\Rightarrow$	$\Rightarrow$
$\ln IMP$	$\Rightarrow$	0	$\Rightarrow$	0	$\Rightarrow$
$\ln INF$	$\Rightarrow$	$\Rightarrow$	$\Rightarrow$	$\Rightarrow$	0

Sources: Authors

Table 5. ARDL results

Equation	PMG LR estimates
Eqn (6)	$\ln FERH_{i,t} = (-5.562 + 0.256\ln ERR - 1.029\ln IMP + 1.2578\ln COST - 0.981\ln INF)_{t-1}$
	(–3.289) (9.092) (–5.453) (3.976) (–2.059)
Eqn (7)	$\ln ERR_{i,t} = (4.698 + 0.278\ln FERH - 0.059\ln IMP + 1.250\ln COST - 0.467\ln INF)_{t-1}$
	(2.378) (7.342) (–5.987) (2.546) (–2.980)
Eqn (8)	$\ln IMP_{i,t} = (2.086 + 0.468\ln FERH + 0.125\ln ERR + 0.679\ln COST - 1.065\ln INF)_{t-1}$
	(2.578) (5.098) (–3.679) (2.708) (–2.553)
Eqn (9)	$\ln COST_{i,t} = (1.075 + 0.065\ln FERH - 1.024\ln IMP + 0.872\ln ERR - 0.527\ln INF)_{t-1}$
	(4.569) (2.679) (–2.659) (9.375) (–6.982)
Eqn (10)	$\ln INF_{i,t} = (0.567 + 1.087\ln FERH - 1.034\ln IMP + 0.267\ln COST - 0.265\ln ERR)_{t-1}$
	(5.906) (3.098) (–4.012) (6.689) (–43.087)

t-values in parenthesis

Sources: Authors

4.3 PMG or MG Panel Analysis

From the Table 6, it noticeable that the Hausman Test reveals that MG is more efficient compared to PMG. What this suggest is that there is significant and enormous difference between samples (individual countries) in our study. Thus, there could be estimation bias due to heterogeneous slopes arising from unobserved characteristics, of individual country such as, welfare factor, environmental factor, economic size, differences in growth or development, financial strength, geographical location, security factor, or governance factor. All these factors can affect the estimates if not controlled for, hence, we based empirical discussion on estimates given by average estimator which is the MG estimator accordingly. In effect, we denounce assumption of a LR slope homogeneity, which the PMG estimator offers (Pesaran et al., 1999). Table 6 shows P-ARDL estimation which have to do with PMG and MG results.

The error coefficient is significant at 1% has right signal which is a negative sign showing that about 3.4% of the discrepancy between the actual and equilibrium FERH is connected annually across the chosen county. From the analysis cost of holding reserve balances is significant both on SR and LR having negative sign in both cases. On the other hand, import prices is statistically significant at SR and LR with negative coefficients respectively. This is in line with findings of Hanson, et al (2020). Both INF and ERR are also statistically significant at both SR and LR. The negative coefficient of INF is an indication that a percentage rise in INF magnified to 0.29% and 0.19% weakening in FERH within period at both LR and SR respectively under review. This do not support findings by Nguyen, Nguyen & Hoang [17]. Finally, Exchange Rate Regime (ERR) had a positive relationship with FERH in short-run while it changed to a negative relationship on long-run indicating that 1% growth in ERR hints 0.08% lessening in FERH among selected countries within period under study in line with similar studies with Kalu et al [18].

In sum, study reveals that inflation and import prices are adversely related with FERH in all the countries. In particular, their negative contributions towards declining reserve holding in Africa is highly significant whether in the SR or LR. Relatively, cost of holding reserves in Africa had declining effect on available reserves given its negative coefficient. Moreover, the effects is highly significant at both SR and LR periods respectively. The finding further showed that ERR is a significant contributor to volume of reserve holdings in Africa. Table 7 report estimates of the speed of adjustment among individual countries. From the table Nigeria has the fastest speed of adjustment with a coefficient of 0.61 indicating the speed of adjustment to the long-run to be approximately 61% compared to Angola with 49%, Kenya with 20%, South Africa with 50%, and that Egypt which had 19%. Again, differences in economic strength, economic size (GDP), government factor, political size, financial depth, etc. in these countries could have accounted for the difference in adjustment speed [19-30].

Table 6. P-ARDL estimation results

Variables	PMG		MG	
	LR Coefficient	SR Coefficient	LR Coefficient	SR Coefficient
C		0.6734** (0.002)		1.048*** (0.000)
lnCOST	-0.0977 (0.240)		-0.1275*** (0.000)	
lnIMP	-0.3732*** (0.000)		-0.046*** (0.000)	
lnINF	-0.0661** (0.041)		-0.296*** (0.000)	
lnERR	-0.0593*** (0.000)		0.030** (0.002)	
Hausman Test				0.2964 (0.009)
ECT_{t-1}		-0.4936*** (0.000)		-0.2980*** (0.000)
Δ(lnCOST(-1))		-0.0616**		-0.0529

Variables	PMG		MG	
	LR Coefficient	SR Coefficient	LR Coefficient	SR Coefficient
		(0.012)		(0.016)
Δ (lnIMP)		0.0017***		-0.0742***
		(0.000)		(0.000)
Δ (lnIMP(-1))		0.0059**		-0.1355***
		(0.002)		(0.0000)
Δ (lnINF)		-0.0346***		-0.1920***
		(0.000)		(0.000)
Δ (lnERR)		-0.3786***		0.0814***
		(0.000)		(0.000)
Observations	200	200	200	900
Log likelihood	-146.1866		5.279926	

***, ** denotes significant at 1%, 5% significance level, respectively.

Sources: Authors

Table 7. Individual country speed of adjustment

Nigeria		
Variable	**Coefficient**	**t-values**
ECT_{t-1}	-0.6178	-18.264
Δ (lnCOST(-1))	-0.7254	-97.956
Δ (lnIMP(-1))	-0.1102	-82.871
Δ (lnINF-1))	-0.1795	-206.483
Δ (lnERR-1))	0.2892	151.189
C	8.8622	2.425
Kenya		
Variable	**Coefficient**	**t-values**
ECT_{t-1}	-0.2028	-19.255
Δ (lnCOST(-1))	-0.1979	-100.478
Δ (lnIMP(-1))	-0.0287	-849.576
Δ (lnINF-1))	-0.0192	-244.571
Δ (lnERR-1))	0.0155	140.567
C	0.7691	50.7689
South Africa		
Variable	**Coefficient**	**t-values**
ECT_{t-1}	-0.5068	-120.765
Δ (lnCOST(-1))	-0.0495	-900575
Δ (lnIMP(-1))	-0.0045	-200.497
Δ (lnINF-1))	-0.0178	-459.468
Δ (lnERR-1))	0.0191	165.589
C	29.578	1829.597
Egypt		
Variable	**Coefficient**	**t-values**
ECT_{t-1}	-0.1907	-120.558
Δ (lnCOST(-1))	-1.4784	-10.4556
Δ (lnIMP(-1))	-0.0765	-100.009
Δ (lnINF-1))	-1.4785	-190.563
Δ (lnERR-1))	0.0687	140.576
C	-20.457	1049.566

Angola		
Variable	**Coefficient**	**t-values**
ECT_{t-1}	-0.4902	-248. 458
Δ (lnCOST(-1))	-1.2479	-189.766
Δ (lnIMP(-1))	-1.0920	-29.565
Δ (lnINF-1))	-0.0148	-244.566
Δ (lnERR-1))	1.458	160.789
C	19.578	17828.68

Sources: Authors

Table 8. GMM estimation

Variable	**Coefficient**	**t-statistic**	**Prob.**
COST(-1)	-0.040972	-2.226003	0.0004
IMP(-1)	-0.241718	2.459348	0.0005
INF(-1)	-0.026727	-6.816208	0.0000
ERR(-1)	0.015469	5.692583	0.0003
J-statistic	19.72811	Instrument rank	5
Prob(J-statistic)	0.000009		

Sources: Authors

4.4 Robustness Checks

Our robustness check centred on system GMM estimation which overcomes endogeneity that characterized OLS estimation of our MG model and so its estimates as shown in Table 8 are relatively efficient amidst limited time dimension. This it achieved by permitting moment conditions number to exceed parameters number. So, with such auxiliary information, efficiency of the GMM estimator was secured. As shown in Table 8, our MG estimates are robust to a GMM specification. In this paper, we empirically ascertain effects of high import prices and exchange rate devaluation on accumulation of foreign exchange reserves in thirty African countries drawing empirical strength on monthly data ranging from January 1980 to December 2020. This makes our NT 200 panel observations [31-50].

The GMM estimates for the analysis is presented in Table 8 from where all variables used in the analysis are all significant at 5%. As well, all the variables used in the analysis exhibited significant negative relationship with the dependent variable (FERH) except ERR which exhibited a positive relationship with FERH as it was with MG estimator. Specifically, ERR is observed to be statistically significant with positive impact on FERH. This corroborates findings by Kalu, Ugwu, Ndubuaku & Ifeanyi [18]. The possible explanation for this is that domestic currencies of African countries are mostly substituted for foreign currencies such as the USD during floating regime [51-64].

INF is significant at 5% however, it exhibited a negative relationship with FERH indicating that a percent rise in INF snowballed into 0.23% drop in FERH within period under study in line with the findings of Hanson, Efang, Umoh & Akpan, (2020). The variable COST, although statistically significant at 5% exhibited a negative relationship with FERH within the period under study, thus, a 1% increase in interest cost of holding reserves leads to a 0.05% decrease in FERH, this is in sharp contrast to earlier findings by Hanson et al, (2020). Price of imports is statistically significant at 5% with a negative sign in line with earlier finding by Nteegah & Opkoi [12]. The J-statistic which is a test of the validity (Joint significance) our instrument clearly indicates that the instruments used in the study is valid since the J-static value of approximately 13.61 is significant.

5. CONCLUSION

The rationale for this study is to determine the impact of exchange rate regimes and import prices on FERH in selected developing African countries. From both SR and LR estimates of both the P-GMM and P-ARDL, there is a clear indication that the variables selected are adequate for the analysis, specifically both estimation technique demonstration a negative relationship between IMP and FERH in line with similar findings in other developing countries [12]. ERR had a positive sign. The positive sign

of exchange rate regime of the selected African countries indicates that ERR positively influence foreign exchange reserve holdings of the countries and this directly increases the price level of imports. The results have shown that exchange rate regime could impact positively and negatively on foreign reserve holdings in selected countries of Africa. Effective ERR regime is desirous as this can boost FERH which is one of the indicators of credit worthiness of a country. As well, it will enable them to effectively and efficiently participate in and achieve the objectives of international trade. It is further recommended that African countries should reduce their importation to enable them build-up higher levels of FERH.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Obadan M. Exchange rate regime for developing and emerging markets. A Paper presented at the 3-day International conference on “Central Banking. Financial stability and growth May 4, 2009. Abuja; 2009.
2. Uzoma CN, Odungweru K, Chukwuma-Ogbonna JA. Foreign trade and external reserve n Nigeria. Int J Dev Emerg Econ. 2021;9 No 2:1-6.
3. Arize AC, Malindretos J. Foreign exchange reserves in Asia and its impact on import demand. Int J Econ Fin. 2012;4(3): 21-32.
   DOI: 10.5539/ijef.v4n3p21.
4. Adegboye OS, Eyuntade OO, Eyuntade AO. The relationship between external reserve and trade: Evidence from Nigeria. IOSR JEF. 2019;10(5):21-7.
5. World Bank [report]. Inaugural Reserves Advisory and Management Program (RAMP) survey on the reserve management practices of central banks: results and observations; 2019.
6. Sanusi KA, Meyer DF, Hassan AS. An investigation of the determinants of foreign exchange reserves in Southern Africa countries. J Int Stud. 2019;12(2): 201-12.
   DOI: 10.14254/2071-8330.2019/12-2/12.
7. Calvo GA, Reinhart CM. Fear of floating. Q J Econ. 2002;117(2):379-408.
   DOI: 10.1162/003355302753650274.
8. Olomola P, Ajayi I. The determinants of international reserves in West African States. Global Journal of Human-Social Science. 2018;18(4):1-9.
9. Tariq M, Haq Z, Jan S, Jehangir M, Aamir M. Real Exchange Rate and Foreign Exchange reserves: A Mercantilist View. Life Sci J. 2014;11:(3s).
10. Choi C, Baek S. Exchange rate regimes and international reserves; 2007:Article ·.
11. Abrishamii H, Mehrara M. ARDL approach to the demand for disaggregate import: the case of Iran. Iran Econ Rev. 2000;7(7):87-109.
12. Nteegah A, Okpoi GE. External Trade and its implications on Foreign Exchange Reserves in Nigeria. West Afr J Ind Acad Res. 2016;17(3):108-19.
13. GÜRĐ. Threshold Granger causality test to examine the relationship between ER and EXR in Turkey. J Econ. 2012;127(1).
14. Aizenman J, Riera-Crichton D, Edwards S. The role of exchange rate and international reserves policies. Rev Econ Stat. 2012; 1-20.
15. Abdullateef U, Waheed I. External reserve holdings in Nigeria: Implications for investment, inflation and exchange rate. University, Ilorin, Nigeria. J Econ Int Fin. 2010;2(9):183-9.
16. Ken R. Assessing reserve adequacy. International Myeloma Foundation [policy paper]; 2011.
17. Nguyen KT, Nguyen V, Haong TT. The impact of foreign reserve accumulation on inflation in Vietnam; An ARDL bounds testing approach. Stud Comp Intell. ISSN 1860-949X. 2019.
18. Kalu UE, Ugwu EO, Ndubuaku CV, Ifeanyi PO. Exchange rate and foreign reserve interface; Empirical evidence from Nigeria. The Economics and finance Letters. 2019;6(1):1-8.
19. Abbas S, Nguyen VC, Yanfu Z, Nguyen HT. The impact of China exchange rate policy on its trading partners: evidence based on the GVAR model. J Asian Fin Econ Bus. 2020;7(8):131-41.
    DOI: 10.13106/jafeb.2020.vol7.no8.131.
20. Acar OE. Choice of exchange rate regimes for developing countries. Better be fixed or floating. IBER. 2011;6(12).
21. Adegboyo OS, Efuntade OO, Efuntade AO. The relationship between external reserve and trade: evidence from Nigeria. J Econ Fin. 2019;10(5):21-7.

22. Aizenman J, Marion N. The high demand for international reserves in the far east: what is going on? J Jpn Int Econ. 2003;17(3):370-400.
DOI: 10.1016/S0889-1583(03)00008-X.
23. Akiba H, Iida Y, Kitamura Y. The optimal exchange rate regime for a small country. Int Econ Econ Policy. 2009;6(3):315-43.
DOI: 10.1007/s10368-009-0140-5.
24. Amity M, Heise S, Wang A. High Import prices along the global supply chain feed through to US Domestic imports. Economics. https-//liberty-street. 2021.
25. Bathalomew D. An econometric estimation of the aggregate import demand function for Sia Leone. J Monet Econ Integr. 2010;10(4):5-24.
26. Berdiev AN, Chang CP, Kim Y. The political economy of exchange rate regimes in developed and developing countries. Eur J Pol Econ. 2009;28(1):38-53.
27. Blomberg SB, Frieden J, Stein E. Sustaining peg rates: the political economy of currency pegs in Latin America. J Appl Econ. 2005;8(2):203-25.
DOI: 10.1080/15140326.2005.12040625.
28. Calvo G, Alejandro I, Rudy L. Optimal holdings of international reserves with special reference to balance-sheet effects and sudden stop [mimeo]; 2012.
29. Cheung YW, Qian X, Remolona E. Hoarding of International reserves: It's a neighborurly day in. Asia Pac Econ Rev. 2019;24:2008-240.
30. Diewert WE, Alterman WF, Eden L. transfer prices and import and export price indexes. Theory and practices. Price and Productivity Measurement 1 & 2 Trafford Press; 2005.
31. Englama A, Oputa NC, Sanni GK, Yakub MU, Adesanya O, Sani Z. An aggregate import demand function for Nigeria: an auto-regressive distributed lag (ARDL) approach. Econ Financ Rev. 2013;51 (3).
32. Essien SN, Uyaebo OS, Omotosho SB. Exchange rate misalignment under different exchange rate regimes in Nigeria. CBN J Appl Stat. 2017;8(1).
33. Eun C, Resnick B, Chilum T. International. Financ Manag. 2021:202.
34. osu OE, Magnus JF. Bounds testing approach to cointegration: an examination of foreign direct investment, trade and growth relationships. Am J Appl Sci. 2006;3(11):2079-85. 83.
35. Gasselin M, Parent N. An empirical analysis of FER in emerging ASIA [Bank of Canada working paper]. Ontario, Canada. 2005;2005-08.
36. Gokhale MS, Raju R. Causality between exchange rate and foreign exchange. Glob J Manag Bus Res. 2013:1-12.
37. Guclu M. How do macroeconomic and political variables affect the flexibility of exchange rate regime? Ege Acad Rev. 2009;9(2):823-35.
38. Gudmundson M. The choice and design of exchange rate regimes; 2007. Big. Available from: http://www.bis.org/elents/cbcdd06.pdf. Accd on 04/Jan/2022.
39. Hargrave M 2020. Foreign exchange reserves Investopedia. Available:https://www. Investopedia.Com/Terms/F/Foreign-Exchange-Reserves.Asp.
40. IMF [report]. International reserves and foreign currency liquidity guidelines; guidelines for A data template. Washington, DC: International Monetary Fund; 2013.
41. Indah N, Puspitasari NFD, Pujiati A. Demand and strategy of imports in declining foreign exchange reserves. Int J Econ Bus Admin. 2020;8(3):96-110.
42. International Monetary Fund. Consultation—press release; staff report; and statement by the executive Director For Nigeria. IMF Country Report No. 17/80; 2017:Article IV.
43. Islami H, Rizki CZ. The effect of interest rates, exchange rates and inflation on Indonesia's foreign exchange reserves. Jurnal Ilmiah Mahasiswa Ekonomi Pembangunan. 2018;3(1):15.
44. Jabara LC. How Exchange Rates do affects prices recent Economic Literature and Data Analysis. Office of industries working paper. Washington, DC: United States international trade commission. 2009;20436.
45. Kakar MK, Kakar AW, Walliullah K. The long-run relationship among money, income and the price level in Pakistan. J Econ Sustain Dev. 2010;2(3):117-28.
46. Markiewicz A. Choice of exchange rate regimes in transition economics: an empirical analysis. J Comp Econ. 2006;34(3):484-98.
DOI: 10.1016/j.jce.2006.06.004.

47. Masson PR, Pattillo C. the monetary geography of Africa The Brookings Institute; 2005.
48. Modeste NC. An empirical analysis of the demand for imports in three CARICOM member countries: an application of the bounds test for co-integration. Rev Black Pol Econ. 2011;38(1):53-62.
DOI: 10.1007/s12114-010-9061-3.
49. Nandi S. Economics of the international financial system. New Delhi: Routledge. ISBN 9781317342236. OCLC 927438010; 2017;173.
50. Nwachukwu EN, Ali IA, Abdullahi SI, Shettima AM, Zirra SS, Falade SB et al. CBN exchange rate and external reserves in Nigeria: A threshold cointegration analysis. J Appl Stat. 2016;7(1)(b):233.
51. Oatley HT. Autonomy and exchange rate stability. International political economy. Longman; 2021.
52. Oyeniran IW, Alamu SA. Determination of optimal level of foreign reserves in Nigeria. CBN-JAS. 2020;11(Vol. 11 No. 1):65-85.
DOI: 10.33429/Cjas.11120.3/5.
53. Oyeniran IW, Maryam WT. Financial market integration and economic growth: an experience from Nigeria, Nigeria Deposit Insurance Corporation. Q J. 2015;26(1/2):31-5.
54. Reny, Agustina. The influence of exports, imports, rupiah exchange rate, and inflation rate on Indonesia's foreign exchange reserves. J Wira Ekon Mikroskil. 2014;4(2):10.
55. Rodŕıguez CS, Funk K. Estimation of optimal international reserves for CostaRica: a micro-founded approach. Research Document No. 01-2012. The ResearchPaper series of the economic research department from Central Bank of Costa Rica; 2012.
56. Schanz J. Foreign Exchange reserves in Africa. Benefits costs and political economy consideration [BIS papers]; 2019.
57. Shijaku G. Optimal level of reserve holding: an empirical investigation in the case of Albania. MPRA Paper 79091. Germany: University Library of Munich; 2012.
58. Tariq M, Haq Z, Jan S, Jehangir M, Aamir M. Real Exchange Rate and Foreign Exchange reserves: A Mercantilist View. Life Sci J. 2014;11:(3s).
59. Tran TV, Le TPTD. Optimum reserves in Vietnam based on the approach of cost-benefit for holding reserves and sovereign risk. J Asian Fin Econ Bus. 2020;7(3):157-65.
DOI: 10.13106/jafeb.2020.vol7.no3.157.
60. Tule MK, Egbuna EN, Sagbamah JEL, Abdusalam SA, Ogundele OS, Oduyemi AO et al. Determination of optimal foreign exchange reserves in Nigeria. Central Bank of Nigeria Working Paper Series CBN/WPS/01/2015/06; 2015.
61. Vaco PN, Odhiambo MN. The determinants of import demand. A review of international literature. AUDCE. 2020;16(N05):101-7.
62. Von Hagen Jv, Zhou J. The choice of exchange rate regime: an empirical analysis for transition economics. Econ Transit. 2005;13(4):679-703.
DOI: 10.1111/j.0967-0750.2005.00237.x.
63. Warnock F, Warnock V. International Capital Flaws and U.S. interest rates. Board of Governors of the Federal Reserve System. International finance discussion paper No. 840; 2005.
64. Yeyati EL, Panizza U. The cost of reserves. Econ Lett. 2008;100(1):39-42-42.
DOI: 10.1016/j.econlet.2007.10.027.

APPENDIX: A Best lag selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-84.355	NA	25.66	2.638	2.657	2.662
1	10.919	39.008*	2.2e-1*	-3.724*	-4.172*	-5.166
2	11.974	94.571	2.46e-2	-3.245	-5.140	-5.72
3	14.027	79.120	4.55e-4	-4.034	-2.041	-5.238
4	19.958	54.210	6.09e-5	-4.980	-2.128	-2.148*

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/88734