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Appraisal of Determinants of Real Exchange Rate Alignment in Kenya

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ABSTRACT: Real exchange rate is an important indicator of competitiveness in the foreign trade of a country. Any changes in real exchange rates would therefore lead to fluctuations in capital flows. It is therefore important to align real exchange rates within the equilibrium levels to avoid negative consequences on the economy. This study sought to understand the determinants of real exchange rate alignment in Kenya using annual data from 1988 to 2019 using Autoregressive Distribution Lag (ARDL) model. The study estimated the long run and short run dynamics of real exchange rate alignment in Kenya. The ARDL bounds test confirmed that a long run relationship exists between real exchange rate and the explanatory variables. Real exchange rate was the dependent variable while the explanatory variables were external public debt, government expenditure, interest rate differentials and productivity differentials. The results revealed that external public debt, government expenditure and productivity differentials are significant determinants of real exchange rate alignment. Interest rate differential was found to be not significant. The Error Correction Model was found to be significant and having the right (negative) sign. This shows that Kenya's real exchange rate adjusts to the long run equilibrium as a response short run shocks of previous periods. The speed of adjustment was found to be 86 percent per year. Both the long run and error correction models were found to be stable as per the CUSUM and CUSUMQ tests. The models also passed all the diagnostic tests including serial correlation, normality, heteroscedasticity, and multicollinearity.

Keywords: Real Exchange Rate Alignment, External Public Debt, Government Expenditure, Interest Rate Differentials, Productivity Differentials.

1.0 INTRODUCTION

Exchange rates play an important role in the realm of financial and economic wellbeing of any country. Specifically, real exchange rates are a clear pointer of economic performance of a nation as it acts as a measure of international competitiveness (Sibanda, Ncwadi & Mlambo, 2013). It shows how resources have been allocated to different sectors hence providing a measure of the relative incentives to different types of activities in an economy (Hosni, 2015).

Masunda (2011) argues that misaligned real exchange rates result when actual exchange rates deviate from the equilibrium path in a consistent manner. This makes real exchange rate misalignment to be a problem in international finance and economics. According to Ojebiyi and Wilson (2011), persistent misalignment through overvaluation and undervaluation has serious implications on the macro economy. It undermines the country's global competitiveness, destabilizes finance and capital accounts, increases likelihood for a debt crisis and exerts inflationary pressure, events that undermine growth in the economy (Jakob, 2015). This therefore underscores the importance of aligning exchange rates within the equilibrium path in order to avert many consequences of misalignment.

The collapse of Breton Wood in 1973 led financial economists developing keen interest on the mechanism of exchange rate behavior. Kenya adopted a fixed exchange rate regime since independence in 1963 where the value of the Kenya Shilling was fixed to US Dollar at 7.14. The years 1974 to 1982 saw erratic movements and exchange rate depreciated against the US Dollar by 14 per cent. Owing to this, the exchange rates regime was changed to a crawling peg at the end of year 1982 (Ndung'u, 1997).

Exchange controls shaped the behavior of exchange rates until the 1990s with the government choosing controls rather than liberalization. These controls were aimed at minimizing balance of payment pressures and conserving foreign exchange reserves. According to Mwega (2014) however, these controls despite being an easy response created significant distortions in the economy. The crawling peg regime was in place until 1990 after which a dual exchange system was brought in until October 1993 when it was

abolished. According to Oiro (2005), the crawling peg exchange rate regime contributed to misalignments of exchange rates leading to its abolishment in 1993 to adopt the floating system.

The main objective of the floating exchange rate policy was to mitigate the problem of misalignment. This was expected to bring several changes to Kenya (Musyoki, Pokhariyal & Pundo, 2012a). First, it was to equilibrate supply and demand for foreign trade by adjustment through nominal exchange rates rather than the levels of reserves. Secondly, was to allow an adjustment mechanism of exchange rates based on shifts in foreign exchange demand and supply. Thirdly, this regime was to give Kenya an independent monetary policy that is more permanent and effective with movements of exchange rates. External imbalances would therefore, be reflected through changes in exchange rates rather than shifts in reserves (Ndung'u, 1999).

The exchange rate was however allowed to float under excess liquidity and massive depreciation leading to excessive inflationary pressure. The healing mop up process led to a rise in treasury-bill rates subsequently increasing all other rates to abnormal levels. After 1993, increased capital inflows resulting from a rise in interest rates caused exchange rates to appreciate (Oiro, 2005). The floating regime recorded positive results as the value of the Kenyan Shilling firmed up against the dollar until 1995. It later depreciated significantly until 2004 and appreciated consistently up to 2007 (Kiptui and Ndirangu, 2016).

The study was motivated by the concerns that the Kenyan exchange rate against the US Dollar could be overvalued by up to 18 per cent according to The International Monetary Fund (2018). The study found that current account deficits narrowed in 2017 owing to lower imports which declined to 21.6 per cent of GDP in 2017 from 33.5 per cent of GDP in 2011 thus offsetting the exports decline. A marginal increase of 5.7 per cent in real exchange rates was recorded for the period 2017-2018. This is regardless of the relative stability recorded in the effective nominal exchange rate. These developments in behavior of real exchange rates raise questions on possible misalignments.

A more recent study by the Central Bank of Kenya (2019) employed the Behavioral Equilibrium Exchange Rate framework to assess exchange rate misalignment in Kenya using data from 2009Q1 to 2017Q4. The study reported that misalignment remained low in the period after 2013 declining from 4.1 per cent to 2.6 per cent in 2014-2017. The country's real exchange rate remained largely consistent with economic fundamentals with stability in relative prices explaining the stability observed in nominal exchange rates. Additionally, the findings of the BEER model were largely consistent with estimates obtained using other methodologies (CBK, 2019).

This study sought to estimate the determinants of real exchange rate alignment in Kenya by testing external public debt as a ratio of GDP, government expenditure as a ratio of GDP, interest rate differentials and productivity differentials between Kenya and United States to determine the short and long run behavior of real exchange rate in Kenya.

Statement of the Problem

Exchange rate misalignment has drawn significant interest in Kenya recently with concerns over whether the Kenya exchange rate is overvalued. According to IMF (2018), the Kenya shilling could be overvalued by up to 18 per cent against the US Dollar. This has a serious implication on the classification of Kenyan exchange rate regime from a flexible floating market-based regime to a managed arrangement (Musyoki, Pokhariyal & Pundo, 2014).

Most empirical studies done in Kenya have focused on the determinants of nominal exchange rate volatility and its impacts on economic variables. These studies include Musyoki, Pokhariyal, and Pundo, (2012b), Mwega (2014), Oiro (2005), Kibiy and Tabitha (2016), Danga and Kiptui (2016) and Musyoki et al., (2014). Studies such as Kiptui and Ndirangu (2016), Musyoki et al., (2012a), Kiptui, Wambua, and Maturu (n.d.)) and CBK (2019) have primarily focused on estimating the degree of misalignment of real exchange rates as opposed to what determines alignment of real exchange rates. This creates a gap to be filled to determine the factors that influence alignment of real exchange rate in Kenya.

According to Ibrahim (2016), misaligned real exchange rates typically tend to disturb relative prices. It sends wrong signals to economic participants and leads to misallocation of available economic resources. The unsustainability of such misallocation may hamper private investments and stifle growth. Overvalued real exchange rates make prices of goods in tradable sectors to fall because of relatively low demand. The fall in prices becomes a disincentive for further investment and slows down economic activity in the tradable goods sector. On the other hand, undervalued exchange rates tend to build inflationary pressures in an economy because of the increase in domestic prices of tradable goods (Hosni, 2015). Recurrent misalignment of the real exchange rate could therefore lead to so many consequences on macroeconomic stability and competitiveness of Kenya in international trade.

This research was therefore designed to identify the determinants of real exchange rate alignment in Kenya. This provides insights on what shapes real exchange rates hence informing decision making on policy measures to minimize misalignments in the context of Kenyan economy.

General Objectives

The main objective of this study was to estimate the determinants of real exchange rate alignment in Kenya.

Specific Objectives

1. To assess the effect of external public debt on real exchange rate alignment in Kenya
2. To estimate the effect of government expenditure on real exchange rate alignment in Kenya

3. To examine the effect of interest rate differentials on real exchange rate alignment in Kenya
4. To determine the effect of productivity differentials on real exchange rate alignment in Kenya

Research Questions

1. What is the relationship between external public debt and real exchange rate alignment in Kenya?
2. What is the relationship between government expenditure and real exchange rate alignment in Kenya?
3. What is the relationship between interest rate differentials and real exchange rate alignment in Kenya?
4. What is the relationship between productivity differentials and real exchange rate alignment in Kenya?

2.0 LITERATURE REVIEW

Theoretical Review

Purchasing Power Parity Theory

This approach was developed by Gustav Cassel in 1914 premised on the law of one price and perfect market assumption in exchange rate determination. This theory argues that identical goods should be sold at identical prices. The rate of exchange is equivalent to the amount required to buy a set of goods at home in comparison with what it would buy in a foreign currency. It is therefore possible to measure the exchange rate between two currencies. Cassel (1918) explains dynamics around the equilibrium rate of exchange between two currencies. The ratio of price indices between countries and base period exchange rate therefore determine equilibrium exchange rate in current period.

Interest Rate Parity Theory

This theory was advocated by Keynes (1923) to provide an explanation of how monetary policy shapes exchange rates. The rise in local interest rates cause appreciation of local currency while a fall in home interest rates causes depreciation of the home currency. This theory creates a link between inflation, interest rates and exchange rates. Failure of interest rate parity to hold leads to exploitation of arbitrage opportunities. Domestic interest rates must therefore be higher than foreign interest rates by the amount of forward premium or discount on domestic currency (Frenkle & Levich, 1975).

Expected exchange rates between two economies are determined by nominal interest rates and spot exchange rates. The expected change in exchange rate is therefore determined by interest rate differentials. Based on a rational expectation framework, the forward exchange rate is strongly influenced by market expectation based on available information. This theory was based on the assumption that there are no transaction costs, markets are complete at equilibrium and competitive and arbitrage opportunities do not exist. Domestic interest rates must therefore be higher than foreign interest rates by an amount equal to the appreciation of the exchange rate. As a result of this, high interest rate currencies tend to appreciate rather than depreciate against low interest rate currencies

The Monetary Theory

Mundell and Fleming (1962) employed the IS-LM framework to introduce the flow of goods, services and capital in an open economy. This theory posits that foreign and domestic differentials in interest rates induces flow of capital between countries to earn higher returns. This is attributable to the balance between demand and supply of national currency thus determining exchange rate alignment. According to Frenkle (1977), this theory proposes that movements in exchange rates are majorly caused by changes in monetary variables. Relying heavily on the overarching assumption of the existence of purchasing power parity between countries, this theory argues that excess domestic money circulation relative to foreign money circulation leads to movements in nominal exchange rates.

Balassa Samuelson Theory

This approach was developed by Balassa (1964) and Samuelson (1964). The approach argued that wealthy nations have high levels of absolute productivity in international trade. This theory posits that countries that have higher productivity growth experience appreciation of exchange rates and this increases with increase in the productivity gap between domestic and foreign countries. According to Levi (1976), the Balassa Samuelson model is a cornerstone in traditional theory of equilibrium real exchange rate determination. For a given level of productivity, a higher nominal GDP growth at home relative to foreign countries tends to cause an appreciation of real exchange rates.

Empirical Review

Saeed, Awan, Sial and Sher (2012) applied an econometric analysis of the Pakistani Rupee against the US Dollar exchange rate using time series data from January 1982 to April 2010. The ARDL approach and the error correction models were used in the study. The study showed a significant appreciating effect of relative debt on PKR/USD exchange rate.

Insah and Chiaraah (2013) conducted a study to assess what causes exchange rate movements in Ghana. Time series data from 1980 to 2012 was tested using the ARDL model. The study reported that outstanding external debt is a major contributor to exchange rate behavior. It was found that a negative relationship exists between real exchange rates and foreign debt levels.

Uddin, Quaosar and Nandi (2013) examined real exchange rate fluctuations in Bangladesh. The research applied the co-integration approach on January 1984 to April 2012 monthly data. The stationarity of the time series was tested using the

Augmented Dickey-Fuller test while long run co-integration was established with the use ARDL approach. From the study, it was found that an increase in debt service results to depreciation of real exchange rates.

An Autoregressive Distributed Lag (ARDL) analysis undertaken by Chowdhury (2012) identifying the determinants of the real exchange rate for Australia using time series data from 1984Q1 to 2011 Q1. The study adopted Edwards' (1989) model in its analysis. The study concluded that long run increase in total government expenditure led to the improvement of exchange rates.

Daboh (2014) used annual aggregate data from 1970-2006 to investigate real exchange rate misalignment in countries in the West African Monetary Zone. The study applied various methods including the Hodrick-Prescott filter method and the Error Correction Model. Results from Ghana indicated a significant depreciation in long-run and short run exchange rates. Increased government expenditure, however, showed an appreciation in Nigeria and Sierra Leone.

The sources of exchange rate movements in Tanzania were analyzed by Lungaiyamu (2015) testing data from 1987 to 2007. OLS regression, Granger causality, and co-integration tests were applied. The results from the research concluded that increase in government consumption resulted in depreciation of real exchange.

Fillemon (2017) used data from 1980 to 2014 to examine the determinants of real exchange rate in Namibia. The study applied the Dickey-Fuller and ARDL tests to check the relationship among variables. The empirical investigations confirmed that a rise in government expenditure led to depreciation of the real exchange rate.

The BEER model was applied by Kiptui et al., (n.d.) to investigate the extent of real exchange rate misalignment in Kenya for the period 1998 to 2012. A Vector Error Correction Model was used to identify the fundamentals driving exchange rate. The results showed that an increase in government expenditure had a positive impact hence leading to appreciation of exchange rates.

Atanda and Iyekoretin (2012) looked at the determinants of real exchange rate dynamics in Nigeria using data from 2008 to 2011. Using Vector Error Correction model, the results indicated that an increase in interest rate differential led to a depreciation of the Naira/Dollar rate.

Ranadive and Burange (2013) examined variables affecting real exchange rate in India, applying quarterly data for the period 1993 to 2011. The ARDL test proved the existence of a long run relationship between the variables. The study found out that long run interest rate differences cause appreciation.

A more recent study conducted by Essien, Uyaebo and Omotosho (2017) for the period 2001Q1 to 2016Q1 using data from Nigeria showed that interest rates differentials had a significant negative influence in real exchange rate alignment. From the study, the BEER approach was adopted and incorporated the co-integrating vector to assess the endogenously determined breakthrough.

Kiptoo (2009) analyzed the movements of the actual exchange rate path from the equilibrium path in 6 out of the 20 COMESA countries. The Permanent Equilibrium Exchange Rate approach was used to conduct the study for the period 1993 to 2006. The co-integration analysis indicated that a decrease (increase) in productivity levels cause depreciation (appreciation) of the real exchange rate.

De Jager (2012) used the VECM model to analyze the equilibrium exchange rate of South Africa. The study utilized data from 1982 to 2011. The study results confirmed a long-term relationship between exchange rate and productivity with an increase in productivity indicating an appreciation.

Oriavwote and Oyovwi (2012) in a similar study used time series data covering from 1970 – 2010 to examine the determinants of real exchange rates in Nigeria. Using the unit root, co-integration, Hendry's general-to-specific model and the error correction models, the study concluded that an increase in output leads to depreciation of real exchange rate.

Chukwuma (2015) used data for the period 1981 to 2012 to find out the determinants of real exchange rate movements in Nigeria. The study used the Balassa-Samuelson Hypothesis, Error Correction Model, Johansen Co-integration and Engle-Granger approaches. The study however did not find productivity differential to be significant; hence Balassa-Samuelson effect could not be confirmed.

This study applied external public debt as a ratio of GDP, government spending as a ratio of GDP, differentials in interest rates between Kenya and the US and productivity differentials between Kenya and the US as the explanatory variables in its analysis.

3.0 RESEARCH METHODOLOGY

Research Design

This study employed descriptive research design in estimating the strength of the effect of each determinant factor on real exchange rate alignment. According to Kibiy and Tabitha (2016), the descriptive design is appropriate since it provides an in-depth relationship between the dependent and explanatory variables. Descriptive research design therefore facilitates better generalization, interpretation and understanding of the problem under study.

Target Population

The target population for this study comprised of annual time series data from 1988 to 2019. The dollar and the Kenya shilling real exchange rate was used to estimate the variables.

Model Specification

ARDL model Specification

The Autoregressive Distributed Lag (ARDL) model developed by Shin and Pesaran (1999) and Pesaran, Smith and Shin (2001) was employed to explain co-integration among the four variables that explain alignment of real exchange rates using the OLS equation as shown below:

$$\Delta RER_t = \alpha_0 + \beta_1 RER_{t-i} + \beta_2 EPD_{t-i} + \beta_3 GE_{t-i} + \beta_4 IRD_{t-i} + \beta_5 PD_{t-i} + \sum\gamma_{1i}\Delta RER_{t-i} + \sum\gamma_{2i}\Delta EPD_{t-i} + \sum\gamma_{3i}\Delta GE_{t-i} + \sum\gamma_{4i}\Delta IRD_{t-i} + \sum\gamma_{5i}\Delta PD_{t-i} + \varepsilon_t$$

Where:

RER_t = Real Exchange Rate at time, t.

EPD_t = External Public Debt as a percentage of GDP at time, t.

GE_t = Government Expenditure as a percentage of GDP at time, t.

IRD_t = Interest Rate Differentials between Kenya and the USA at time, t.

PD_t = Productivity Differentials between Kenya and the USA at time, t.

ε_t = stands for the error term at time t.

α_0 = the intercept coefficient estimate, that is; the value that would be taken by the dependent variable if explanatory variables take a value of zero.

Δ denotes the first difference operator

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ represent the coefficients of the long run relationship.

$\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5$ represent the short run dynamics of the model.

Error Correction Model

The Error Correction Term coefficient was obtained from the long run model and the error correction model specified accordingly as shown below:

$$\Delta RER_t = \sum\gamma_{1i}\Delta RER_{t-i} + \sum\gamma_{2i}\Delta EPD_{t-i} + \sum\gamma_{3i}\Delta GE_{t-i} + \sum\gamma_{4i}\Delta IRD_{t-i} + \sum\gamma_{5i}\Delta PD_{t-i} + \lambda ECT_{t-i} + \varepsilon_t$$

Where:

ECT_{t-i} was the lagged Error Correction Term,

λ is the adjustment parameter to the long-run equilibrium after short run shock

4.0 RESULTS AND DISCUSSION

Descriptive Statistics

The summary descriptive statistics for the variables used in the study are presented in Table 1 below. The average real exchange rate was 117.66 with the minimum and maximum values being 62.98 and 164.99 respectively and a standard deviation of 39.37. The mean external public debt to GDP was 48.51 per cent with a standard deviation of 26.26 and maximum and minimum values of 123.64 per cent and 21.37 per cent respectively. Maximum government expenditure to GDP was 28.06 per cent while the minimum value was 7.47 per cent. The average government expenditure per GDP was 18.22 per cent while the standard deviation was 5.25. Interest rate differentials were found to have a mean of 4.4 per cent with a maximum of 14.31 per cent, minimum of -12.80 per cent and standard deviation of 6.61. Average productivity differential was -0.34 per cent with a maximum of 5.55 per cent, minimum of -6.05 per cent and standard deviation of 2.88. Real exchange rate, interest rate differential and productivity differential were found to have a negative skew while external public debt to GDP and government expenditure to GDP were found to have a positive skew. The probability values for the Jarque Bera statistics were relatively high with all variables except external public debt having a p-value more than 5 per cent significance level. This confirms that the data set follow a normal distribution.

Table 1: Summary Descriptive Statistics

	RER	EPD	GE	IRD	PD
Mean	117.6557	48.51313	18.21775	4.450415	-0.338571
Median	137.0186	42.64478	18.05241	4.539851	-0.077003
Maximum	164.9906	123.6401	28.06814	14.31307	5.550311
Minimum	62.98273	21.36513	7.465856	-12.79631	-6.04679
Std. Dev.	39.37119	26.25964	5.247526	6.610837	2.87662
Skewness	-0.213603	1.124275	0.152311	-0.801896	-0.186676
Kurtosis	1.275102	3.513579	2.724113	3.572157	2.439409
Jarque-Bera	4.210369	7.092984	0.225211	3.866014	0.604874
Probability	0.121823	0.028826	0.893503	0.144712	0.739015
Sum	3764.981	1552.42	582.9681	142.4133	-10.83426
Sum Sq. Dev.	48052.8	21376.63	853.6323	1354.798	256.5233
Observations	32	32	32	32	32

***Source**: E-Views 11.0 Result Output, 2020*

Unit Root Tests

The Augmented Dickey Fuller and Phillips Perron tests were employed in this study. The rationale of applying these two tests is to enhance and corroborate the robustness of the test results. According to Gujarati (2005), the ADF test is appropriate for uncorrelated and homoscedastic errors while PP is powerful for small samples and follows first order correlation.

The null hypothesis was that time series data under study had a unit root (non-stationary) while the alternative hypothesis was that the time series is stationary (has no unit root) (Green, 2004). The test results were compared against the MacKinnon (1991) critical values. The test results are as presented in Table 2 below:

Table 2: Results of ADF and PP unit root test at Level

	At Level Intercept		P Values			With Trend and Intercept		P Values		
Variables	**ADF**	**PP**	**ADF**	**PP**	**Status**	**ADF**	**PP**	**ADF**	**PP**	**Status**
RER	-0.4115	-0.2561	0.8968	0.9219	Non-Stationary	-2.7957	-2.7823	0.2078	0.2124	Non-Stationary
EPD	-1.2109	-1.2064	0.6594	0.6614	Non-Stationary	-2.2029	-2.2258	0.4741	0.4621	Non-Stationary
GE	-0.0966	-0.2193	0.9424	0.9271	Non-Stationary	-1.1787	-1.1666	0.9003	0.9028	Non-Stationary
IRD	-4.3275	-4.328	0.0015	0.0015	Stationary	-4.4417	-4.4714	0.0058	0.0054	Stationary
PD	-2.8291	-2.8482	0.0639	0.0614	Non-Stationary	-4.6895	-4.7524	0.0031	0.0026	Stationary

***Source**: E-Views 11.0 Result Output, 2020*

Critical value for the ADF and PP statistic with an intercept = -2.97 at 95 per cent confidence level

Critical value for the ADF statistic with an intercept and Trend= -3.54 at 95 per cent confidence level

The results of the unit root test at level as depicted in Table 2 shows that all variables except IRD are non-stationary at level. IRD and PD are stationary at level with trend and intercept while EPD and GE are non-stationary at level with trend and intercept.

Table 3: ADF and PP unit root Results at First Difference

	At Level Intercept		P Values			With Trend and Intercept		P Values		
Variables	**ADF**	**PP**	**ADF**	**PP**	**Status**	**ADF**	**PP**	**ADF**	**PP**	**Status**
RER	-7.3722	-7.3764	0.0000	0.0000	Stationary	-7.4777	-7.4954	0.0000	0.0000	Stationary
EPD	-6.2015	-6.2015	0.0000	0.0000	Stationary	-6.1063	-6.1063	0.0001	0.0001	Stationary
GE	-4.6421	-4.4825	0.0007	0.0010	Stationary	-4.8999	-5.7115	0.0019	0.0002	Stationary
IRD	-7.0748	-10.343	0.0000	0.0000	Stationary	-7.0277	-10.252	0.0000	0.0000	Stationary
PD	-7.4236	-12.286	0.0000	0.0000	Stationary	-7.3105	-12.242	0.0000	0.0000	Stationary

***Source**: E-Views 11.0 Result Output, 2020*

Table 3 above shows the results of the first difference of the variables under estimation. The results show that all variables are stationary both at level and with trend and intercept. This therefore supports the use of ARDL approach to co-integration since it is appropriate irrespective of whether the variables are integrated of order I(0) or I(1) (Enders, 2010).

Optimal Lag Length Selection

The study applied the Hannan-Quinn Information Criterion (HQ), Schwarz Information Criterion (SC), Final Prediction Error (FPE), Sequential Modified LR Statistic (LR) and Akaike Information Criterion (AIC) to determine the optimal lag. An optimal lag length of 2 was recommended because it gave the lowest values and was selected by most of the criteria (AIC, FPE, LR and HQ). The results are shown in table 4 below.

Table 4: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-479.4657	NA	7.35e+08	34.60469	34.84259	34.67742
1	-375.7235	163.0234	2743104.	28.98025	30.40761*	29.41661
2	-343.7377	38.84001*	2012816.*	28.48126*	31.09809	29.28125*

***Source**: E-Views 11.0 Result Output, 2020*

ARDL Bounds Test for Co-integration

The study applied the Bounds Test to determine existence of long run relationship between the dependent variable and the explanatory variables with the null hypothesis of no co-integration (Nkoro & Uko, 2016).The results were tabulated in table 5 below. From the results, the null hypothesis of no

co-integration was rejected since the computed F-Statistic of 5.42 is greater than the critical value of 4.01 at 5 per cent level of significance at unrestricted intercept and no trend obtained from Table CI (iii) of Pesaran et al. (2001). The null hypothesis of no co-integration was therefore rejected hence confirming existence of a long run relationship.

Table 5: Long Run Bounds Test Results

Test Statistic	Value	
F Statistic	5.421153	
Significance Level	**Lower Bound Value**	**Upper Bound Value**
1%	3.74	5.06
5%	2.86	4.01
10%	2.45	3.52

Source: *E-Views 11.0 Result Output, 2020*

ARDL Model Estimation

The study applied the Akaike Information Criteria to conduct a broader lag length selection for the ARDL(p,q,..q) model. Using the model lag selection criteria graph with lag length 2, ARDL model (2,2,1,2,1) was the most recommended model. The Wald test was used to identify insignificant variables which were deleted from the model in order to come up with a parsimonious model. The results are presented in table 6 below:

Table 6: ARDL (2,2,1,2,1) Model Results

Dependent Variable: D(RER)
Method: Least Squares
Sample (adjusted): 1991 2019
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	54.43114	11.73863	4.636925	0.0002
RER(-1)	-0.344504	0.06759	-5.096989	0.0001
EPD(-1)	0.075236	0.037586	2.001680	0.0546
GE(-1)	-1.236566	0.333977	-3.702552	0.0016
IRD(-1)	0.173788	0.187003	0.929334	0.3650
PD(-1)	-2.703174	0.790589	-3.419191	0.0031
D(RER(-2))	0.523228	0.168522	3.104809	0.0061
D(EPD(-2))	-0.24876	0.10148	-2.451323	0.0247
D(GE(-1))	-0.168335	0.379214	-0.443905	0.6624
D(IRD(-2))	0.435881	0.119759	3.639662	0.0019
D(PD(-1))	2.071267	0.596613	3.471711	0.0027
R-squared	0.75124	Mean dependent var		-3.286232
Adjusted R-squared	0.61304	S.D. dependent var		8.128584
S.E. of regression	5.056477	Akaike info criterion		6.360914
Sum squared resid	460.2233	Schwarz criterion		6.879543
Log likelihood	-81.23325	Hannan-Quinn criter.		6.523342
F-statistic	5.435886	Durbin-Watson stat		2.193923
Prob(F-statistic)	0.000951			

Source*: E-Views 11.0 Result Output, 2020*

The parameter estimation for the long run coefficient:

$$RER_t=54.4311+0.0752EPD_t-1.2366GE_t+0.1738IRD_t-2.7032PD_t$$

The results of the estimated model show that Real Exchange Rates take the value of 54.4311, when all the coefficients of regressors assume a value of zero. Holding all other factors unchanged, a unit increase in external public debt causes 0.0752 increase in real exchange rate. The implication of this is that an increase in Kenya's external public debt liability causes a rise in real exchange rate levels. The findings of this study therefore support similar studies including Siregar and Rajan (2006), Odera (2015) and Kibiy and Tabitha (2016) who showed that high levels of external debt had a negative effect on exchange rates.

Government expenditure as a ratio of GDP was found to have a negative influence on real exchange rate movement. A unit increase in government expenditure was found to significantly cause appreciation in real exchange rate levels. Government expenditure to GDP had a coefficient of 1.2366 implying that a unit rise in government expenditure led to 1.2366-unit reduction in real exchange rate levels. Government expenditure can therefore be used as a tool to induce desirable influence on exchange rate levels in Kenya.

Interest rate differentials as measured by the difference between interest rates in Kenya and United States were found to have a positive relationship with real exchange rate with a coefficient of 0.1738. This influence was however found not to be significant. This is because the p-value was above the 5 per cent level of significance. Productivity differential was significant in the study with a negative sign. A unit rise in productivity differential led to 2.7032-unit decrease in real exchange rate. This conclusion conforms with economic theory which provides that increase in productivity differentials lead to appreciation of real exchange rates. Similar studies that arrived at the same finding include MacDonald and Ricci (2003) and Saayman (2010).

All the variables included in the estimation, apart from interest rate differentials, were found to be statistically significant at 5 per cent level of significance. The results from the estimation are consistent with economic theory in terms of the expected signs of the variables. Economic theory argues that increase in government expenditure and productivity differentials causes appreciation of real exchange rates while increases in external public debt leads to depreciation in real exchange rate.

The coefficient of determination (R^2) was found to be 0.7512, meaning that 75.12 percent of variations in real exchange rate is jointly explained by all the explanatory variables included in the estimation. The adjusted R^2 was found to be 0.613. The predictive power of the F statistic was confirmed to be 5.436 and statistically significant. Thus, a confirmation that real exchange rate alignment is significantly explained by the variables estimated.

Error Correction Model Estimation

The Error Correction Term was obtained from the long run coefficient using lag length of 2. The ECT was lagged (ECT_{t-1}) and estimated. The results of the estimation are captured in table 7

$$ECT = RER-(0.4174*EPD-3.9201*GE+1.8817*IRD-6.9962*PD+151.5095)$$

Table 7: Error Correction Model of the ARDL (2,2,1,2,1) Model

Dependent Variable: D(RER)
Method: Least Squares
Sample (adjusted): 1992 2019
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.848017	1.367286	-2.082971	0.0497
D(RER(-2))	0.360802	0.15917	2.266774	0.0341
D(EPD(-2))	-0.197648	0.112172	-1.762001	0.0926
D(GE(-1))	0.27999	0.672022	0.416639	0.6812
D(IRD(-2))	0.50829	0.139004	3.656651	0.0015
D(PD(-1))	-0.865635	0.485932	-1.781392	0.0893
ECT(-1)	-0.867805	0.392812	-2.209215	0.0384
R-squared	0.558289	Mean dependent var		-3.643139
Adjusted R-squared	0.432086	S.D. dependent var		8.043019
S.E. of regression	6.061223	Akaike info criterion		6.654018
Sum squared resid	771.507	Schwarz criterion		6.987069
Log likelihood	-86.15626	Hannan-Quinn criter.		6.755835
F-statistic	4.423739	Durbin-Watson stat		1.43225
Prob(F-statistic)	0.004826			

***Source**: E-Views 11.0 Result Output, 2020*

The results show that the Error Correction Term is -0.8678 (0.0384). This result provides support for co-integration among variables included in the model. This is because the ECT coefficient is statistically significant and has the correct (negative) sign. The speed of adjustment to long run equilibrium as a result of short run shocks of previous period was 86.78 per cent. This implies that adjustments towards equilibrium following a shock adjusts at a rate of 86.78 per cent per year.

The Autoregressive Distributed Lag and Error Correction Models were subjected to residual diagnostic and stability tests to ascertain their robustness. These tests include serial

correlation, normality, heteroscedasticity, multicollinearity, Cumulative Sum of recursive residuals (CUSUM) and Cumulative Sum of squares of recursive residuals (CUSUMQ). The results of these tests confirmed that the model met all diagnostic and stability requirements.

5.0 CONCLUSION AND RECOMMENDATIONS

Conclusion

This study examined the determinants of real exchange rate alignment in Kenya by employing the ARDL method. Annual data from 1988 to 2019 was used with the dependent variable being real exchange rate. The explanatory variables were external public debt, government expenditure, interest rate differentials and productivity differentials. The empirical results of the long run and short run model confirmed that productivity differential contributed majorly to real exchange rate alignment and that an increase in productivity differentials lead to appreciation of real exchange rates.

Government expenditure had the second most influence on real exchange rate having an appreciating effect. A rise in spending by government therefore induces real exchange rate appreciation while a reduction in causes depreciation. External public debt had a negative significant influence on real exchange rates. An increase in external public debt contributes to depreciation of exchange rates while a reduction leads to appreciation of real exchange rates. The government should therefore seek alternative sources of financing its operations to reduce over reliance of external borrowing. An increase in interest rate differentials would lead to a rise in exchange rates while a reduction would cause a decline in exchange rates but was found to be statistically insignificant.

Recommendations

The study recommends that prudent debt management strategies should be adopted by the Kenya government to manage external public debt. External public debt should be maintained at sustainable levels hence reducing its excess accumulation. Additionally, borrowed funds should be used appropriately in economic activities that generate returns to refinance borrowed resources. This study recommends that a clear macroeconomic framework should be put in place to ensure that efficiency in government spending is enhanced. Government resources should be channeled to sectors that yield the greatest benefit. Government spending should be utilized as a tool to strengthen real exchange rates, enhance employment and economic growth levels. Lastly, it is recommended that policies that enhance productivity of workers should be adopted. Employees should be empowered with necessary skills and technology. Government and private sector players should also invest in appropriate research and development strategies.

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