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Determinants of Export and Import Dynamics: The Role of Exchange Rates in Kenya's Economy

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Abstract

This study investigates the long-run and short-run dynamics among Kenya's exchange rate, exports, and imports using monthly data from January 1992 to October 2017 through a Vector Error Correction Model (VECM). ADF test analysis confirms that the variables are non-stationary at levels but become stationary after first differencing, indicating integration of order one. The VECM reveals cointegration, with imports strongly driving shilling depreciation and exports exerting a smaller appreciating effect. The shilling shows moderate error correction, while imports and exports exhibit strong adjustments, reflecting high trade sensitivity. A significant relationship exists between the exchange rate, exports, and imports, with exports negatively influencing imports, suggesting potential trade balance improvements. However, limited export responsiveness to depreciation and import crowding effects highlight structural challenges. Policymakers should prioritize stabilizing the shilling, diversifying exports, and reducing reliance on inelastic imports (e.g., oil, machinery) to enhance Kenya's trade balance and economic resilience, addressing structural constraints to improve competitiveness.

Keywords: Stationarity, ADF Test, Vector Error Correction Model, VEC Stability Condition Check
JEL Classification: F1, F130

INTRODUCTION:

Kenya transitioned from a fixed exchange rate to a managed floating regime by 1993, following economic reforms driven by the IMF and World Bank. The Kenyan shilling was devalued significantly to correct overvaluation, aiming to boost export competitiveness. In 1993, the exchange rate was approximately 58 KES per USD, rising to about 76 KES by 1996. The shilling stabilized somewhat in the early 2000s, averaging around 76–80 KES per USD. The floating regime allowed market-driven adjustments, though periodic Central Bank interventions managed excessive volatility.

Kenya's exports were predominantly agricultural (tea, coffee, horticulture), accounting for about 50% of export revenue in 1993. However, the early 1990s saw sluggish export growth due to an overvalued shilling, high production costs, and adverse weather conditions. Real GDP growth plummeted to 0.5% in 1992 and 0.2% in 1993, reflecting weak export performance. Trade liberalization measures from the mid-1990s bore fruit, with exports growing by 15% annually from 1990–1996, recovering from a 2.6% decline in the 1980s. By 2005, agriculture (tea, horticulture, coffee) accounted for 65% of export earnings, with tea and horticulture contributing 23% and 22%, respectively. Regional integration (EAC, COMESA)

boosted exports to Uganda (12.3%) and Rwanda (30.5%). Exports rebounded after 2009, driven by regional trade (EAC, COMESA) and the 2010 EU Economic Partnership Agreements. Tea, coffee, and horticulture remained dominant, with exports reaching $11.82 billion by 2017. However, exchange rate volatility negatively impacted tea exports to the UK and horticulture to the EU . The shilling faced pressure, depreciating from 80 KES per USD in 2010 to 102.22 KES by 2015–2019, stabilizing at this level through 2017. Volatility affected export profitability, particularly for tea and horticulture to the EU and UK.

Tight import controls and foreign exchange restrictions persisted into the early 1990s, limiting imports of machinery and inputs, which hampered industrial growth. Imports grew due to demand for capital goods and oil, with major suppliers being China, India, UAE, and South Africa. Imports grew steadily, driven by machinery, transport equipment, and oil, with a trade deficit persisting. High import costs, exacerbated by a weaker shilling, increased production costs, affecting domestic prices and inflation.

GDP growth averaged 4–5% from 2003–2007, driven by agriculture and services. The 2008 post-election violence and global financial crisis disrupted this trend, with exports declining due to reduced global demand and high input costs. Agriculture contracted by 2.7% in 2009. GDP growth averaged 5–6% from 2013–2017 under the Jubilee government, supported by small business growth and services. However, debt sustainability concerns emerged, with public debt rising due to exchange rate depreciation and increased borrowing. Inflation averaged 7–8%, partly driven by import costs. This history reflects Kenya's struggle to balance exchange rate stability with export growth and import dependency, constrained by external shocks and domestic challenges.

Literature Review:

Muhammad, Z. (2014) investigates the impact of exchange rate instability on Pakistan's imports, exports, trade balances, foreign exchange reserves, and GDP from 1952 to 2010. He suggests a significant relationship between these variables, with exchange rate changes affecting GDP notably. Exchange rate depreciation positively influences exports, yet erratic fluctuations can disrupt economic growth. Various tests ensure the model's reliability for predicting Pakistan's trade balances and GDP.

Duasa, J (2008) investigated the impact of exchange rate shocks on Malaysian import and export prices using a vector error correction model (VECM) with monthly data from January 1999 to December 2006. Employing variance decompositions and impulse response functions, it finds significant exchange rate effects on import prices but incomplete pass-through, highlighting dynamic interactions among nominal exchange rates, money supply, and trade prices.

Matesanz Gómez, David and Fugarolas Álvarez-Ude, Guadalupe (2006) they examined the impact of real exchange rate (RER) on Argentina's trade balance (TB) from 1962, using VAR-based cointegration tests and impulse response functions. The Marshall-Lerner condition holds under fixed exchange rate regimes but not under flexible ones, despite RER overvaluation episodes. Short-run TB rarely follows the J-curve pattern, except pre-1991. The 2002 devaluation, abandoning the currency board, likely improved TB, supporting flexible exchange rate policies for sustainable economic growth.

Objectives of the Study:

1. To investigate whether the time series data on exchange rate, import, and export in the economy of Kenya are stationary.
2. To examine the existence of a dynamic relationship among exchange rate, import, and export in the

Kenyan economy.

3. To determine whether there is a long-run relationship among the variables—exchange rate, import, and export—in Kenya.
4. To assess the stability of the relationship among exchange rate, import, and export over the study period.

Data Source: Secondary data have been collected from the International Monetary Fund (IMF) – International Financial Statistics (IFS) and various issues of the Direction of Trade Statistics Yearbook.

Test of Stationarity: Augmented Dickey-Fuller (ADF) Unit Root Test

Stationarity of exchange rate (e_t), export and import series have been studied through the Augmented Dickey Fuller (ADF) tests. The basic ADF equation estimated with appropriate changes under different assumptions are

$\Delta e_t = \alpha_1 + \beta_1 t + \gamma_1 e_{t-1} + \delta_{1i} \sum_{i=1}^{n} \Delta e_{t-1} + \varepsilon_{1i}$……………………………..(1)

$\Delta X_t = \alpha_2 + \beta_2 t + \gamma_2 X_{t-1} + \delta_{2i} \sum_{i=1}^{n} \Delta X_{t-1} + \varepsilon_{2i}$……………………………..(2)

$\Delta M_t = \alpha_3 + \beta_3 t + \gamma_3 e_{t-1} + \delta_{3i} \sum_{i=1}^{n} \Delta M_{t-1} + \varepsilon_{3i}$……………………………..(3)

$\varepsilon_{1t} \sim \mathrm{iidN}(0, \sigma^2_{\varepsilon_1})$, $\varepsilon_{2t} \sim \mathrm{iidN}(0, \sigma^2_{\varepsilon_2})$ and $\varepsilon_{3t} \sim \mathrm{iidN}(0, \sigma^2_{\varepsilon_3})$,

where $\Delta e_t = (e_t - e_{t-1})$, $\Delta X_t = (X_t - X_{t-1})$ and $\Delta M_t = (M_t - M_{t-1})$

The optimal lag (k) may be determined through Akaike Information Criterion, Schwartz Information Criterion, Hannan-Quinn Information criterion etc.

Table:1 Results of the Augmented Dickey Fuller (Unit Root Test)
(Automatic based on SIC, MAXLAG=15) [Sample: - 1992: I -2017:X]

Country	Variable	ADF Test Stat.	Prob* Value	Mackinnon Critical Value			Remarks
				1%	5%	10%	
Kenya	e_t	-2.265	0.184	-3.451	-2.871	-2.572	Non-Stationary
	Δe_t	-13.146	0.000	-3.451	-2.869	-2.571	Stationary
	$Export_t$	-1.098	0.717	-3.451	-2.871	-2.572	Non-Stationary
	$\Delta Export_t$	-13.473	0.000	-3.451	-2.871	-2.572	Stationary
	$Import_t$	-0.673	0.850	-3.451	-2.871	-2.572	Non-Stationary
	$\Delta Import_t$	-15.380	0.000	-3.451	-2.871	-2.572	Stationary

where e_t stands for Exchange Rate at level and
Δe_t stands for 1st difference of Exchange Rate and Δ present diference datasets.

It is observed from the ADF Tests that

1. Exchange rate(e_t), export and import series at level are having unit roots even at 10% level of significance.
2. the Exchange Rate (Δe_t), $\Delta Export_t$ and $\Delta Import_t$ and are free from unit roots even at 1% level of significance.
3. Exchange Rate (e_t), $Export_t$ and $Import_t$ are non-stationary and I(1) variable in the economy of

Kenya.

4. Exchange Rate (Δe_t), $\Delta Export_t$ and $\Delta Import_t$ are stationary i.e all are I(0) variables.

VECM Model : When the variables are cointegrated, we use a VECM, which incorporates short-run dynamics and long-run equilibrium correction.

The Vector Error Correction Model (VECM): The estimable relevant Vector Error Correction Model for e_t, M_t and X_t over the sub-period 1992:1-2017:10 consists of the following equations.

$$E_t = \alpha_1 + \rho_1 z_{t-1} + \beta_{1i}\sum_{i=1}^{m} E_{t-i} + \gamma_{1i}\sum_{i=1}^{m} M_{t-i} + \delta_{1i}\sum_{i=1}^{m} X_{t-i} + \omega_{1t} \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$M_t = \alpha_2 + \rho_2 z_{t-1} + \beta_{2i}\sum_{i=1}^{m} E_{t-i} + \gamma_{2i}\sum_{i=1}^{m} M_{t-i} + \delta_{2i}\sum_{i=1}^{m} X_{t-i} + \omega_{2t} \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$X_t = \alpha_3 + \rho_3 z_{t-1} + \beta_{3i}\sum_{i=1}^{m} E_{t-i} + \gamma_{3i}\sum_{i=1}^{m} M_{t-i} + \delta_{3i}\sum_{i=1}^{m} X_{t-i} + \omega_{3t} \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

E_t = First Differenced Series of Exchange Rate at time t-i; i =1,2,……,m

M_t = First Differenced Series of Import at time t-i; i =1,2,……,m

X_t = First Differenced Series of export at time t-i; i =1,2,……,m

Z_{t-1} is the error correction term since the Johansen Cointegration Tests confirm the existence of only one Cointegrating Equation between E_t, M_t and X_t. The lag length (m), in the estimation, is determined through the Akaike Information Criterion (AIC) and Schwartz Information Criterion (SIC) etc.

Results of the Estimated VEC Model for the Period 1992:1-2017.10

The VEC Model, consisting of the equations (4), (5) and (6), has been estimated for the period **1992:1-2017.10**. Results of the estimation are being presented through the Tables-1,2 and 3 below.

Table – 1

Results of the VEC (1,2) Model Estimation

Sub-period: 1992:1-2017.10 Sample (adjusted): 1992:05 – 2017:10 Included Observations: 306 (after adjusting end points)

Dependent Variable	Explanatory Variable/Constant	Coefficient	S.E	t-stat.
Δe_t	Constant	-0.004	0.127	-0.029
	Z_{t-1}	-0.058	0.017	**-3.481***
	Δe_{t-1}	-0.410	0.053	-7.699
	Δe_{t-2}	-0.331	0.054	-6.157
	$\Delta import_{t-1}$	0.031	0.009	**3.309***
	$\Delta import_{t-2}$	0.013	0.005	**2.376***
	$\Delta export_{t-1}$	-0.004	0.001	**-3.394***
	$\Delta export_{t-2}$	-0.002	0.001	**-2.295***
R^2 = 0.244 Adj R^2 = 0.226 F-Stat. = 13.712 Log Likelihood = -675.439 AIC = 4.467 SIC = 4.564 S.E= 2.229				

*(**) Indicates statistical Significance at the 1% (5%) level.

Table – 2 Results of the VEC(1,2) Model Estimation

Sub-period: 1992:1-2017.10 Sample (adjusted): 1992:05 – 2017:10 Included Observations: 306 (after adjusting end points)

Dependent Variable	Explanatory Variable/Constant	Coefficient	S.E	t-stat.
$\Delta import_t$	Constant	0.180	1.499	0.120
	Z_{t-1}	-2.360	0.195	-12.067
	Δe_{t-1}	2.877	0.626	4.592
	Δe_{t-2}	2.354	0.633	3.718
	$\Delta import_{t-1}$	0.338	0.111	3.040
	$\Delta import_{t-2}$	0.052	0.063	0.828
	$\Delta export_{t-1}$	-0.124	0.014	**-8.925***
	$\Delta export_{t-2}$	-0.047	0.011	**-4.244***
$R^2 =$ 0.699 Adj $R^2 =$ 0.691 F-Stat. = 98.887 Log Likelihood = -1429.800 AIC = 9.397 SIC = 9.494 S.E= 26.228				

*(**) Indicates statistical Significance at the 1% (5%) level.

Table – 3

Results of the VEC(1,2) Model Estimation

Sub-period: 1992:1-2017.10 Sample (adjusted): 1992:05 – 2017:10 Included Observations: 306 (after adjusting end points)

Dependent Variable	Explanatory Variable/Constant	Coefficient	S.E	t-stat.
$\Delta export_t$	Constant	-0.713	8.284	-0.086
	Z_{t-1}	3.616	1.081	3.346
	Δe_{t-1}	2.192	3.461	0.633
	Δe_{t-2}	0.055	3.498	0.016
	$\Delta import_{t-1}$	-1.986	0.614	-3.235
	$\Delta import_{t-2}$	-1.123	0.349	-3.221
	$\Delta export_{t-1}$	-0.632	0.077	-8.238
	$\Delta export_{t-2}$	-0.186	0.062	-3.003
$R^2 =$ 0.468 Adj $R^2 =$ 0.456 F-Stat. = 37.519 Log Likelihood = -1952.830 AIC = 12.815 SIC = 12.913 S.E= 144.909				

*(**) Indicates statistical Significance at the 1% (5%) level.

Explain the relationship among exchange rate, imports, and exports in Kenya's economy using the Vector Error Correction Model, based on the results presented in Tables 1, 2, and 3.

From the Table -1 we explained the coefficient of cointegrating equation on Exchange Rate was -0.058

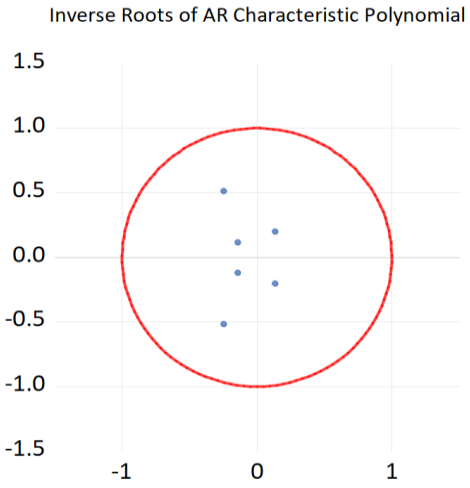
and t-stat. value was 3.481 indicated that the exchange rate deviates from equilibrium (e.g., the shilling was overvalued), it adjusts downward (depreciates). The value of t-statistic indicates highly significant.
Again, in the table -2 the coefficient of cointegrating equation on import was -2.360 and t- stat. value was 12.067 which implies that the imports adjust strongly, decreasing by 2.360 units per month when the exchange rate is too high. The t-stat. value was 12.067 confirmed highly significant, indicating rapid correction to reduce imports. More ever, in table-3 we explained the coefficient value of cointegrating equation on Export was 3.616 and t- stat. value was 3.347 means that the Exports adjust positively, increasing by 3.616 units per month when the exchange rate is too high.
The short-run dynamics are captured by the coefficients on the first and second lags of the differenced variables:
Again, in the Table-1 we see that the coefficient for the first lag of import on Exchange Rate ware 0.031 and t- stat. value was 3.309 and for second lag the values ware 0.013, t. stat. was 2.376 which means that lagged imports depreciate the shilling, consistent with increased foreign currency demand. Both coefficients are highly significant, though the second lag has a smaller effect. Again, in case the coefficient of 1st lag export on exchange rate was -0.004 and t-stat. value was 3.394 and for 2nd lag it was 2.294 which indicates that the lagged exports appreciate the shilling, reflecting increased demand for the shilling. Both coefficients are significant, with the first lag having a stronger effect.
Similarly, in Table -2 we explained the coefficient for the 1st lag of export on import was -0.124 and the t- stat. value was -8.925 and for the 2nd lag the value was -4.244 which means that the lagged exports reduce imports, possibly due to resource competition or improved trade balances. Both coefficients are significant.
Model Fit and Diagnostics: The value of R^2 about Exchange Rate, import and export ware 0.244, 0.699 and 0.468 which means that the model explains a moderate portion of exchange rate variability and a high portion for imports and exports, indicating strong explanatory power for trade variables. The value of Standard Errors on Exchange Rate (2.229) shows moderate volatility, while Import (26.229) and Export (144.909) reflect higher trade volatility. Similarly, high value of F-stat. for Import confirmed model is highly significant and the value of Akaike and Schwarz Criteria: Suggested a good balance between fit and complexity.

Table-4
VEC Stability Condition Check
[Roots of the AR Characteristic Polynomial A(L)]
Endogenous Variable: Exchange rate, Import, Export Exogenous Variable: C Lag Specification: 1 2

Roots of Characteristic Polynomial	
Endogenous variables: ΔExchange Rate ΔImport ΔExport	
Exogenous variables:	
Lag specification: 1 2	
Root	Modulus
1.000000	1
1.000000	0.9999999999999999
0.064652 - 0.642257i	0.6455024316939058
0.064652 + 0.642257i	0.6455024316939058

-0.266790 - 0.559059i	0.6194546682179382
-0.266790 + 0.559059i	0.6194546682179382
-0.423982 - 0.412595i	0.5916040910310459
-0.423982 + 0.412595i	0.5916040910310459
-0.578175	0.578174505329621
VEC specification imposes 2 unit root(s).	

Figure -1



Examination of the Stability of the VAR Model

The Table 4 and Figure-1 presents the roots and respective modulus of each of the roots in A(L)

It is observed that

1. three of the eigen values are positive.
2. three of the eigen values are negative.
3. The roots of the characteristic polynomial (derived from det(A(L)) = 0) determine the system's stability. These roots can be real or complex, and their modulus (absolute values) indicate whether the system is stable. Stability Condition: For a VECM to be stable, all roots of the characteristic polynomial must lie inside the unit circle (modulus < 1) for stationary components.

The remaining roots should have modulus less than 1 to ensure that short-run dynamics are stable. The output lists nine roots for a VECM with three endogenous variables (ΔExchange Rate, ΔImport, ΔExport) and lag specification 1 and 2 (two lags). Roots with modulus = 1 (two roots: 1.000000 and 0.9999999999999999) indicate unit roots, consistent with the VECM specification imposing 2 unit roots. The remaining roots have modulus less than 1 (ranging from 0.578 to 0.645), suggesting stable short-run dynamics.

The economic interpretation of the VECM models the relationships among the first differences of Exchange Rate, Imports, and Exports (ΔExchange Rate, ΔImport, ΔExport), with two lags and no exogenous variables. The variables are likely cointegrated, reflecting a long-run equilibrium relationship, possibly driven by trade and exchange rate dynamics in Kenya's economy.

Summary, Conclusions and policy implications:

The VECM reveals that Kenya's exchange rate, imports, and exports are cointegrated, with imports strongly influencing shilling depreciation and exports having a smaller appreciating effect. The shilling

adjusts moderately to disequilibria, while imports and exports show strong adjustments, reflecting trade sensitivity. The limited export response to depreciation and import crowding effects highlight structural challenges. Policymakers should stabilize the shilling, diversify exports, and reduce import dependence to enhance Kenya's trade balance and economic resilience.

Exchange Rate Dynamics: The shilling's moderate error correction (-0.058) suggest it influenced by trade but also external factors (e.g., remittances, tourism).

Import Dependence: In the Table-2 positive effect of depreciation on imports (2.877) and strong error correction (-2.360) indicate that imports are sensitive to exchange rate movements but adjust quickly. This reflects Kenya's reliance on essential imports (e.g., oil, machinery), which are inelastic to price changes. The negative export effect on imports (-0.124) suggests that export growth may reduce import reliance, improving the trade balance.

Trade Balance: The interplay between exports and imports suggests that boosting exports could reduce imports, but high import demand limits trade balance improvements. The limited export sensitivity to depreciation complicates efforts to use exchange rate policy to improve competitiveness.

Policy Implications in the Economy of Kenya:

1. **Exchange Rate Management**: The moderate error correction for Exchange Rate and persistence in short-run dynamics suggest that the Central Bank of Kenya should use foreign exchange reserves or monetary policy to reduce shilling volatility, supporting trade stability and controlling import-driven inflation.
2. **Prevent Overvaluation**: The positive export adjustment (3.616) to an overvalued shilling is unusual and may reflect temporary competitiveness. Interventions (e.g., selling foreign currency) could prevent excessive appreciation, which harms exports.
3. **Enhance Export Resilience**: The weak effect of depreciation on exports (2.192) was insignificant which suggested that the policies should focus on non-price factors, such as improving quality or diversifying markets for tea, coffee, and horticulture.
4. **Diversify Exports**: Investing in value-added exports (e.g., processed agricultural goods, tourism) could reduce reliance on price-insensitive agricultural exports and enhance currency inflows.
5. **Monetary and Fiscal Policy Coordination**: The lower interest rates could weaken the shilling, potentially supporting exports, but the weak export response suggests limited impact. Inflation risks from higher import costs (2.877) must be monitored.
6. **Fiscal Measures**: Subsidies for export industries or tax incentives for domestic production of import substitutes could reduce import reliance and enhance trade balance.
7. **Economic Diversification**: Expanding non-agricultural exports (e.g., manufacturing, services) could increase exchange rate sensitivity and reduce trade deficits.

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