Effect of Trade Openness and Agriculture on Tax Revenue Performance in Kenya

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Abstract

Purpose: Taxes play a critical role for most governments around the world in funding investments in capital, infrastructure and the delivery of essential services. The study therefore sought to examine the effect of trade openness and agriculture on tax revenue performance in Kenya.

Methodology: The study adopted correlational research design, Vector Error Correction Model (VECM) mechanism and Granger causality test to establish the relationship between the study variables. The choice of the VECM was influenced by its ability to estimate both short run and long run relationships. The theoretical framework of the study followed Heller's neoclassical maximization utility approach. Annual time series data for the study were sourced from the World Bank Development Indicators for the period 1980-2020.
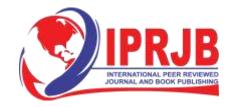
Results: The study findings established that in the long-run agriculture share (-0.64, t-statistics = 14.57) and trade openness (-0.08, t-statistics = 3.88) have negative and significant effect on tax revenue performance in Kenya. The Pairwise Granger Causality test results indicated unidirectional causality running from tax revenue performance to trade openness. This suggests that tax rates have effect on trade openness in Kenya.

Unique Contribution to Theory, Policy and Practice: The study adds to literature by proving the Arthur's Laffer curve theory which advocates for lowering tax rates in order to boost productivity and encourage expansion of corporation. The findings of the study may provide the National Treasury with foundation for policy formulation and analytical framework for estimating the associated tax revenue with variables under consideration in this study. The study may be of importance to KRA in determining appropriate tax rates that are favorable in boosting revenue mobilization.

Keywords: *Tax Revenue, Agriculture Share, Trade Openness Share, VECM*

INTRODUCTION

Tax revenue mobilization remains an important policy objective because most governments around the world rely on taxation to fund investments in capital, infrastructure, and the delivery of essential services to their citizens like education, healthcare and social security. It should be noted that the ability of the government to provide these services is contingent to sufficient revenues from taxation (IMF, 2011). Considering this significant role of taxes, developing countries especially those in Sub-Saharan Africa find it difficult to provide essential services to their population due to lack of enough tax revenue. These countries have therefore been forced into debt trap as a result of increasing public debt. This is echoed by Piancastelli &Thirwall (2019) who argue that too high debt as a percentage of GDP leads to fiscal crisis and recipient countries find it difficult repaying the debt.

Viewed as an important policy objective, countries around the world have made significant progress in mobilizing domestic financing for development in the twenty-first century. Developing countries on the other hand are still faced with challenges in raising their revenues from domestic sources. These challenges range from a large informal sector, low levels of per capita, small tax base, transfer pricing abuse, low domestic savings and investments to poor governance and capacity, IMF (2021). These developing nations continue to struggle to raise their share of tax revenue in GDP to the required level that can support public spending and spur economic growth. These countries are required to attain at least 15 percent regarded as the minimum threshold for sustainable development. However, many developing countries are still unable to achieve a tax yield of 15 percent due to a limited tax base and a general lack of tax administration capacity (Chongvilaivan & Chooi, 2021).

The share of tax revenue in Gross Domestic Product has failed to keep pace with the relatively growing economy and in recent years the ratio has been fluctuating while fiscal deficit in financing the ever increasing public expenditure is still a challenge that Kenya faces. Failure of the tax revenues to keep pace with the growing economy and steady decline in its share of GDP in recent years implies that Kenya continues to rely on public debts to finance her development expenditures. This has contributed to a growing concessional borrowings leading to increased fiscal deficits and debt vulnerabilities raising doubts of public debt sustainability in Kenya. For instance, in the fiscal year 2019/20 public debt increased to around 66 percent of Gross Domestic Product, up from 62 percent in the 2018/19 fiscal year, IMF (2021). This increase in public debt stock is primarily driven by increased public spending which is exacerbated by insufficient domestic revenue mobilization.

Notwithstanding the magnitude of effort by Kenya, the tax revenue-to-GDP ratio has lagged behind the comparatively growing economy and in recent years the ratio has been declining. This fluctuation and decline in tax revenue-to-GDP ratio was primarily contributed by the changes in the economy's structure that started in 2014/15, where agriculture gained a sharp increase relative to other sectors of the economy thus leading to a shrinking tax base; changes in discretionary policy that resulted in loss of significant revenue; an abrupt rise in remissions and exemptions in tax that eroded the taxable base (KRA, 2019).

Studies that have been carried out in Kenya on factors influencing tax revenue places less emphasis on the variables considered in this study. Besides, available literature presents studies that were done in other countries using cross-country data, thereby producing conflictual

findings. In light of this that the study sought to establish the effect that trade openness and agriculture have on tax revenue performance in Kenya.

Agriculture and Tax Revenue Performance

This sector of the economy is important for alleviating extreme poverty and boosting economic growth. The sector is a source of employment, livelihood and generation of income in developing countries. World Bank (2018) reported that agriculture accounted for over 25 percent of Gross Domestic Product in some developing countries.
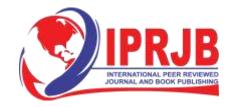
The sector remains one of the most important sectors in promoting economic development in Kenya. Ojiambo (2015) argued that agriculture is such a large part of the Kenyan economy thus its performance reflects that of the entire country. Despite the fact that the sector remains the most important, share of Gross Domestic Product derived from it has declined over time. Being a sector inextricably nexus to other sectors of the economy, changes in its performance has an impact on other sectors and the country's well-being. Given the importance of agriculture sector's contribution to Kenya's economic growth, is declining tax revenue-to-GDP ratio attributed to poor agricultural performance and declining productivity? It remains unknown how share of agriculture sector affects tax revenue performance, raising the desire to investigate the effect of share of agriculture in GDP on tax revenue performance in Kenya.

Trade Openness and Tax Revenue Performance

Trade is a crucial tool for promoting economic development as it contributes significantly towards economic growth of countries involved. Advocates and available empirical literature argues that intensified participation of countries in trade spur growth of their economies, which is regarded as indispensable status for wider development (UNCTAD, 2014). Given the contribution and importance of trade, countries around the globe continue to pursue trade despite challenges of trade barriers and countries that are more open by reducing trade barriers bear faster growth, become more innovative, productivity improves higher income and opportunities become available to their citizens (World Bank, 2018).

Like other countries around the world, trade contributes significantly towards Kenya's economic growth and development. It enables the country to connect to the global markets where exports and imports provide a critical channel for the flow of technology, finance, and services required to improve productive capacity in the key sector of the economy that promote structural transformation such as industry, agriculture and services. As a result of trade's ability to spur economic growth, the Kenya government prioritized the sector to conduce the envisioned 10 percent economic growth and poverty reduction (Republic of Kenya, 2013).

Recent empirical literature supports with strong evidence that spur economic and subsequently improve revenue mobilization (Bothole, 2010; Saibu, 2012; Gaalya, 2017; Ashgar & Mehmood, 2017; Ndoye, 2017) while trade openness according to studies such as (Warrad & Shubali, 2018; Sanusi, 2021), reduces tax revenue. From the aforementioned literature, no recent study has taken the direction of investigating the effect that the degree of openness has on tax revenue performance in Kenya. Majority of the studies have looked into the relationship that exists between the degree of openness and economic growth (Musila & Yiheyis, 2015; Githanga, 2015; Bruecker & Lederman, 2015; Kiganda, 2017; Abdillahi, 2017). Given the importance of trade on economic growth, this study therefore, seeks to establish the effect of trade openness on tax revenue performance in Kenya.

LITERATURE REVIEW

A number of studies have been carried out concerning tax revenue performance in different countries and used varieties of methodologies using different determinant variables. This study focuses on previous studies in which Agriculture share and trade openness in GDP are studied as independent variables in the tax revenue performance.

A study by Hamdan & Rana (2021) investigated tax revenue determinants in Malaysia, Brazil, India, China, Pakistan, Mexico and Turkey where the primary goal was to establish the impact of GDP growth, agriculture, employment, trade and manufacturing on tax revenue. The study revealed agriculture share to have a negative effect on tax revenue of these countries.

Piancastelli & Thirwall (2019) examined the factors that determine tax revenue efforts for both developing and developed countries. The author established that agriculture share in GDP has significant and positive effect.

Gobachew et al. (2018) investigated the factors determining tax revenue in Ethiopia. The study revealed that agriculture share in GDP has statistically and significant negative effect on tax revenue in Ethiopia. While this study established statistically and significant effect, a study by Ikhatua & Ibadin (2018) which examined the determinants of tax revenue efforts in Nigeria revealed that agriculture has significant positive effect on tax revenue in Nigeria.

Addison & Levin (2012) sought to establish the determinants of tax revenue in Sub-Saharan Africa. The researcher established that agriculture has statistically and negative effect on total tax revenue to GDP ratio.

Eltony (2002) studied determinants of tax efforts in 16 Arabic countries. The study revealed that agriculture sector in GDP negatively and significantly affects tax revenue. The findings of this study is consistent with the findings of Castro & Camarillo (2014) who sought to establish factors that determine tax revenue in 34 Organization for Economic Cooperation and Development (OECD) from 2001 to 2010. The study findings established that agriculture sector share in GDP has a negative and statistically effect on tax revenue.

A study by Sanusi (2021) sought to investigate the effect of macroeconomic factors on tax revenue in Economic of West African states (ECOWAS). The researcher used panel data for the study variables for the period ranging 2005 to 2019. The explanatory variables incorporated include inflation, GDP, unemployment, openness in trade and exchange rates. The study findings revealed that openness in trade negatively affected tax revenue but insignificant.

Warrad & Shubita (2018) sought to investigate the effect that openness to international trade has on tax revenue performance in the countries in the Middle East and North Africa. Panel dataset for the period ranging 2000 to 2015 for 9 selected MENA countries was used. The researchers examined the variables of corruption level, degree of openness, population and GDP per capita. The study findings using the panel fully modified least squares, established a negative relationship between international openness and government revenue

Gaalya et al. (2017) examined the effect that the degree of openness has on tax revenue of East African countries. The study examined the effects of openness on different categories of taxes. The study established that trade openness had a positive influence on total tax revenue, indirect taxes and trade taxes, while negatively related to average tariff rates.

A study by Asghar & Mehmood (2017) Sought to establish the effect of degree of openness on tax revenue on tax revenue collection along with other non-tax determinants in Pakistan. Time

series data for the period ranging 1980 to 2015 and estimating co-integration, ARDL bound testing approach was employed by the researchers. The study established that trade openness is inversely linked with tax revenue performance in Pakistan. The study further explains that when openness is followed by reducing the tariffs, there may be a reduction situation in tax revenue; otherwise the outcome of trade openness might be different.

Jaffri et al. (2015) sought to empirically examine the effect of trade liberalization on tax revenue in Pakistan. The researchers made use of the ARDL model and data ranging 1982 to 2013 to establish the relationship that exist. The study findings revealed a positive relationship between trade liberalization and tax revenue in Pakistan.

Chaudhry & Munir (2010) examined the factors responsible for the low tax revenue in Pakistan by employing time series data for the period 1973 to 2009. The researchers incorporated the explanatory variables of per capita income, agriculture share in GDP, manufacturing share, degree of openness, foreign aid, literacy level and political stability. The model for the study was estimated using OLS regression analysis. The study findings revealed that degree of openness is an important determinant of tax efforts in Pakistan.

Chilima (2005) sought to investigate the factors determining tax revenue in Malawi. The researcher used a log-linear model, along with time series data from 1980 to 2016. The independent variables involved in the study include the degree of openness, inflation, exchange rate, money supply, domestic debt, agriculture share, manufacturing share and services share in GDP. The study findings established that degree of openness is a strong and significant determinant of tax revenue.

Overview of Literature Review

The study's motivation stems from studies that have discovered diverse and, at times, contradictory empirical evidence and magnitude of structural factors on tax revenue performance. These findings have sometimes resulted in conflicting discussions about the direction of economic policy mix that allows for maximum mobilization of tax revenue required to spur economic growth. However, it should be noted that the majority of these studies used cross-sectional and panel data from multiple countries, with only a few using time series data.

Data Type and Source

The annual time series data for this study were sourced from the World Bank Development indicators for the period of 1980 to 2020.

Econometric Models

Model Specification

The model specification for this study adopted regression approach based on theoretical framework. This approach reflects the works of (Tanzi, 1992; Piancastelli, 2001; Teera, 2002; Murunga, 2016 and Mwangi, 2019). The theoretical framework is translated into a functional relationship as shown:

$$T/_Y = f(V) + \varepsilon \tag{3.1}$$

Vector Error Correction Model (VECM)

To estimate the short-run and long-run effects of the time series data, VECM was employed. Furthermore, this model allows for the possible estimation of speed of adjustment coefficient even if there is only one co-integrating relationship.

$$\Delta lntxr_t = \theta + \sum_{t=1}^{k} \beta_i \Delta lntxr_{t-i} + \sum_{j=1}^{k} \emptyset_j \Delta lnagric_{t-j} + \sum_{m=1}^{k} \varphi_m \Delta lnopen_{t-m}$$
$$+ \sum_{n=1}^{k} \delta_n \Delta lnfaid_{t-n} + \pi_1 ECM_{t-1}$$

k= the lag length

$\theta, \beta, \emptyset, \varphi and \delta$ = short-run dynamic coefficients of the model

π_i = the speed of adjustment parameter with a negative sign. Measures the rate at which *txr* returns to equilibrium after changes in *agric, open and faid*

$ect = lhtxr_{t-1} - \beta_2 lagric_{t-1} - \beta_3 6lopen_{t-1} - \beta_4 lfaid_{t-1}$

ECT_{t-1} = The long-run co-integrating equations' lagged OLS residuals

The ECT explains how the derivation of the previous period from the long-run equation influences short-run movement in the dependent variable.

μ_{it} = Stochastic error terms

RESULTS AND DISCUSSIONS

Table 1: Descriptive Statistics Results

	TAX	OPEN	AID	AGRIC
Mean	9.595450	53.08784	6.085088	24.41065
Median	8.075025	54.13227	4.820528	25.54020
Maximum	15.18702	72.85848	16.98248	29.86876
Minimum	6.074440	27.23390	2.446328	16.25498
Std. Dev.	3.379459	10.44222	3.463179	3.954335
Skewness	0.628041	-0.423486	1.426400	-0.441672
Kurtosis	1.700214	3.211410	4.424190	1.828198
Jarque-Bera	5.581445	1.301847	17.36826	3.678753
Probability	0.061377	0.521564	0.000169	0.158917
Observations	41	41	41	41

The descriptive statistics results indicate the mean values of tax revenue share, trade openness share, foreign aid share and agriculture share to be 9.60%, 53.09%, 6.09% and 24.41% respectively. The variables' respective maximum and minimum values are equally shown indicating variations over the study period for the respective series. The difference between the maximum and minimum values for the variables, 9.00, 45.62, 14.54 and 13.61 respectively are significantly high. The results indicate that tax revenue, foreign aid and agriculture sector are not spread out from the mean i.e. they have smaller standard deviations except the variable of trade openness which is more spread out from the mean than the rest of the series with a large

standard deviation of 10.44. It can further be noted that the standard deviations of the variables are less than their means. This indicates that there are no outliers in the series hence the variables are likely to be normally distributed. The further confirmation by the Jacque-Bera test indicates the series to be normally distributed. Conversely, the variable of foreign aid is shown not to be normally distributed. However, this is not a problem since the error term of the series is normally distributed.

Stationarity Test

The study performed a combination of the Augmented Dickey Fuller and Phillips-Perron tests on levels and first difference for each study variable. The Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) tests suggested similar results of stationarity after first difference leading to a rejection of the null hypothesis of non-stationarity at 5% significance level. Results indicate that the variables of tax revenue share, agriculture share, trade openness share and foreign aid share of GDP are integrated of order 1, I (1), i.e. they became stationary after first differencing.

Table 2: Unit Root Test Results

Augmented Dickey Fuller Test					
		TAX	**OPEN**	**AID**	**AGRIC**
Null Hypothesis: Has a unit root					
Level	ADF Test Statistics	-0.217669	-1.151036	-1.718038	-1.298021
	(p-values)	(0.9278)	(0.6859)	(0.4147)	(0.6212)
	Critical values				
	(5% level)	-2.936942	-2.936942	-2.936942	-2.936942
1st Difference	ADF Test Statistics	-5.578762	-6.221695	-6.709414	-6.600481
	(p-values)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	Critical Values				
	(5% level)	-2.938987	-2.938987	-2.938987	-2.938987

Note: When p-value is higher than 5% level, null hypothesis of a unit root cannot be rejected, implying non-stationarity. Test equations included intercept.

Phillips-Perron Test					
		TAX	**OPEN**	**AID**	**AGRIC**
Null Hypothesis: Has a unit root					
Level	PP Test Statistics	-0.217669	-1.127378	-1.759353	-1.27167
	(p-values)	(0.9278)	(0.6956)	(0.3946)	(0.6333)
	Test Critical Values				
	(5 % Level)	-2.936942	-2.936942	-2.936942	-2.936942
1st Difference	PP Test Statistics	-5.583712	-6.221578	-6.711361	-6.603236
	(p-Values)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	Critical Values				
	(5% Level)	-2.938987	-2.938987	-2.938987	-2.938987

Note: When p-value is higher than 5% level, null hypothesis of a unit root cannot be rejected, implying non-stationarity. Test equations included intercept.

Lag Length Selection

According to Mc Millin & Ozcicke (2001), VAR models are commonly used in forecasting and therefore selection of an optimal lag length is a crucial aspect when specifying vector Autoregressive models. Accordingly, determination of appropriate and an optimal lag length is a crucial step in the estimation of VAR models. In the light of this, if a higher order lags length than the true lags length is chosen, an increase in the mean square forecast errors of the VAR and autocorrelation may be experienced, whereas including too few lags also leads to specification errors, (Lutkepohl, 1993). Hence, it was necessary to decide on the optimal lag length to be employed before estimation of a time series equation. Although Wooldridge (2013) suggests appropriate of 1 or 2 lags for annual data, 1 to 8 lags for quarterly data and 6, 12 or 24 lags for monthly data, selection of optimal lags is basically an empirical issue and the most common practice is by some statistical procedures. SC and HQ suggest an optimal lag of 1 while LR, FPE and AIC suggest an optimal lag of 2.

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-415.0642	NA	25311.42	21.49047	21.66110	21.55169
1	-285.9042	225.2022	76.82728	15.68739	16.54050*	15.99348*
2	-266.6626	29.60235*	66.92099*	15.52116*	17.05676	16.07212

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Johansen Cointegration Test

The study performed the Johansen cointegration test to establish the long run relationship. Cointegration test was performed based on the null hypothesis of no cointegration. Ssekuma, (2011) asserts that Johansen cointegration test has the ability to estimate more than one cointegrating relationship, if data set contains two or more time series. Both Trace test and maximum eigenvalue results indicate that there is one (1) cointegrating relationship. The study therefore, rejects the null hypothesis of no cointegration relationship at 5% level of significance.

Table 4: Johansen Cointegration Test Results

Hypothesized No. of CE(s)	The Trace Test	Trace Statistic	0.05 Critical Value	Prob.**
	Eigenvalue			
None *	0.618833	57.78065	47.85613	0.0045
At most 1	0.251238	20.16448	29.79707	0.4118
At most 2	0.144214	8.880426	15.49471	0.3766
At most 3	0.069440	2.806778	3.841466	0.0939

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
* denotes rejection of the hypothesis at the 0.05 level

Maximum Eigenvalue

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.618833	37.61617	27.58434	0.0019
At most 1	0.251238	11.28406	21.13162	0.6190
At most 2	0.144214	6.073648	14.26460	0.6038
At most 3	0.069440	2.806778	3.841466	0.0939

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Vecm Estimation Results

Table 5: Results of Long Run Estimates

1 Cointegrating Equation(s):			Log likelihood	-276.7449
TAX	**OPEN**	**AID**	**AGRIC**	**CONSTANT (C)**
1.000000	0.083733	0.248376	0.644991	-31.26712
	(0.02161)	(0.04984)	(0.04425)	
	[3.87519]	[4.98349]	[14.5746]	

Note: Standard error ( ) & t-statistics [ ]

The long run (normalized) equation is derived from the cointegrating coefficients. Therefore, the estimated long run equation is illustrated as:

$$Tax_t - 31.27 + 0.08Open_t + 0.25Aid_t + 0.64Agric_t = 0 \qquad (4.1)$$

$$Tax_t = 31.27 - 0.08 Open_t - 0.25 Aid_t - 0.64 Agric_t \qquad (4.2)$$

Effect of Trade Openness on Tax Revenue Performance

Equation 4.2 shows how tax revenue responds to changes in the levels of trade openness in Kenya. This was based on the null hypothesis (H_{01}) that trade openness share in GDP has no significant effect on tax revenue performance in Kenya. From equation 4.2, the results indicated that level of trade openness had a negative and statistically significant effect on tax revenue performance in the long run and this finding does not conform to a priori expectation. From the equation, it is clearly seen that the trade openness has a coefficient of (-0.08) and a t-statistics of 3.88 (t > 1.96), which implies that a 1% increase in the levels of trade openness contributes to a 0.08% decrease in tax revenue over the study period. Given these findings, the study rejects the null hypothesis (H_{01}) since a statistically significant relationship between trade openness share in GDP and tax revenue performance was established.

Effect of Agriculture on Tax Revenue Performance

Equation 4.2 indicates the relationship that exists between agriculture share and tax revenue performance in Kenya. This was based on the null hypothesis (H_{02}) that agriculture share in GDP has no significant effect on tax revenue performance in Kenya. From equation 4.2, agriculture share is indicated to have a coefficient of (-0.64) and t-statistics of 14.57 (t>1.96). The result in equation 4.2 indicated the coefficient for the share of agriculture sector in GDP to be negative and statistically significant to total tax revenue performance in the long run and this conforms to a priori expectation. This implies that a one percent increase in the share of agriculture sector could lead to a reduction in tax revenue by as much as 0.64 percent. Based on these results, the study rejects the null hypothesis (H_{02}) given the statistically significant relationship between share of agriculture and tax revenue performance established.

Vector Error Correction Model Short-Run Estimates

Table 6: Vector Error Correction Model Estimates (Short-run)

Error Correction:	D(TAX)	D(OPEN)	D(AID)	D(AGRIC)

CointEq1	-0.270306*	-2.363442	-0.975547	0.055719
	(0.10680)	(0.87893)	(0.25103)	(0.22715)
	[-2.53085]	[-2.68899]	[-3.88611]	[0.24529]
D(TAX(-1))	0.216324	0.154944	0.566814	-0.730343
	(0.17056)	(1.40359)	(0.40088)	(0.36275)
	[1.26832]	[0.11039]	[1.41391]	[-2.01336]
D(OPEN(-1))	0.030474	0.148019	-0.067789	-0.060201
	(0.02648)	(0.21788)	(0.06223)	(0.05631)
	[1.15101]	[0.67935]	[-1.08933]	[-1.06911]
D(AID(-1))	0.059527	0.003115	-0.054972	0.121289
	(0.07468)	(0.61460)	(0.17554)	(0.15884)
	[0.79705]	[0.00507]	[-0.31316]	[0.76360]
D(AGRIC(-1))	0.166479	0.457215	0.512076	-0.06156
	(0.09746)	(0.80200)	(0.22906)	(0.20727)
	[1.70824]	[0.57009]	[2.23553]	[-0.29700]
C	0.197384	-0.773453	-0.160288	-0.035898
	(0.11744)	(0.96644)	(0.27603)	(0.24977)
	[1.68076]	[-0.80031]	[-0.58070]	[-0.14372]
R-squared	0.265050	0.218905	0.403183	0.201648
Adj. R-squared	0.153694	0.100557	0.312756	0.080685
Log likelihood	-37.37489	-119.5756	-70.70394	-66.80537
F-statistic	2.380203	1.849677	4.458664	1.667028

Note: Standard errors in ( ), t-statistics [ ] & * denotes statistical significance at 5% level of significance.

Based on the VECM results in Table 6, the study obtains the short run equation estimated as follows;
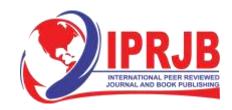
$$\Delta \text{Tax} = -0.270306 \boldsymbol{ECT}_{t-1} + 0.216324 \Delta \text{Tax}_{t-1} + 0.030474 \Delta \text{Open}_{t-1} + 0.059527 \Delta \text{Aid}_{t-1} + 0.166479 \Delta \text{Agric}_{t-1} + 0.197384 \qquad (4.4)$$

Short-Run Effect of Agriculture on Tax Revenue Performance in Kenya

VECM results in equation (4.4) above indicate that one lagged period agriculture share has positive and significant effect on the current period tax revenue at 0.1 significance levels in the short run with coefficient and p-value of 0.166479 and 0.097 respectively. This implies that a percentage increase in agriculture share is associated with 0.17% increase in tax revenue on average ceteris paribus in the short run.

Short-Run Effect of Trade Openness on Tax Revenue Performance in Kenya

From equation (4.4) above, VECM results indicate that one period lagged trade openness share has positive and insignificant effect on the current period tax revenue in the short run with coefficient and p-value of 0.030474 and 0.258 respectively. This shows that an increase in 1% of trade openness share causes 0.03% increase in the current period tax revenue in the short

run. The findings of this study consistent with (Muibi & Sinbo, 2013) who found insignificant effect of trade openness on tax revenue performance in Nigeria.

Error Correction Estimate

The ideal coefficient of error correction term is required to be negative and statistically significant. This is because a positive coefficient (speed of adjustment) means that the VECM continues to move away from the long-run equilibrium after experiencing a shock, instead of converging to it. In Table 6, the coefficient of the error correction term (-0.27) is negative and statistically significant with p-value of 0.0163. This implies that the tax revenue's previous period's deviation from the long-run equilibrium is corrected in the current period at an adjustment speed of approximately 27%.
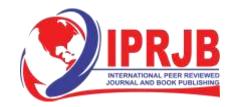
Causality Test

Cointegration established in Table 4.5 indicates a possibility of existence of a causal relationship between the study variables. The study therefore, conducted pairwise granger causality test to examine causality linkage between tax revenue performance, foreign aid, trade openness and agriculture share in GDP in Kenya. This test was based on the null hypothesis of no causality and the results presented in Table 7.

Table 7: Pairwise Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
OPEN does not Granger Cause TAX	39	1.16156	0.3251
TAX does not Granger Cause OPEN		3.36874	0.0463*
AID does not Granger Cause TAX	39	1.77477	0.1849
TAX does not Granger Cause AID		0.55757	0.5777
AGRIC does not Granger Cause TAX	39	5.20494	0.0107*
TAX does not Granger Cause AGRIC		4.68574	0.0159*
AID does not Granger Cause OPEN	39	1.79492	0.1815
OPEN does not Granger Cause AID		2.79401	0.0753**
AGRIC does not Granger Cause OPEN	39	0.97518	0.3874
OPEN does not Granger Cause AGRIC		0.6426	0.5322
AGRIC does not Granger Cause AID	39	0.12463	0.8832
AID does not Granger Cause AGRIC		0.6509	0.5280

Note: The lag length p = 2, **and * implies rejection of the null hypothesis of no causality at 5% and 10% level of significance respectively.

The results in Table 7 indicate that unidirectional causality exists between trade openness in GDP and tax revenue performance (OPEN←TAX). This implies that the null hypothesis of no causality is rejected for the causal relationship between trade openness in GDP and tax revenue performance in Kenya. The unidirectional causality running from tax revenue performance and trade openness in GDP is significant at 5% level of significance. The unidirectional causality running from the tax revenue performance and trade openness in GDP is consistent with the findings of Amankwaah &Agyei (2018) who investigated the relationship between trade openness and trade tax revenue in Ghana. However, this contradicts the finding of Loganathan

(2020) who examined the effects of growth, financial development and trade openness on tax revenue in Malaysia for the period 1970-2017. Given that the various studies established varied results, the findings of causality from tax revenue performance to trade openness in GDP implies that tax revenue performance affects trade openness in Kenya.

CONCLUSIONS AND RECOMMENDATIONS

The study concludes that there is a significant negative long-run relationship between agriculture share and tax revenue performance and trade openness share and tax revenue performance in Kenya. The Pairwise Granger Causality test results in the case of trade openness share and tax revenue validates the Laffer curve theory that illustrates how tax rates have adverse effects on tax revenue performance, that is, tax rate affects the amount of tax revenue that government can collect. New trade agreements should be pursued to explore new markets; international markets should be exploited by considering diversification from primary products through value addition process; reduction of growing trade deficit by promoting exports over imports and the country should consider allocating more funds to agriculture sector in order to enhance productivity and income to farmers since the current allocation falls short of the required international commitment.

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