Research Article

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Trade Globalization, Overseas Investment, and Tax Revenue Growth in Sub-Saharan Africa

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Abstract: The financial setbacks of the sub-Saharan African regions have necessitated this study. The study assesses the role of trade openness and foreign direct investment (FDI) in driving tax revenue growth in sub-Saharan Africa. The major parameter representing the dependent variable is tax revenue growth while the independent factors include trade openness, exports, imports, and GDP as a moderating element. The research runs from 1990 to 2022 and employs the vector error correction model (VECM), with a unit root test that yields order one, while the Johansen co-integration test shows a long-run connection for all variables. The VECM results suggest that the long-run disequilibrium is corrected at a positive rate of 8.5%. It is also noteworthy that a percentage change in trade openness would result in a 13.7% decrease in tax income, but fluctuations in all other parameters except GDP will enhance tax revenue growth in sub-Saharan Africa. The test for the impact of all criteria on tax revenue growth yields minor results; however, tax revenue growth initiatives in Sub-Saharan Africa have a negative short- term effect on FDI but a favourable long-term impact. In addition, trade openness has a negative effect on GDP and exports in the short run, while imports have a negative impact on foreign investment. The policy implications include that bilateral trade policies will need to be reviewed, with an emphasis on exports, economic growth, and tax collection schemes. In addition, the governments in sub-Saharan African regions are encouraged to enact tax policies that would engender the inflow of overseas investment.

Keywords: trade openness, exports, imports, foreign investment, tax revenue growth, GDP

JEL classification codes: F10, F15, F43, H20

1 Introduction

The promotion of global interaction and capital exchange, essential for enhancing the international visibility of emerging economies, relies heavily on the freedom of trade. The globalization of commerce significantly contributes to the growth of revenue in emerging economic countries (Raghutla, 2020). The primary objective of global trade and foreign investment inflows is to augment government revenue by effectively imposing taxes on businesses and corporate activities. Consequently, economies must engage in cross-border commerce with other countries to boost productivity and compete with trade counterparts to earn foreign currency by exporting goods and services (Nguyen et al., 2023). Trade liberalization plays a crucial role in enabling emerging economies, abundant in low-skilled labour, to fully leverage their competitive advantage by fostering innovation and creativity, leading to substantial returns on investment and increased output (Gnangnon, 2017; Krugman, 1985; Udeagha & Ngepah 2021). Therefore, free trade constitutes a significant aspect of intellectual and legislative dialogues. Trade liberalization and enhanced productivity stand out as the most efficient policies for reducing inequality, as emphasized by Winters et al. (2004). Huchet-Bourdon et al. (2018) suggest that countries specializing in producing low-quality goods may face adverse effects on their economic performance. Conversely, regions focusing on producing high-quality goods may yield favourable outcomes.

Trade globalization, as delineated by trade permeability and liberalization, leads to heightened commercial activities and diminished barriers to trade (Kurtes et al., 2023). The phenomenon of globalization allows for unrestricted mobility of individuals, exchange of knowledge, dissemination of ideas, and trade of goods and services (Aggarwal & Karwasra, 2024; Fraihat et al., 2023). The liberation in trade fosters economic growth by optimizing resource allocation, improving efficiency through technology transfer and knowledge spill-overs, and broadening

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the range of available goods and services (Barro & Sala-i-Martin, 1997). Previous research (Grossman & Helpman, 1991; Romer, 1990; Young, 1991) affirms that liberalized trade contributes to economic development across various regions globally. Open trade benefits both advanced and emerging economies by facilitating the spread of knowledge (Edwards, 1997; Krugman, 1985; Romer, 1990; Winters, 2004).

Recent research conducted by Duan et al. (2022) has affirmed that trade liberalization plays a significant role in the generation of environmental pollution within China, leading to increased levels of carbon dioxide emissions. Wani and Mir (2021) have established a notable inverse correlation between exports, overseas remittances, and the GDP growth of India, while Udeagha and Ngepah (2021) have provided further support for the adverse impact of trade liberalization on the economic growth of South Africa. Malefane and Odhiambo (2021) have illustrated that trade openness does not affect the GDP growth of Lesotho. Conversely, findings from a previous study in Serbia have indicated that enhanced commercial flexibility, particularly in terms of export regulations, contributes positively to overall long-term economic recuperation. Nevertheless, the existence of a connection between trade accessibility and sustained economic growth remains uncertain. Siddika and Ahmad (2022) have highlighted the mixed outcomes associated with the influence of free trade, especially within developing nations, prompting a pressing need for an in-depth investigation supported by empirical evidence.

The contentious debate surrounding the impact of trade liberalization and foreign investments on a nation's economic development has persisted over the years (Salvatore, 2011), yet the ramifications on tax revenue growth in developing countries have not been thoroughly explored. Consequently, there remains a scarcity of research examining the impact of trade openness on the growth of tax revenue in sub-Saharan Africa. Thus, the present study aims to assess the effects of trade openness and inflows of foreign direct investment (FDI) on tax revenue growth specifically in Sub-Saharan Africa. This underscores the vital reason why this study is of utmost importance. This highlights the crucial justification for the significance of this research.

2 Literature Review

2.1 Conceptual Definitions

Dragusha et al. (2023) define trade liberalization as a multidimensional concept that involves the establishment of multiple relationships and interconnectedness between nations and groups that comprise the contemporary world, commonly referred to as the international community. According to Dragusha et al. (2023), to liberalize trade, tariffs, quotas, and non-tariff barriers must be decreased or removed. Stronger export industries can profit from greater investment in resources, usage of capacity, economies of scale, and advances in technology as a result of international market competitiveness. Nevertheless, importation has an important role in fuelling the growth of the economy. Imports can give local companies the opportunity to use foreign technology and intermediary supplies, leading to long-term growth of the economy (Tafirenyika et al., 2023).

Furthermore, Lashkaripour (2020) posited that the substitution of a portion of the domestic tax revenue with import duties can be advantageous. This is due to the fact that in cases where trade elasticity is low and import tariffs prove to be more efficient in revenue generation, the burden falls mainly on domestic consumers. The trade-off between efficacy and efficiency highlights that even an uncooperative government could replace a small part of its internal tax income with import duties in a beneficial manner. Conversely, the effectiveness of export duties varies depending on the trade elasticities at the industry level (Lashkaripour, 2020).

2.2 Theoretical Underpinnings of the Study

The two theories underpinning this work include the Reimbursement Theory and the Neoclassical Growth Theory.

2.2.1 The Reimbursement Theory

According to the reimbursement theory, financial equilibrium is considered a result of global trade freedom. Given that rising trade risk lowers national fiscal stability, there is a greater desire to provide reimbursement through extensive redistribution and service arrangements. Furthermore, because authorities invest larger amounts on social welfare to make amends for households hurt by commerce, open-border societies usually have a greater amount of expenditure (Mehta & Mallikarjun, 2023; Mireku et al., 2017). Thus, government investment in infrastructure improves global commercial activities and serves as a catalyst for financial equilibrium whereby developed economies transfer technology and expertise to developing economies. This theory is very key to this study which wishes to explore the

effectiveness of global trading in improving tax revenue and the extent to which tax revenue in Sub-Saharan Africa can lead to improvement in social infrastructure that will engender the transfer of technology through globalization of commerce as a way of reimbursing the tax compliant economy.

2.2.2 Neoclassical Growth Theory

The initial component of the neoclassical growth hypothesis contends that commerce liberalization can promote capital creation and increase the distribution of resources potency, hence promoting a boost in the level of growth in economies (Kong et al., 2021). According to the idea, immediate balance is caused by alternating labour and capital inputs into this manufacturing process. The idea also contends that technology progress has a significant impact on financial markets and that economic expansion is unlikely to continue without technical advancements. Thus, without the globalization of trade, the equilibrium advocated by the neoclassical group will not be effective in developing economies such as that of Sub-Saharan Africa. Trade liberalization promotes a proper mix of capital, labour, and technology which helps to boost tax revenue in the region.

2.3 Empirical Studies

Edo (2024) demonstrated that the direct impact of trade openness and domestic public debt yielded a notably positive outcome. Furthermore, the results indicated that the combined impact of commercial globalization and domestic public debt was markedly advantageous, whereas the combined impact of trade openness and foreign public debt was moderately favourable. The research confirmed that trade openness and national debt acted as complementary catalysts for economic advancement in sub-Saharan African countries. Singh (2024) conducted an assessment of the enduring relationship between imports, exports, FDI, and economic growth in the context of India's economic transformation spanning the period from 1991 to 2019. Through the utilization of a co-integration model, it was unveiled that there exists a sustained correlation between GDP per capita, exports, imports, and FDI. The outcomes of the study indicated that exports played a pivotal role in positively influencing GDP per capita, whereas imports and FDI demonstrated a negative influence. Importantly, imports exhibited a more substantial detrimental impact on GDP per capita compared to FDI. Additionally, the vector error correction model unveiled the presence of long-term causality from GDP per capita, exports, and imports to FDI, along with short-term causality from GDP per capita to FDI, imports to FDI, and GDP per capita to exports.

Bajraktari et al. (2023) examined the impact of global trading openness on revenue growth in Western Balkan nations from 2000 to 2021 by employing Fraser Institute yearly statistics. The research revealed that commerce worldwide openness and economic expansion were positively related. Dragusha et al. (2023) examined the link between trade liberalization, international trade, and economic expansion in Albania, utilizing yearly business growth data from 1994 to 2019. The research findings for the Albanian instance indicated that commerce liberalization had an advantageous impact on economic expansion, exports of goods, and imports from abroad. Minh and Trinh (2023) investigated the link between FDI inflows, openness to commerce, and the impact of FDI on economic development in 60 emerging market nations between 1995 and 2019. The research undertaken proved that FDI exerted a beneficial influence on the growth of the economy in emerging economies. The investigation also discovered a substantial borderline of inflows of FDI compared to GDP, which modifies the influence of inbound FDI on the expansion of the GDP. Considering the importance of trade openness, a considerable ceiling was discovered, indicating the host nations' absorption potential.

Vidriza et al. (2023) offered authorities with a synopsis of multiple elements that influence GDP growth for G20 members, as well as approaches to sustaining financial success in the face of the implications of liberalization, globalization, and unrestricted commerce for G20 participating nations from 2016 to 2020. Apart from commerce, the findings revealed that specifically chosen macroeconomic variables such as FDI, expenditures by the government, and price increases had a substantial negative influence on the economy's expansion. Tafirenyika et al. (2023) used the autoregressive distributed lag (ARDL) co-integration approach to investigate the effect of exports, imports, and openness to commerce on Namibian economic development. The study found a significant negative correlation between importation and economic expansion, whereas exports and freedom of trade had both beneficial and significant associations. The study further indicated that short-term economic development was stimulated by exports, imports, and freedom of trade.

Mehta and Mallikarjun (2023) studied how budgetary shortfalls, the currency exchange rate, and openness to trading affect current account deficits. According to the study, currency rate and trade permeability have a considerable impact on the current account imbalance. The study found that liberal trade policies that benefit domestic sectors and expansive fiscal measures contribute to a greater

current account shortfall. Nisha and Madhvi (2023) investigated the impact of capital investment creation on greenhouse gas emissions throughout two separate phases of India's growing economy. India liberalized its economic system through trade liberalization in 1991, resulting in two separate phases of restricted and unrestricted commerce. The statistical information on the economy from 1971 to 2021 is separated into two distinct sections: prior to (1971–1990) and after (1991–2021) liberalization. Fund creation was measured using the amount of gross fixed capital created, while the ecological effect was represented by the release of carbon dioxide. Findings showed that gross fixed capital created had no substantial association with carbon emissions prior to liberalization, but had a large, beneficial influence after liberalization.

Onifade et al. (2022) investigated the implications of trade liberalization on the financial health of a few chosen Middle Eastern and North African nations. The statistical evidence confirmed that local expenditure and workforce composition had a substantial advantageous effect on the economic expansion in these nations, but openness to trading turned out to have an adverse effect on financial performance within the time frame of the study. Siddika and Ahmad (2022) conducted a cross-country analysis on trade facilitation and the rise of the economy from 1995 to 2010.

Leveraging on an innovative panel methodology and the Sachs-Warner freedom measure, the research concluded that trade liberalization exerted a strong positive influence on economic productivity. According to Dauti and Elezi's (2022) research, freedom of trade, price rises, Money invested and production gaps significantly impact the financial situation in Central and Eastern Europe and the Western Balkans.

Previous study explored the relationship between the actual pace of growth and the percentage of imported and exported goods in GDP, using Serbia as a case in point. The study used VAR technique and spanned 2000–2019. Commercial flexibility, especially geared towards export regulations, leads to a long time overall economic recovery. Conversely, the percentage of importation in the nation's gross domestic product maintained an adverse relationship with GDP. Udeagha and Ngepah (2021) investigated the disproportionate impact of trade liberalization on economic expansion in South Africa using a nonlinear ARDL model. The findings revealed that commerce freedom had both immediate and long-term adverse implications for the economy's expansion.

Oloyede et al. (2021) presented a positive yet statistically insignificant link between economic growth and trade openness within the integrated models of Economic Community of West African States (ECOWAS) and Southern African Development Community, as well as within the distinct Regional Economic Communities. Malefane and Odhiambo (2021) used an ARDL bound analysis to investigate the changing effect of openness to commerce on Lesotho's GDP growth. The study used four measures of trade openness, including three trade-based proxies and a trade openness index. This study's empirical findings revealed that global trade liberalization had no substantial influence on GDP growth in the immediate or distant future, regardless of the indicator employed. Wani and Mir (2021) looked into the relationship between globalization, encompassing overseas investment, exports, imports, and foreign remittances, and economic expansion in India. According to the report, imports and FDI boosted India's growing economy. On the other hand, exports and overseas remittances exhibited a negative and substantial association with GDP growth.

Popović et al. (2020) used a panel model to identify explanatory variables for economic growth in Balkan nations. Their analysis concluded that only the influence of trade liberalization is statistically noteworthy and in an advantageous perspective. Raghutla (2020) studied the influence of freedom of trade on economic development in five developing market nations, using data from 1993 to 2016. Utilizing the panel calculation approaches statistical findings prove the long-term correlation among trade liberalization, growth in the economy, financial expansion, rising prices, workforce, and technological advances, while long-run flexibility shows that openness to trade had a major beneficial effect on the growth of the economy. Additionally, the variety of panel non-causation tests revealed a two-way causal relationship between revenue growth and price hikes, as well as a causality that is unidirectional that flows from commercial advancement to international accessibility and industrial progress to financial stability in the near term.

Krajišnik et al. (2020) studied the influence of export patterns on growth in the economy of Bosnia and Herzegovina. The study identified a poor arrangement for international trade activity in Bosnia and Herzegovina, highlighting the need to enhance export success in order to lower the country's foreign trade imbalance. The study found that exports were essential for Bosnia and Herzegovina's prosperity. Osabuohien et al. (2019) demonstrated that the presence of trade complementarity had a remarkable and positive impact on the levels of bilateral trade specifically limited to the sub-regional area. Popović et al. (2019) found a beneficial correlation between overall commerce and increase in GDP in the sovereign nation of Srpska. Researchers also found an unfavourable link between trade imbalances and Growth.

Gnangnon (2017) investigated the effects of international trade policy liberalization on nations' levels of

economic growth, as measured by real per capita income. The study is especially pertinent in light of rising criticism against trade with other nations, which might promote home chauvinism and impede commerce worldwide freedom. The research was carried out using a panel data set of 155 nations across non-overlapping 4-year sub-periods spanning 1995–2014. The evidence collected provided significant backing for the hypothesis that global trade openness boosts the development of the economy.

Keho (2017) investigated the influence of trade liberalization on economic development in Cote d'Ivoire from 1965 to 2014 using a framework consisting of multiple variables with capital accumulation, labour, and commerce liberalism as the predictors. The findings indicated that openness to trading had an auspicious impact on economic growth in both the short and long term.

The study also found a beneficial and significant complementary association between trade liberalization and capital development in boosting economic expansion. Mireku et al. (2017) examined the influence of openness to commerce on Ghana's GDP variability from 1970 to 2013. Results revealed that increases in freedom of trade had a beneficial impact on both long-term as well as short-term economic expansion fluctuations. Instability in local lending to the business community, as well as shocks from economic liberalization and openness to finance, all resulted in rapid economic unpredictability. Olayiwola et al. (2015) found within the ECOWAS that intra-regional imports were higher than intra-regional exports, with maximum values of 20 and 15%, respectively, from 1999 to 2009.

3 Methodology

3.1 Specification of Vector Error Correction Models

The conventional VECM showing both the long- and short-run relationship is specified as shown below:

$$\Delta Y_t = \sigma + \sum_{i=1}^{k-1} \gamma_i \Delta Y_{t-i} + \sum_{j=1}^{k-1} \eta_j \Delta X_{t-j} + \sum_{m=1}^{k-1} \xi_m \Delta R_{t-m} + \lambda \mathrm{ECT}_{t-1} + \mu_t, \tag{1}$$

Here:

1. ECT_{t-1} is the lagged OLS residual obtained from the long-run co-integrating equation:

$$Y_t = \sigma + \eta_j X_t + \xi \mu_t$$

It is expressed as $\mathrm{ECT}_{t-1} = [Y_{t-1} - \eta^1 X_{t-1} - \xi^1 R_{t-1}]$, the co-integrating equation. The ECT explains that the previous period's deviation from LR equilibrium (which is the error) influences short-run (SR) movement in the dependent variable.

2. λ is the coefficient of the ECT and the speed of adjustment. It measures the speed at which y (dependent variable) returns to equilibrium after changes in X and R.

For the purpose of this study, the following VECM applies:

$$\begin{aligned}\Delta \mathrm{LnTXR}_t = {} & a + \sum_{i=1}^{k-1} = \beta_i \Delta \mathrm{LnTXR}_{t-i} + \sum_{j=1}^{k-1} = \varnothing_j \Delta \mathrm{LnTRG}_{t-j} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnIMP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnEXP}_{t-l} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnOSI}_{t-l} \\ & + \sum_{m=1}^{k-1} = \varphi_m \Delta \mathrm{LnGDP}_{t-m} + \lambda_1 \mathrm{ECT}_{t-1} + \mu_1 t\end{aligned} \tag{2}$$

$$\begin{aligned}\Delta \mathrm{LnTRG}_t = {} & a + \sum_{i=1}^{k-1} = \beta_i \Delta \mathrm{LnTXR}_{t-i} + \sum_{j=1}^{k-1} = \varnothing_j \Delta \mathrm{LnTRG}_{t-j} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnIMP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnEXP}_{t-l} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnOSI}_{t-l} \\ & + \sum_{m=1}^{k-1} = \varphi_m \Delta \mathrm{LnGDP}_{t-m} + \lambda_2 \mathrm{ECT}_{t-1} + \mu_2 t\end{aligned} \tag{3}$$

$$\begin{aligned}\Delta \mathrm{LnIMP}_t = {} & a + \sum_{i=1}^{k-1} = \beta_i \Delta \mathrm{LnTXR}_{t-i} + \sum_{j=1}^{k-1} = \varnothing_j \Delta \mathrm{LnTRG}_{t-j} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnIMP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnEXP}_{t-l} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnOSI}_{t-l} \\ & + \sum_{m=1}^{k-1} = \varphi_m \Delta \mathrm{LnGDP}_{t-m} + \lambda_3 \mathrm{ECT}_{t-1} + \mu_3 t\end{aligned} \tag{4}$$

$$\begin{aligned}\Delta \mathrm{LnEXP}_t = {} & a + \sum_{i=1}^{k-1} = \beta_i \Delta \mathrm{LnTXR}_{t-i} + \sum_{j=1}^{k-1} = \varnothing_j \Delta \mathrm{LnTRG}_{t-j} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnIMP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnEXP}_{t-l} \\ & + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnOSI}_{t-l} \\ & + \sum_{m=1}^{k-1} = \varphi_m \Delta \mathrm{LnGDP}_{t-m} + \lambda_4 \mathrm{ECT}_{t-1} + \mu_4 t\end{aligned} \tag{5}$$

$$\Delta \mathrm{LnOSI}_t = a + \sum_{i=1}^{k-1} = \beta_i \Delta \mathrm{LnTXR}_{t-i} + \sum_{j=1}^{k-1} = \varnothing_j \Delta \mathrm{LnTRG}_{t-j} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnIMP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnEXP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnOSI}_{t-l} + \sum_{m=1}^{k-1} = \varphi_m \Delta \mathrm{LnGDP}_{t-m} + \lambda_5 \mathrm{ECT}_{t-1} + \mu_5 t \quad (6)$$

$$\Delta \mathrm{LnGDP}_t = a + \sum_{i=1}^{k-1} = \beta_i \Delta \mathrm{LnTXR}_{t-i} + \sum_{j=1}^{k-1} = \varnothing_j \Delta \mathrm{LnTRG}_{t-j} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnIMP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnEXP}_{t-l} + \sum_{l=1}^{k-1} = \varnothing_j \Delta \mathrm{LnOSI}_{t-l} + \sum_{m=1}^{k-1} = \varphi_m \Delta \mathrm{LnGDP}_{t-m} + \lambda_6 \mathrm{ECT}_{t-1} + \mu_6 t \quad (7)$$

where Ln is the natural log; t is the time; k is the maximum lag; β is the coefficients; $\varnothing$ is the difference in parameters; Δ is the difference operators; $K - 1$ is the lag length reduced by 1; λ is the speed of adjustment parameter with a negative sign; β_i, ϕ_j, φ_m are short-run kinetic coefficients of model modification and long-term stabilization; ECT^{t-1} is the error correction term represents the lagged value of the residuals produced from the reliant variable's co-integrating regression with the regression factors. Long-run details are acquired from the long-run co-integrating interaction. $\mu_1 t$ are residuals (stochastic error terms frequently termed impulses, or innovations or shocks) (Table 1).

Table 1: Variable information and measurements

Variable code	Description	Measurement	Source
Dependent			
LNTXR	Tax revenue	Tax revenue % to GDP	WDI
Independents			
LNTRG	Trade-to-GDP ratio	The ratio of the total of exports and imports to GDP	WDI
LNIMP	Imports	Billion USD	WDI
LNOSI	Overseas Investments	Billion USD	WDI
LNEXP	Exports	Billion USD	WDI
Moderating			
LNGDP	Gross Domestic product	Billion USD	WDI

WDI = World Bank Development Indicators.

4 Results

This section displays the findings of the data analysis conducted for the purpose of this investigation. The results include descriptive statistics, unit root tests, VAR Lag Order Selection Criteria, the Johansen Co-integration Rank Test, and vector error correction estimates.

The statistical analysis presented in Table 2 aims to characterize the nature of the datasets prior to their utilization in this examination. The principal objective of elucidating the data collected for this research is to ensure their homogeneous distribution, thereby mitigating hysteresis and the interdependence of autonomous variables. The pivotal indicators for assessing the normality of the datasets, as indicated in Table 2, include kurtosis and Jarque-Bera statistics, particularly focusing on the associated *p*-values. Examination of kurtosis values reveals a range of 2–3, signifying conformity to the acceptable norms of normal distribution. Moreover, all Jarque–Bera *p*-values exceed the established threshold of 0.05 for each variable. Consequently, we can deduce that our datasets exhibit appropriate dispersion.

Table 3 illustrates the unit root test, utilized to examine the integration sequence of each distinct dataset derived for the variables. As indicated by Table 3, the Augmented Dickey-Fuller (ADF) statistic suggests that the variables exhibit stability at first difference or order one. Consequently, this implies that the variables are not stationary at levels and requires a co-integration test (Engle & Granger, 1987) to ascertain the optimal method for data analysis. Nonetheless, prior to conducting the co-integration analysis on the variables, it is imperative to establish the Vector Auto-correlation lag length order for this specific purpose (Table 4).

Table 2: Descriptive statistics

	LNTXR	LNTRG	LNIMP	LNGDP	LNOSI	LNEXP
Mean	2.626	3.919	5.376	6.736	2.649	5.366
Median	2.721	3.922	5.541	6.881	2.976	5.696
Maximum	3.336	4.146	6.275	7.624	4.303	6.284
Minimum	1.374	3.692	4.283	5.784	0.148	4.339
Std. Dev.	0.584	0.137	0.747	0.698	1.117	0.708
Skewness	-0.486	-0.071	-0.178	-0.089	-0.660	-0.173
Kurtosis	2.152	1.869	1.332	1.241	2.268	1.362
Jarque-Bera	2.291	1.784	4.002	4.295	3.133	3.854
Probability	0.318	0.410	0.135	0.117	0.208	0.146
Sum	86.67	129.3	177.4	222.2	87.44	177.1
Sum Sq. Dev.	10.91	0.599	17.84	15.59	39.97	16.02
Observations	33	33	33	33	33	33

Source: Outputs from the System, 2024.

Table 3: Unit root test

Variable type	ADF Statistic	Critical value @ 5%	*P*-value	Order of Integration
LNTXR	−5.373	−2.960	0.000	I(1)
LNTRG	−5.374	−2.964	0.000	I(1)
LNIMP	−4.437	−2.960	0.001	I(1)
LNGDP	−3.459	−2.960	0.016	I(1)
LNOSI	−10.05	−2.960	0.000	I(1)
LNEXP	−5.265	−2.960	0.000	I(1)

Source: Authors' calculation, 2024.

Table 5: Johansen co-integration rank test

Series: LNTXR LNTRG LNIMP LNGDP LNOSI LNEXP				
Hypothesized no. of CE(s)	**Eigenvalue**	**Trace statistic**	**0.05 Critical value**	**Prob.**
None	0.807	163.2	95.75	0.000***
At most 1	0.763	113.8	69.82	0.000***
At most 2	0.639	70.59	47.86	0.000***
At most 3	0.466	39.99	29.79	0.002***
At most 4	0.390	21.18	15.49	0.006***
At most 5	0.190	6.327	3.841	0.011***

Source: Authors' calculation, 2024. *** shows significance level at 1%.

The lag length selected by AIC is the most relevant in this study. Thus, the lag length used in this study based on AIC selection is 2 as indicated in Table 4.

Johansen's examination of co-integration in Table 5 is utilized for the purpose of verifying co-integration and offers a structure for examining co-integrating connections and implementing the Vector Error Correction Method to compute short-term coefficients, short-term adjustment coefficients, and long-term co-integrating relationships. The outcome of the Johansen Co-integration test reveals that nearly all the variables are co-integrated at a significance level of 1%. Consequently, a long-term association is present among the parameters utilized in this investigation. In situations where a prolonged relationship is evident in sequences that exhibit unit roots at the initial difference, it is advisable to employ the Vector Error Correction Method to demonstrate the pace of error adjustment in the short term (Table 6).

The procedure of error rectification within the framework of the vector error correction model (VECM) plays a crucial role in restoring a state of equilibrium over a prolonged period. It evaluates the speed at which a system reverts to its long-term relationship subsequent to a sudden deviation or disruption from a balanced state. Put simply, it gauges the effectiveness of the model's coefficients in offsetting any short-term disequilibrium before reverting to a stable long-run relationship. The process of error adjustment is determined based on the interdependency among the coefficients, reflecting the continual association among each parameter. The phenomenon under consideration involves the process of adjustment aimed at returning all variables to their most advantageous conditions. Consequently, the presence of a corrective term that yields a positive outcome suggests a forthcoming favourable adjustment of parameters towards attaining long-term balance, while a negative corrective factor indicates an unfavourable change leading towards stability.

The error correction expression here suggests that a beneficial change in speed of around 8.5% in the short term will be employed to remedy every long-run imbalance. A percentage change in LNTRG results in a 13.7% decrease in LNTXR in the near run. In the short run, a percentage change in LNIMP is related to a 23.9% rise in LNTXR, whereas LNGDP is connected with a 41.3% drop in LNTXR. A percentage change in LNOSI is connected with a 7.7% rise in LNTXR, whereas EXP is correlated with a 4.6 increase in LNTXR in the near term.

Further statistics, as shown in the Table in Appendix, suggest that none of the factors employed in this investigation exhibits a significant influence on LNTXR in the short or long term. This finding is in line with previous works

Table 4: VAR lag order selection criteria

Endogenous variables: LNTXR LNTRG LNIMP LNGDP LNOSI LNEXP						
Sample: 1990–2022						
Included observations: 31						
Lag	**Log*L***	**LR (Likelihood Ratio)**	**FPE (Final Prediction Error)**	**AIC (Akaike Info Criterion)**	**SC (Schwarz Info Criterion)**	**HQ (Hannan-Quinn Info)**
0	92.79	NA	1.491	−5.599	−5.322	−5.508
1	222.2	200.4*	3.771	−11.63	−9.683*	−10.99*
2	264.3	48.92	3.371*	−12.02*	−8.413	−10.84

Lag orders selected by the criteria are identified by * Authors' calculation, 2024.

Table 6: Vector error correction estimates

Sample (adjusted): 1992–2022						
Included observations: 31 after adjustments						
Cointegrating Eq:	**CointEq1**					
LNTXR(−1)	1.000					
LNTRG(−1)	−0.775					
	(0.777)					
	[−0.998]					
LNIMP(−1)	−0.866					
	(0.641)					
	[−1.351]					
LNGDP(−1)	−2.581					
	(0.665)					
	[−3.882]					
LNOSI(−1)	−0.694					
	(0.108)					
	[−6.441]					
LNEXP(−1)	3.689					
	(0.707)					
	[5.217]					
C	4.502					
Error Correction:	**D(LNTXR)**	**D(LNTRG)**	**D(LNIMP)**	**D(LNGDP)**	**D(LNFDI)**	**D(LNEXP)**
CointEq1	0.085	0.012	−0.017	−0.036	1.083	−0.136
	(0.104)	(0.092)	(0.129)	(0.078)	(0.247)	(0.159)
	[0.816]	[0.131]	[−0.131]	[−0.461]	[4.390]	[−0.851]
D(LNTXR(−1))	−0.135	−0.195	−0.058	0.009	−1.672	−0.206
	(0.243)	(0.216)	(0.302)	(0.182)	(0.578)	(0.374)
	[−0.557]	[−0.903]	[−0.192]	[0.054]	[−2.894]	[−0.549]
D(LNTRG(−1))	−0.137	−0.492	−0.692	−0.699	−0.224	−1.010
	(0.381)	(0.337)	(0.473)	(0.285)	(0.904)	(0.586)
	[−0.361]	[−1.459]	[−1.462]	[−2.451]	[−0.248]	[−1.724]
D(LNIMP(−1))	0.239	−0.400	−0.174	0.282	−1.700	0.091
	(0.382)	(0.338)	(0.475)	(0.286)	(0.906)	(0.588)
	[0.627]	[−1.183]	[−0.367]	[0.986]	[−1.875]	[0.155]
D(LNGDP(−1))	−0.413	−0.312	0.129	0.195	0.397	0.152
	(0.541)	(0.479)	(0.673)	(0.406)	(1.285)	(0.833)
	[−0.762]	[−0.650]	[0.192]	[0.479]	[0.309]	[0.183]
D(LNOSI(−1))	0.077	0.0409	0.019	−0.037	−0.117	−0.023
	(0.075)	(0.066)	(0.093)	(0.056)	(0.178)	(0.115)
	[1.036]	[0.617]	[0.206]	[−0.652]	[−0.658]	[−0.204]
D(LNEXP(−1))	0.046	0.589	0.550	0.169	−0.063	0.459
	(0.334)	(0.296)	(0.416)	(0.251)	(0.794)	(0.514)
	[0.138]	[1.992]	[1.324]	[0.676]	[−0.079]	[0.892]
C	0.061	0.0207	0.039	0.025	0.289	0.039
	(0.028)	(0.026)	(0.036)	(0.022)	(0.069)	(0.044)
	[2.108]	[0.806]	[1.093]	[1.132]	[4.205]	[0.881]
R-squared	0.112	0.216	0.207	0.419	0.678	0.247
S.E. equation	0.108	0.096	0.134	0.081	0.257	0.166
F-statistic	0.413	0.904	0.856	2.371	6.906	1.079

Source: Authors' calculation, 2024.

Table 7: VEC Serial Correlation LM Tests

Sample: 1990–2022		
Included observations: 31		
Lags	**LM-Stat**	***P*-value**
1	30.36118	0.7334
2	41.83524	0.2323

Table 8: VEC heteroskedasticity tests

Sample: 1990–2022		
Included observations: 31		
Chi-sq	**Df**	***P*-value**
280.2259	294	0.7087

Source: Authors' calculation, 2024.

which showed that trade openness (Bajraktari et al., 2023; Singh, 2024), FDI (Vidriza et al., 2023), and import (Tafirenyika et al., 2023) did not impact positively on a country's financial growth. However, in the near run, LNEXP has a positive influence on LNTRG. This result corroborates the works of Dragusha et al. (2023) among others. Whereas LNTRG has a negative impact on LNGDP which is in agreement with the works of Udeagha and Ngepah 2021, LNTXR has a long-term positive effect on LNOSI, but in the short run, it has a detrimental effect. Further research shows that LNIMP has a negative impact on LNOSI in the short run, whereas LNTRG has a negative impact on LNEXP. The result is proved in the works of (Tafirenyika et al., 2023).

4.1 Diagnostic Tests

The diagnostic tests in Tables 7 and 8 show that our model has no correlation between variables or unevenness because the *p*-values are greater than 0.05.

5 Conclusion and Recommendation

5.1 Conclusion

The research looks at how trade globalization, investments from abroad, exports, and imports affect sub-Saharan Africa's tax income growth. We used data from 1990 to 2022 and employed VECM since all of the parameters used in this analysis were shown to be stationary at the first difference and had long-run co-integration (Rehal, 2022). The results reveal that the long-run divergence in achieving the intended tax revenue increase through the different factors analysed would return to equilibrium at an optimistic rate of adjustment of 8.5%. The findings further reveal that a proportional increase or decrease in LNTRG leads to a 13.7% fall in LNTXR in the short term. In the near term, a shift in LNIMP corresponds to a 23.9% increase in LNTXR, whereas LNGDP corresponds to a 41.3% decrease in LNTXR. A percentage change in LNOSI correlates with a 7.7% increase in LNTXR, whereas EXP correlates with a 4.6 increase in LNTXR in the near term.

Based on the effect analysis, no parameter assessed in this study has a substantial impact on tax revenue increase. Trade openness appears to have a negative impact on economic growth and exports in Sub-Saharan Africa, whereas import and tax revenue growth have an adverse effect on overseas investment in the short run, but tax revenue growth has a positive influence on FDI in the long run. These findings raise a number of policy concerns, including the examination of trade policies for imports and exports in sub-Saharan Africa.

5.2 Recommendation

It is critical that the government implement measures that increase exports while reducing imports in the region. Too much importation will result in an overdependence on foreign products, adverse balance of payment, and reduction of FDI in local industries in the region since the products will not receive adequate patronage from the people who have become too used to foreign goods and services. It is also critical for governments in Sub-Saharan Africa to reconsider tax policies that hamper the entrance of foreign investment. This is vital at this moment because of the long-standing advantages of FDI to growing countries; as a consequence, it is important to formulate tax policies that would attract these investments for the benefit of the sub-Saharan African countries. It is also necessary to evaluate bilateral trade policies affecting Sub-Saharan African nations to ensure that they promote regional economic advancement and increase exports of local products.

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Appendix

Vector Error Correction Estimates result with *p*-values

	Coefficient	Std. error	*t*-Statistic	Prob.
C(1)	0.084835	0.103917	0.816378	0.4157
C(2)	−0.135415	0.243259	−0.556669	0.5787
C(3)	−0.137340	0.380593	−0.360858	0.7188
C(4)	0.239425	0.381712	0.627241	0.5315
C(5)	−0.412635	0.541366	−0.762210	0.4472
C(6)	0.077536	0.074859	1.035768	0.3021
C(7)	0.046306	0.334204	0.138555	0.8900
C(8)	0.061027	0.028949	2.108057	0.0368**
C(9)	0.012099	0.092097	0.131376	0.8957
C(10)	−0.194680	0.215592	−0.903005	0.3681
C(11)	−0.492409	0.337306	−1.459828	0.1466
C(12)	−0.400133	0.338297	−1.182786	0.2389
C(13)	−0.311954	0.479794	−0.650185	0.5167
C(14)	0.040960	0.066345	0.617388	0.5380
C(15)	0.589971	0.296193	1.991845	0.0484**
C(16)	0.020673	0.025657	0.805735	0.4218
C(17)	−0.016869	0.129243	−0.130524	0.8963
C(18)	−0.058044	0.302546	−0.191853	0.8481
C(19)	−0.691999	0.473352	−1.461911	0.1460
C(20)	−0.174227	0.474743	−0.366992	0.7142
C(21)	0.129214	0.673309	0.191909	0.8481
C(22)	0.019141	0.093104	0.205587	0.8374
C(23)	0.550304	0.415657	1.323938	0.1877
C(24)	0.039359	0.036005	1.093164	0.2762
C(25)	−0.035934	0.077950	−0.460984	0.6455
C(26)	0.009944	0.182474	0.054495	0.9566
C(27)	−0.699810	0.285492	−2.451244	0.0155**
C(28)	0.282299	0.286330	0.985922	0.3259
C(29)	0.194763	0.406091	0.479605	0.6323
C(30)	−0.036609	0.056153	−0.651953	0.5155
C(31)	0.169431	0.250694	0.675846	0.5003
C(32)	0.024592	0.021716	1.132447	0.2594
C(33)	1.083316	0.246768	4.390017	0.0000***
C(34)	−1.671972	0.577661	−2.894381	0.0044***
C(35)	−0.224098	0.903786	−0.247955	0.8045
C(36)	−1.700017	0.906442	−1.875484	0.0628*
C(37)	0.397479	1.285570	0.309185	0.7576
C(38)	−0.117073	0.177766	−0.658580	0.5113
C(39)	−0.062889	0.793627	−0.079243	0.9370
C(40)	0.289095	0.068746	4.205286	0.0000***
C(41)	−0.136139	0.159995	−0.850898	0.3963
C(42)	−0.205680	0.374532	−0.549166	0.5838
C(43)	−1.010008	0.585979	−1.723626	0.0870*
C(44)	0.091354	0.587700	0.155444	0.8767

C(45)	0.152374	0.833512	0.182810	0.8552
C(46)	−0.023569	0.115256	−0.204490	0.8383
C(47)	0.459183	0.514556	0.892387	0.3737
C(48)	0.039255	0.044572	0.880716	0.3800

* means significance level at 10%; ** indicates significance level at 5%; and *** represents significance level at 1%.

Equation: D(LNTXR) = C(1)*(LNTXR(−1) − 0.775037521442*LNTRG(−1) − 0.866024600656*LNIMP(−1) − 2.58101138986*LNGDP(−1) − 0.694453331394*LNOSI(−1) + 3.68950675628*LNEXP(−1) + 4.50191737803) + C(2)*D(LNTXR(−1)) + C(3)*D(LNTRG(−1)) + C(4)*D(LNIMP(−1)) + C(5)*D(LNGDP(−1)) + C(6)*D(LNOSI(−1)) + C(7)*D(LNEXP(−1)) + C(8)

Observations: 31

R-squared	0.111769	Mean dependent var	0.057163
Adjusted *R*-squared	−0.158562	SD dependent var	0.100402
SE of regression	0.108069	Sum squared resid	0.268615
Durbin–Watson stat	1.906723		

Equation: D(LNTRG) = C(9)*(LNTXR(−1) − 0.775037521442*LNTRG(−1) − 0.866024600656*LNIMP(−1) − 2.58101138986*LNGDP(−1) − 0.694453331394*LNOSI(−1) + 3.68950675628*LNEXP(−1) + 4.50191737803) + C(10)*D(LNTXR(−1)) + C(11)*D(LNTRG(−1)) + C(12)*D(LNIMP(−1)) + C(13)*D(LNGDP(−1)) + C(14)*D(LNOSI(−1)) + C(15)*D(LNEXP(−1)) + C(16)

Observations: 31

R-squared	0.215738	Mean dependent var	0.003887
Adjusted *R*-squared	−0.022950	SD dependent var	0.094697
SE of regression	0.095778	Sum squared resid	0.210987
Durbin–Watson stat	2.164742		

Equation: D(LNIMP) = C(17)*(LNTXR(−1) − 0.775037521442*LNTRG(−1) − 0.866024600656*LNIMP(−1) − 2.58101138986*LNGDP(−1) − 0.694453331394*LNOSI(−1) + 3.68950675628*LNEXP(−1) + 4.50191737803) + C(18)*D(LNTXR(−1)) + C(19)*D(LNTRG(−1)) + C(20)*D(LNIMP(−1)) + C(21)*D(LNGDP(−1)) + C(22)*D(LNOSI(−1)) + C(23)*D(LNEXP(−1)) + C(24)

Observations: 31

R-squared	0.206784	Mean dependent var	0.061640
Adjusted *R*-squared	−0.034629	SD dependent var	0.132139
SE of regression	0.134408	Sum squared resid	0.415505
Durbin–Watson stat	2.008822		

Equation: D(LNGDP) = C(25)*(LNTXR(−1) − 0.775037521442*LNTRG(−1) − 0.866024600656*LNIMP(−1) − 2.58101138986*LNGDP(−1) − 0.694453331394*LNOSI(−1) + 3.68950675628*LNEXP(−1) + 4.50191737803) + C(26)*D(LNTXR(−1)) + C(27)*D(LNTRG(−1)) + C(28)*D(LNIMP(−1)) + C(29)*D(LNGDP(−1)) + C(30)*D(LNOSI(−1)) + C(31)*D(LNEXP(−1)) + C(32)

Observations: 31

R-squared	0.419182	Mean dependent var	0.053236
Adjusted *R*-squared	0.242412	SD dependent var	0.093136
SE of regression	0.081065	Sum squared resid	0.151145
Durbin–Watson stat	1.675361		

Equation: D(LNOSI) = C(33)*(LNTXR(−1) − 0.775037521442*LNTRG(−1) − 0.866024600656*LNIMP(−1) − 2.58101138986*LNGDP(−1) − 0.694453331394*LNOSI(−1) + 3.68950675628*LNEXP(−1) + 4.50191737803) + C(34)*D(LNTXR(−1)) + C(35)*D(LNTRG(−1)) + C(36)*D(LNIMP(−1)) + C(37)*D(LNGDP(−1)) + C(38)*D(LNOSI(−1)) + C(39)*D(LNEXP(−1)) + C(40)

Observations: 31

R-squared	0.677609	Mean dependent var	0.086793
Adjusted *R*-squared	0.579490	SD dependent var	0.395747
SE of regression	0.256629	Sum squared resid	1.514743
Durbin–Watson stat	2.400641		

Equation: D(LNEXP) = C(41)*(LNTXR(−1) − 0.775037521442*LNTRG(−1) − 0.866024600656*LNIMP(−1) − 2.58101138986*LNGDP(−1) − 0.694453331394*LNOSI(−1) + 3.68950675628*LNEXP(−1) + 4.50191737803) + C(42)*D(LNTXR(−1)) + C(43)*D(LNTRG(−1)) + C(44)*D(LNIMP(−1)) + C(45)*D(LNGDP(−1)) + C(46)*D(LNOSI(−1)) + C(47)*D(LNEXP(−1)) + C(48)

Observations: 31

R-squared	0.247159	Mean dependent var	0.057145
Adjusted *R*-squared	0.018034	SD dependent var	0.167909
SE of regression	0.166388	Sum squared resid	0.636754
Durbin–Watson stat	1.949849		