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## **Influence of Exchange Rate on Collection of Tax Revenue in Tanzania Using VECM Analysis**

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**Abstract:** Collection of tax revenue is very important to support the government's plans. This paper examines how exchange rates affect collection of tax in Tanzania. This paper employed a time series methodology and quantitative research approach. The population of the study comprises the financial data for 30 years from 1993 to 2023. The study included 30 observations (year data) collected from trustworthy institutions such as the World Bank (WB) and Tanzania Revenue Authority (TRA). Since the explanatory variables are cointegrated with tax revenue collection, the study's findings found that exchange rates influence Tanzania's tax revenue collection when trade openness is controllable variable. According to the analysis, there is association between exchange rates and collection of tax revenue and also the variables moving towards equilibrium and there is cointegration in long run term. The research recommended that in order for the government to boost the tax revenue collection also the government should formulate friendly laws and regulations.

**Keywords:** Exchange rate; Tax Revenue; Tanzania

### **1. Introduction**

The connection between tax revenue collection and exchange rate has recently emerged as a major economic concern now a day. Taxation is critical for long-term development since it funds a state's basic functions and encourages economic growth (Epaphra & Kaaya, 2020). Taxation is sometimes overlooked as a motivator for the economic growth, as well as the expansion of national infrastructures. Current investigation has put emphasis on assessing the association between exchange rates and tax revenue collection, although the findings have been mostly theoretical rather than practical (Ofori et al., 2021; Epaphra & Kaaya, 2020). Recent research similar to this examines the association between exchange rates and collection of tax revenue, but the results have often been theoretical (Ofori et al., 2021; Epaphra & Kaaya, 2020).

Tanzania's financial transformation asserted that public spending and revenue have continued to rise, with expenditures frequently outpacing receipts. Large fiscal deficits result from a mismatch between

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revenue and spending that leads deficit budget. Tax changes have been enacted; however, they have not been as effective as anticipated. Poor administration system in aspect of tax revenue collection attributable to either tax system insufficiencies or insufficient government effort, equally of which are influenced by a number of tax issues. Maganya (2020) conducted research in poor countries and hypothesized that some elements had a direct impact on tax regimes. The research motivated on tax income and the tax to GDP ratio, neglecting other factors of revenue collection.

Tanzania's economic transformation demonstrates that government spending and revenue collection have steadily increased, with expenditures usually surpassing collections. Previous study has indicated that changes in tax rates increase tax revenue collection in developing countries including Tanzania (Ibrahim and Jairo, 2023). However, because these experiments were not carried out in Tanzania, there are a few literatures on the issue. Given this situation, that's why the study of investigating the nexus between exchange rate and collection of tax revenue in Tanzania has become very crucial, because the study is few. In emerging countries, the fundamental purpose of collection of tax revenue is to stimulate economic and social development. Mismatching between expenditure and revenue causa deficit budget. Tax transformation adjustments were adopted; in order to control exchange rate against collection of tax revenues, Tanzania Revenue Authority established the international taxation unit under large taxpayer department. However, this transformation still affects the payment of tax, so it leads the tax collection to be ineffective.

The strategies settled by the United Nations known as the Millennium Development Goals, which require enough money to archive their agenda, the tax collection is very important to achieve the goals. Tanzania intends to achieve the following goals by Vision in 2025: Reduce poverty, offer worldwide training and advancement of infrastructures (Mengistie, 2018). Tanzania accepted the Millennium Development Goals, which they want to be attained in 2025. Tanzania's Vision 2025 is to eliminate poverty and economic development, and foster worldwide connections. The government will achieve these objectives through sponsorship from wealthy nations and the utilization of taxpayer monies. Education, HIV/AIDS prevention, environmental sustainability, and global collaboration is one of agendas that the government may need to archive (Maganya, 2020).

Collection of tax revenue is critical to support sustainable economic development for rich and poor nations (Kikwasi & Sospeter, 2023). Tanzania, like many developing nations, struggles to provide social services for its citizens by using the tax collected (Mengistie, 2018). Despite significant revenue collection towards economic development in Tanzania and numerous African countries, revenue collection remains weak; therefore, Tanzania depends on loans and grants to finance the deficit budget (August, 2023). Previous studies in Tanzania, Kenya, Ethiopia, and Rwanda indicated that the exchange rate influences the revenue collection (Mwenda et al., 2023). Juliannisa et al., (2023) assumed that exchange rates served as a tool for stimulating and enhancing revenue collection; consistent with this Keynesian hypothesis, a positive link was found between exchange rate, trade openness, and revenue collection. Therefore, this study intends to examine how the exchange rate influences collection of tax revenue in Tanzania.

The research findings will be vital the government in assisting formulate and execute both financial and economic policies for acclimatizing the tax collection environments. Furthermore, study findings will be useful researchers to stimulate further research in the area of taxation, tax regulators, academicians who wish to undertake further research on taxation will also find the literature from this study to be of

greater value and financial analysts. Business persons who pay taxes will demand the accountability of their taxes in the growth of economy by putting pressure on government to wisely spend taxes collected for right purposes.

## 2. Literature Review

Fiscal policy theory proposes that the government taxes, public funds and investment, should support the economic growth of any country. The government makes policy choices on how to appropriately distribute limited assets to archive their plans (Hassler et al., 2021). Governments must make decisions on how to allocate limited resources, resulting in trade-offs in developing countries (Khattry, Hassler et al., 2021).

Boburmirzo and Boburjon's (2022) empirical evaluations reveal that contractionary monetary policy has an effect of poor revenue collection, but expansionary monetary policy does not work properly and hence leads to dropping of tax revenue collection. Boburmirzo and Boburjon (2022) demonstrate that an exchange rate is more likely to change price than a negative shock, but Hassler et al. (2021) use the Markov switching model to US data and find statistically significant evidence of asymmetry. Boburmirzo and Boburjon (2022) demonstrate the effects of monetary policy and revenue collection, and found that there is positive association between variables. The statistical data show that there is a negative exchange rate and collection of tax revenue. Furthermore, Kikwasi and Sospeter's (2023) analysis covered 38 nations from 1950 to 1990; the findings demonstrate the positive effects between monetary policy and collection of revenue. Furthermore, Rehman et al. (2020) discovered that the effects of monetary policy on prices are symmetrical. The empirical data indicate a positive relationship between exchange rate and revenue collection in Mexico, Chile, Ghana, Uruguay, and China, but less so in Nigeria and Malawi.

According to Jaipuria et al. (2021), taxes contain the five distinct consequences on growth of development. First, greater levies can disappoint investment by increasing the statutory exchange rate and reduce taxes, and high corporate tax rates. Second, taxes discourage labour force contributions or misrepresent job-related selections, influencing skill development, education, and training. Third, tax policies may disappoint production development by delaying research and development and venture capital investment in high technology firms. Fourth, tax policy may affect per capita marginal output by diverting investment away from deeply overtaxed subdivisions and into more narrowly overtaxed divisions with lower whole output. Fifth, substantial taxes of labour supply may limit the best use of knowledge by prohibiting staffs from working in industries with high community output but high exchange rates.

## 3. Research Methodology

This paper employed a time series methodology and quantitative approach. The population of the study comprised financial data 30 years from 1993 to 2023. The study included 30 observations (year data) collected from trustworthy institutions such as the World Bank (WB) and Tanzania Revenue Authority (TRA).

**3.1. Model Specification**

It is a statistical model that forecasts the association between variables and establishes the long run connection between variables. The study adopts Vector Error Correlation Model (VECM) because the study intends to establish the long run association between 1993 and 2023. This methodology was adapted from prior research done by Jaipuria et al. (2021) on the subject, the scholars examined the relationship between dependent and independent variables by using vector error correlation model. The research aims are to analyse the influence of exchange rates on collection of tax revenue in Tanzania.

The exchange rates, trade openness and tax revenue formulae are as express as follows:

$$GDPT_t = f (TO, ER) \dots \dots \dots (i)$$

Whereby:  $GDPT_t$ = Tax to GDP ratio;  $TO$  = Trade Openness;  $ER$  = Exchange rate

$$GDPT_t = \alpha + \beta_1 TO_t + \beta_2 ER_t + \varepsilon_t \dots \dots \dots (ii)$$

Whereby:  $GDPT_t$ = Tax to GDP ratio;  $TO$  = Trade Openness;  $ER$  = Exchange Rate ;  $\alpha$ = Constant;  $\beta_1, \beta_2, \beta_3$ , and  $\beta_4$  are Beta e;  $\varepsilon$  is the error term ,  $t$  is year,  $\alpha$  is significance level of 95%.

**Table 1. Measurement of Variables**

S/n	Variable	Indicator	Source
1	Dependent Variable Tax revenue	Tax to GDP ratio	<ul style="list-style-type: none"> <li>• Word Bank (WB)</li> <li>• Revenue Authority (TRA)</li> </ul>
2	Independent Variables <ul style="list-style-type: none"> <li>• Trade Openness</li> <li>• Exchange Rate</li> </ul>	<ul style="list-style-type: none"> <li>• Export and Import</li> <li>• TZS/USD</li> </ul>	<ul style="list-style-type: none"> <li>• Word Bank (WB)</li> </ul>

**4. Results and Discussion**

**4.1. Stationarity Test for Exchange Rate**

The essence of stationarity test is to test the long run association between variables and hence to decide which model will fit for specific data. therefore accept the  $H_0$  that the series is non-stationary at level I(0) or I(1).

**4.1.1. Stationarity at Level**

The stationarity test indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is negative as shown in Table 1. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon, 2022).

**4.1.2. Augmented Dickey-Fuller**

**H<sub>0</sub>**: exchange rate has a unit root

Exogenous: Continuous, nonlinear trend

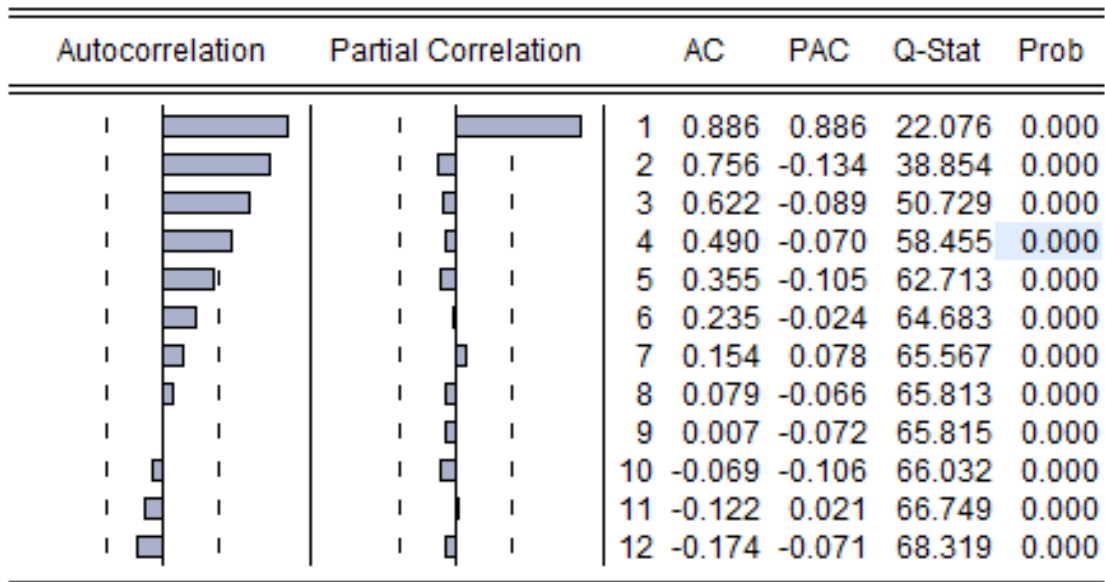
Lag Length: 1 (Programmed - constructed on AIC, maxlag=2)

**Table 2. Stationarity at level**

			t-Statistic	P-Value .*
ADF test statistic			-2.405434	-0.3673
Test critical values:	10% level		-5.416345	
	5% level		-2.622033	
	1% level		-3.248592	

Source: Author's findings (2024)

Table 1 indicated that the ADF test for the unit root suggests that the likelihood value for the exchange rate is -0.3673, which is more than the arithmetical importance at level of 5%, therefore accept the  $H_0$  that the series is non-stationary at level I(0). Similarly, the correlogram shows that several bars are beyond the confidence bound, as seen in Figure 1.



**Figure 1. Partial Correlation**

Source: Author's Findings (2024)

#### 4.2. Stationarity at First Difference

Figure 1 indicated that the ADF test for the unit root suggests that the likelihood value for the exchange rate is -0.0115, which is more than the arithmetical importance at level of 5%, therefore we accept the  $H_0$  that the series is non-stationary at level I(1).

$H_0$ : D (EXCHANGE) has a unit root

Exogenous: Constant

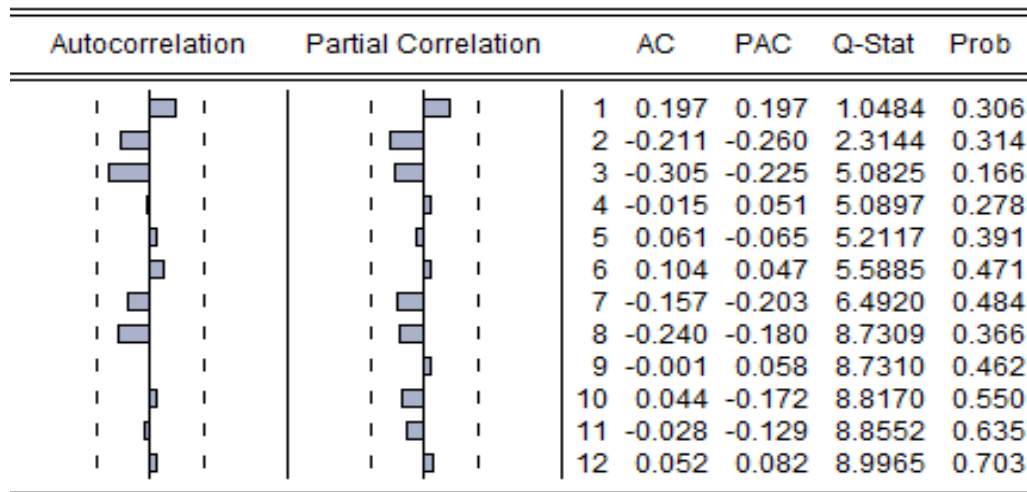
Lag Length: 0 (Instinctive - established on AIC, maxlag=2)

**Table 3. Stationarity at First Difference**

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.690673	-0.0115
Test critical values:	1% level		-2.752946	
	5% level		-2.998064	
	10% level		-2.638752	

Source: Author's findings (2024)

According to Figure 2, the ADF test for the unit root yields likelihood values for the exchange rate of -0.0115, which is less than the 5 % level of geometric importance. As a result, we reject the H0 that the series is non-stationary at level I(1) and accept H(1), implying that the exchange rate is stable at I(1). Similarly, the correlogram shows that multiple bars are inside the confidence interval, as seen in Figure 2.



**Figure 2. Autocorrelation**

Source: Author's findings (2024)

### 4.3. Johansen Cointegration Test

The long-run association between the variables was determined using Johansen's cointegration test. The Ho holds that there is no cointegration, whereas the H1 holds that cointegration exists. To evaluate if variables have a long-term connection, the Johansen Cointegration approach employs two criteria: the trace statistic and the maximum eigen statistic. When the Trace statistic surpasses the critical values at the 5% significance level, it is assumed that the variables have a long-run connection; otherwise, there is no long-run association between the variables in a linear pattern.

#### 4.3.1. Trace Statistic

The trace statistics indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Table 3. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon, 2022).

**Table 4. Unrestricted Cointegration Rank Test (Trace)**

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	P-Value.**
None *	22.000	35.000	0.020
At most 1 *	66.000	36.000	0.000
At most 2 *	20.00	22.000	0.004

Source: Author's findings (2024)

Table 5 shows that the trace statistic for all hypothesised cointegrating equations surpasses the critical threshold, with likelihood values less than 0.05. Reject the Ho, but support the H1 (cointegration). These statistics reveal that the three variables, tax revenue, trade openness, and exchange rate, are all cointegrated. The three variables cointegrate and eventually reach equilibrium.

**4.3.2. Maximum Eigen Statistic**

The unrestricted cointegration rank test indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Table 5. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon, 2022).

**Table 5. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value (CV)	P-Value.**
None *	62.000	52.3625	0.002
At most 1 *	82.023	15.8222	0.004
At most 2	26.1220	21.5252	0.001
At most 3 *	7.65220	4.3526	0.001

Source: Author's findings (2024)

According to Table 6, the Max Eigen statistic for the expected number of Cointegrating Equations (CE) reveals three CE at zero, one, and three, with Max Eigen values more than the CV and likelihood standards less than the 5% important threshold. The maximum Eigen value for at most two did not match the criteria for cointegration, since it was 13.092, which is less than the critical number 52.3625. The exam usually identifies three integrating equations. Take the H1 of cointegration while rejecting the null hypothesis.

**4.3.3. Long Run Model**

The exchange rate contributes an important function to any nation on collection of tax revenue. The short run and long run risk have effect either negative or positive to collection of tax revenue. For a regularized comparison, understand the coefficients of variables in an opposite effect symbol in the long run as per Table 6.

**Table 6. Normalized cointegrating coefficients (SE in parentheses)**

Collection of Tax Revenue	Exchange Rate
2.01200	-23.00
	(36.00)

Source: Author's findings (2024)

Table 7 reveals that the coefficient of trade openness is -23.00, demonstrating a positive long-term association between trade openness and tax revenue collecting components. Similarly, the exchange rate has a positive long-term impact on the equilibrium position, with normalized impact values of -23.00 and -36.00, respectively. This happens when tax revenue is the dependent variable, and exchange rates are the regressors. In general, all independent variables, including trade, correlate favorably with the dependent variable (tax revenue collection). The study complemented professional research.

#### 4.4. Vector Error Correction Model

The error correlation estimates indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all cointegration equations is negative as shown in Table 7. This means that when exchange rate increases the collection of revenue drop. This finding supported by authors who said exchange rate is inverse proportion to collection of tax revenue in Tanzania (Boburmirzo and Boburjon, 2022).

**Table 7. Error Correction Estimates**

Cointegrating Eq:	CointEq1
	[-4.23058]
EXCHANGE_RATE (-1)	-63582.00
	(203.00)
	[-11.3600
C	3623.00

Source: Author's findings (2024)

The ECT Equation:

$$ECT_{t-1} = 18200909 + 1Tax - 175970Trade - 7638.023Exchange$$

#### 4.4.1. Vector Error Correction Model

The ECT is shown, and the response variable is collection of tax revenue, and the other variables such as trade openness and the exchange rate are explanatory variables.

The dependent variable: DTax

$$DTax = C(1) Exchange(1) + 18200909.4 + C(2)D(Tax(1)) + C(3)D(Tax(-2)) + C(4)D(Exchange(-1)) + C(9)D(Exchange(-2)) + C(10)$$

**Table 8. Vector Error Correlation description**

	B	ST.E	t-Statistic	P-Values
C(1)	-1.362000	0.20000	-3.256525	1.0205
C(2)	-1.280201	0.32100	-2.29780	1.2200
C(3)	1.443020	0.42000	1.84235	1.4652
C(4)	-5000000	53242.00	-0.99682	0.2325
C(5)	-5420000	45350.00	-1.63005	0.1233
C(6)	-7402000	36252.00	-1.397820	0.4652
C(7)	-3600000	63515.00	-0.985220	0.7700
C(8)	-2352.00	258525.00	-0.693589	0.5020
C(9)	-42000.00	52523.00	-0.978520	0.0235
C(10)	2340500	85623.00	1.695280	0.0980



Source: Author's findings (2024)

Table 8 depicts the ECT which is  $c(1) = -0.0205$ , indicating a good indicator of alteration to the equilibrium demonstrating 25.87%, implying that the model will be modified by 2% in the long run and with a likelihood value of 0.0351, which is less than the significance threshold. Likewise,  $c(2)$  to  $c(9)$  are the short run coefficients indicating the risks in the model, and  $c(10)$  is a persistent.

#### 4.5. Diagnostics Test

##### 4.5.1. Serial Correlation Test

The Breusch-Godfrey Serial Correlation LM Test indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Table 9. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon (2022).

**Table 9. Breusch-Godfrey Serial Correlation LM Test**

F-statistic	4.0555	Prob. F(3,21)	-0.0005
Obs*R-squared	6.0000	Prob. Chi-Square(2)	-0.0000

Source: Author's findings (2024)

Results as represented in Table 10 perceived that R 2 equivalent to likelihood worth of 0.0005, which is greater than the 5% important level. Accept the Ho that the model has no serial correlation, henceforth not travail from serial correlation.

##### 4.5.2. Heteroskedasticity Test and ARCH Effects

The heteroskedasticity test: Breusch-Pagan-Godfrey indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Table 10. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon, 2022).

**Table 10. Heteroskedasticity Test: Breusch-Pagan-Godfrey**

F-statistic	25.00000	P-Value F(8,14)	0.0520
Obs*R <sup>2</sup>	2.000000	P-Value Chi- 2(8)	0.2000
Scaled explained SS	15.00000	P-Value Chi- 2 (8)	0.6325

Source: Author's findings (2024)

##### 4.5.3. Heteroskedasticity Test Arch Effect

The heteroskedasticity test: Breusch-Pagan-Godfrey indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Table 11. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon, 2022).

**Table 11. Heteroskedasticity Test: ARCH**

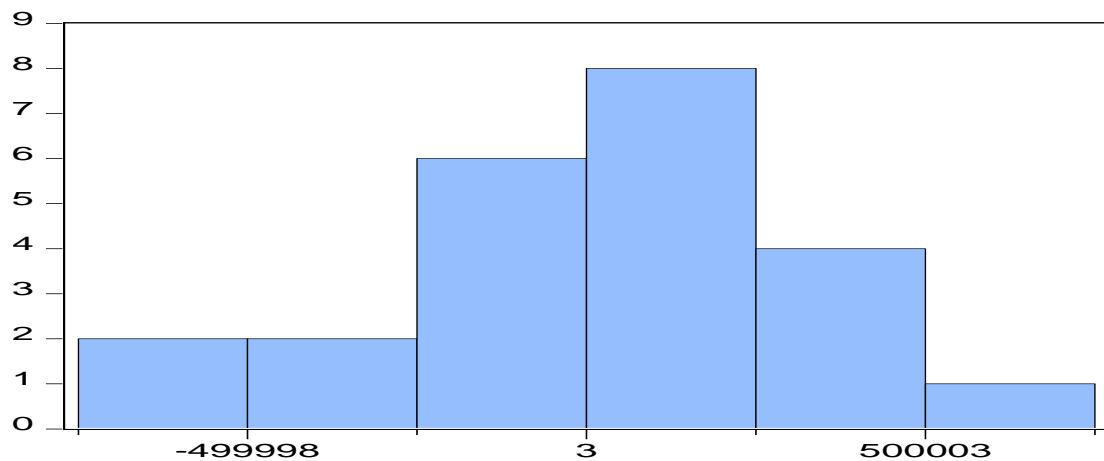
F-statistic	0.025320	P-Value. F(1,20)	0.3325
Obs*R-squared	0.002020	P-Value Chi-2(1)	0.3658

Source: Author's findings (2024)

Table 12 shows that the observed R2 is 94.4%, which is above the significance level of 5%. Accepting the Ho and rejecting the H1 results in a model devoid of ARCH effects.

**4.5.4. Normality Test**

The test for normality indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Figure 3. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo & Boburjon, 2022).



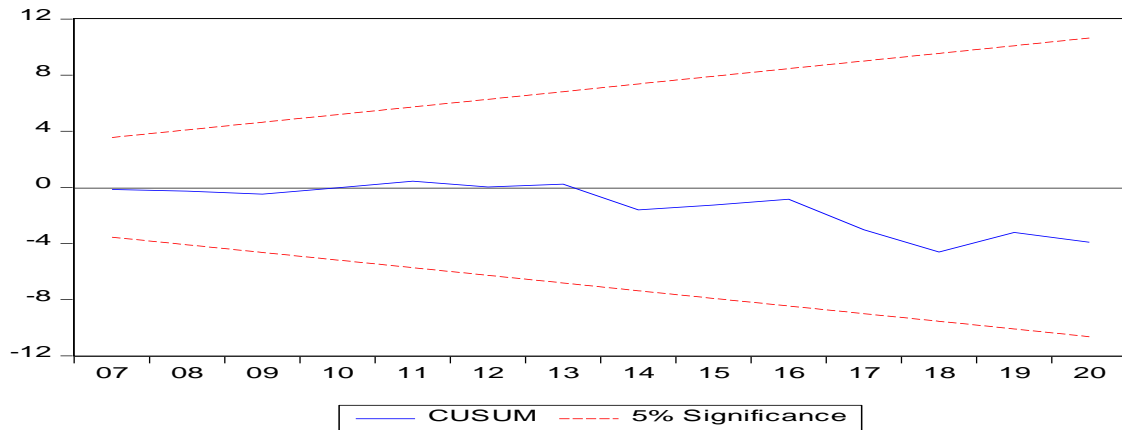
**Figure 3. Test for Normality**

Source: Author's findings (2024)

Figure 3 clearly shows the normal curve, with Jarque Bera's likelihood of 74.43%, which is above the 5% significance onset. As a consequence, all variables under study have a normal distribution.

**4.5.5. Stability Test**

The stability test indicated that there is negative association between exchange rate and collection of tax revenue in Tanzania since all P- Values is less than 0.05 as shown in Figure 4. This means that when exchange rate influence collection of tax revenue in Tanzania. This finding supported by authors who said exchange rate influence collection of tax revenue in developing countries (Boburmirzo and Boburjon, 2022).



**Figure 4. Test for Stability**

Source: Author's findings (2024)

Figure 4. indicated that the blue route lies between the 5% meaning level, presentation that the model is constant, but if the blue route base on separate the 5% significance level, means that the model is not upright.

## 5. Conclusion and Recommendations

Since the explanatory variables are cointegrated with tax revenue collection, the study's findings found that exchange rates influence Tanzania's tax revenue collection when trade openness is controllable variable. According to the analysis, the association between exchange rates and collection of tax revenue is moving towards equilibrium and long-term cointegration. To boost national tax revenue collection and streamline financial processes, the report recommends developing and implementing a more practical tax regime. The Future research should expand number of observations in order to get the true picture of casual effect between variable.

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