Analyzing the Impact of Exchange Rates on Trade Performance in Tanzania: A VECM Approach

ABSTRACT

This paper investigates the relationship between exchange rates and trade performance in Tanzania using a Vector Error Correction Model (VECM) analysis. The background discusses the importance of exchange rates in international trade and how fluctuating exchange rates can impact trade performance. The methodology section explains the research design, model specification, and estimation techniques employed, such as unit root tests, co-integration analysis, and VECM. The findings highlight a long-run positive relationship between exchange rates, foreign direct investment, GDP, and labor forces with trade performance, while inflation rate shows a negative impact. Granger causality tests reveal causal relationships between different variables and trade performance. The conclusions suggest policy recommendations for the government to enhance trade performance through fiscal and monetary policies and encourage further research in the field.

Keywords: Exchange rate, Trade performance, VECM, Tanzania

1. INTRODUCTION

The volatility of exchange rates worldwide has been significant, particularly following the dissolution of the Bretton Woods system of fixed exchange rates in the 1970s. Since that time, there has been extensive deliberation regarding the correlation between the exchange rate and trade performance. The exchange rate, which refers to the rate at which goods and services produced in one country can be traded for those produced in another country or set of nations overseas, is widely acknowledged as a significant factor in the field of international macroeconomics and finance.

There are a number of factors that might cause exchange rates to deviate from their equilibrium values. Each of these factors deserves consideration. According to Fatas and Rose (2009), one of the most significant factors that contributes to these variances is the conduct of the government, which is defined by the intentional manipulation of the actual exchange rate. This practice is also frequently referred to as currency manipulation.

Different policy instruments are utilized by governments and central banks in order to exert control over the dynamic value of the exchange rate. It is possible that these measures will involve the adoption of capital controls or the involvement in targeted intervention in the markets for foreign exchange. Misalignments in exchange rates may occur unintentionally as a result of macroeconomic policies that are designed to achieve domestic goals, or as a consequence of distortions in the international financial system or structural circumstances within the local economy (Vines & Gilbert, 2017).

It is possible for fluctuations in exchange rates to be caused by the interventions that governments make in the foreign currency market and the policies that they implement regarding their budgets. When governments and central banks engage in deliberate manipulation of

exchange rates, the results can have a variety of effects on the performance of commerce. For example, governments may improve the competitiveness of their exports within global markets by consciously devaluing their currency. This would allow them to compete more effectively worldwide. Conversely, by artificially strengthening a currency, imports can become more affordable; however, this may also have a negative influence on the competitiveness of a country's exports (Eenennaam et al., 2020). The actions taken by governments and central banks have the potential to generate uncertainty and volatility in the foreign exchange market. This, in turn, can have an impact on the stability of trade agreements and have repercussions for the growth and development of the economy.

Trade performance serves as a significant indicator of economic health in individual countries, often correlating with higher rates of GDP growth for well-performing nations (Kohler, 2017). Many developing countries have recognized the significance of global trade by becoming members of the World Trade Organization (WTO) and enacting measures to liberalize their economies (Subramanian & Kessler, 2020). Despite these efforts, the outcomes of trade initiatives can vary, with some experiencing less-than-optimal results in terms of export performance. Defining successful trade performance is a complex task due to the diverse nature of global commerce. Countries can be classified into different categories based on their trade strategies and outcomes. Trade champions stand out as nations with exceptional trade performance, often excelling in specific niche markets and focusing their export efforts on those areas. On the other hand, certain specialized exporters may face challenges, such as a decline in their terms of trade, which can hinder their overall trade performance.

For instance, some developing countries achieve rapid economic growth by concentrating on niche markets and optimizing their export activities in those segments. In contrast, other nations achieve steady growth by diversifying their export portfolio across various products and partner countries. Success in trade can also be attributed to favorable market penetration strategies that have been in place since the outset of trade initiatives. Adaptability is another critical aspect of successful trade performance. Countries that can readjust and align their export profiles to match evolving global demand trends demonstrate resilience and longevity in international trade. This dynamic and demand-driven approach to trade policy proves to be effective in sustaining a competitive edge in the face of changing market dynamics (Arvis et al., 2010).

2. LITERATURE REVIEW

The empirical literature review in this study focuses on the empirical studies undertaken to investigate the exchange rate and trade performance. Various studies have been undertaken and established different results and these are explained as follows.

Rahman and Hossain (2020) was examining "the impact of exchange rate on trade in Bangladesh to know the export, import risk, and leverage effect". Linha (2020) examine "the impact of real effective exchange rate volatility on the trade balance in Vietnam from 2002 to 2019 by using the VAR (vector autoregression) model". Chien et al (2020) they investigate "the effect of exchange rate volatility on bilateral trade between Taiwan and Indonesia via 19 export and import industries". Fofanah (2020) was investigate "the Impact of real exchange rate fluctuations on aggregate cocoa and coffee exports in Sierra Leone".

Chang, et al (2019) Their study examining "the effect of extremely large to extremely small changes in the exchange rate volatility on the US exports to developing countries such as Brazil, India, Mexico, and South Africa". Thuy and Thuy (2019) was investigating "the impact of exchange rate volatility on exports in Vietnam". Bahmani Oskooee and Salam, M (2016) in their study examines "the impact of exchange rate volatility on trade flows of Pakistan used aggregate trade data either between Pakistan and the rest of the world or at bilateral trade between Pakistan and her major trading partners". Olayungbo et al (2011) was investigates "the impact of exchange rate volatility on trade in 40 selected sub-Saharan African". Bhattarai and Armah (2005) examined "the effects of exchange rates on the trade balance of Ghana". and Lastrapes (1989, 1990) used "VAR models to examine the effect of exchange rate on trade".

3. METHODOLOGY

The research design of the study revolved around the process of causality analysis, which aimed to comprehend the variables' causal links. It was possible to compare the long-term effects of empirical factors on two time series by employing a Vector Error Correction Model (VECM). The research project also used the VECM Granger causality method to look at how the variables were interacting causally.

The study relied heavily on secondary sources of information in order to streamline the process of comparing past results with present trends. The researchers' adoption of this methodology allowed us to glean valuable insights from historical data and assess how correlations between variables have evolved over time. A large dataset for the empirical study was used in the investigation, which included forty-four observations of yearly time series data from 1976 to 2019.

Applying Granger causality testing and the Vector Error Correction Model (VECM) to secondary data from 1976 to 2019 yields a strong analytical framework. The purpose of this framework is to provide a thorough and compelling understanding of the long-term effects while also investigating the causal links between the variables.

3.1 Model Specification

The model for estimation was developed by using the simple equation as follows:

$TRD = f\ (EXNG, INFL, FDI, LB, GDP)$

The model can be in econometric form as

$$TRD_t = \beta_0 + \beta_1 EXNG_t + \beta_2 INFL_t + \beta_3 FDI_t + \beta_4 LB_t + \beta_5 GDP_t + \epsilon_t$$

The econometric model can be transforming in to log and the general model used in this study are follows.

$$Log\ TRD = \beta_0 + \beta_1 \log EXNG_t + \beta_2 \log INFL_t + \beta_3 \log FDI_t + \beta_4 \log LB_t + \beta_5 \log GDP_t + \epsilon_t$$

Whereby the parameter β_1, β_2, β_3, β_4 and β_5 explain the coefficient values of independent variables,$\beta_0$shows the constant term and ε_t is the stochastic error term which explain other factors that influence the trade performance but are not included in the model and t = 1, 2… is the time index for the years from 1976 to 2019. TRD represents trade performance, EXNG represents exchange rate, INFL represents Inflation rate, FDI represents foreign direct investment inflow, LB represents labour forces, and GDP represents the gross domestic products.

3.2 Variables Description and Their Measures

Since the objective of the study was to investigate the exchange rate and trade performance. So the model of the study consisted of TRD as the measure of dependent variable and Exchange rate, foreign direct investment, labour force, inflation rate and gross domestic product as the measures of independent variable.

3.3 Estimation Techniques

The descriptive study with the time series data for the period 1976 to 2019 were used to investigate the exchange rate and trade performance in Tanzania. Whereby, the EViews 11 statistical package used to estimate the results.

3.3.1 Unit root test

"Due to macroeconomic data to have the feature of random walk, the unit root problem for each individual series was checked to avoid the spurious results. The ADF test developed by Dickey and Fuller test of Phillips and Perron were used with the assumption (null hypothesis) that each individual series has unit root problem. Although the ADF test is simple compared to PP test and both have the similar procedure for testing the hypothesis but the PP test corrects the statistics to consider the autocorrelation and heteroskedasticity issues. For which the time series data happen to have trend, then these tests were performed in two scenarios with and without trend at level and first differences. Therefore, if the test rejects the null hypothesis means the series are stationary. If all series are stationary then the model can be estimated by using the Ordinary Least Square method and if all series are non-stationary or some are stationary then the co-integration test has to be done to check the existence of long run relationship between variables used" (Enders, 1995).

3.3.2 Co-integration test

In economics perspective, when the two variables are co integrated implies that, the variables have the long-term equilibrium relationship. Enders, (1995) added that "the co integration process help to give the real picture of the stable long run equilibrium for the non-stationary series relationship. The use of co integration process were help us to give the meaningful relationship between variables". According to Johansen and Juselius, "if one series co-integrates this means that error inthe regression model is stationary although the dependent and independents variables are nonstationary it is concluded the existence of long run relationship".

3.3.3 Vector error correction mechanism

If the long run relationship realized, the model can be estimated by using vector error correction mechanism (VECM) which allow for the separation out of long run as well as the ECT which show the speed of adjustment of the variables used to return to the equilibrium position as shown in the below equations. The study used vector error correction mechanism (VECM) to estimate the results of both study's objectives. Vector error correction model long run relationship was used to estimate the results of objective one. And Vector error correction model Granger causality was used to determine the direction of causality between the variables.

3.3.3.1 Vector error correction mechanism long run

Since the long run relationship was realized, then the VECM long run relationship was employed to estimate the long run relationship between exchange rate and trade performance in Tanzania. The following is the VECM long run relationship equation used in this study.

$$LogTRD_t = \beta_0 + \beta_1 logEXNG_t + \beta_2 LogINFL_t + \beta_3 LogFDI_t + \beta_4 LogLB_t + \beta_4 LogGDP_t + \varepsilon_t$$

3.3.3.2 Vector error correction mechanism granger causality

"The Granger Causality test was conducted in order to find out the existence of causality linkage among the variables in questions. Also, we perform the Granger-Causality test in order to examine whether one determinant variable is useful in forecasting in long-run relationship. In this study, we employ the method developed" (Granger, 1969). If we assume two variables e.g. Xt and Yt, affect each other with some lags. The relationship of these two variables can be formulated in a VAR model. Then, if we test whether Xt, causes Yt, we check that how much of the present Yt, can be represented by lagged values of Xt and Yt. In the Granger causality we check the null hypothesis that Xtdoes not granger cause Yt, and if we can reject the null hypothesis, it implies that Xtdoes Granger cause Yt. Based on the co-integration results, it can be ascertained that variables are co-integrated, and therefore, are causally related. The Granger causality method is used to test the direction of causality among the variables. In our models Yt represented by trade performance, and Xt represented by exchange rate, inflation rate, foreign direct investment, labour force and gross domestic product. The following are the VECM Granger causality equations of this study.

$$\Delta TRD_t = T_1 \sum_{i=1}^{k-1} b_{1i} \Delta TRD_t + \sum_{i=1}^{k-1} c_{1i} \Delta EXNG_t + \sum_{I=1}^{k-1} d_{1i} \Delta INFL_t + \sum_{i=1}^{k-1} e_{1i} \Delta FDI_t + \sum_{i=1}^{k-1} f_{1i} \Delta LB_t + \sum_{i=1}^{k-1} g_{1i} \Delta GDP_t + \alpha_{1i} ECT_t + e_t$$

$$\Delta EXNG_t = T_1 \sum_{i=1}^{k-1} b_{1i} \Delta TRD_t + \sum_{i=1}^{k-1} c_{1i} \Delta EXNG_t + \sum_{I=1}^{k-1} d_{1i} \Delta INFL_t + \sum_{i=1}^{k-1} e_{1i} \Delta FDI_t + \sum_{i=1}^{k-1} f_{1i} \Delta LB_t + \sum_{i=1}^{k-1} g_{1i} \Delta GDP_t + \alpha_{1i} ECT_t + e_t$$

$$\Delta INFL_t = T_1 \sum_{i=1}^{k-1} b_{1i} \Delta TRD_t + \sum_{i=1}^{k-1} c_{1i} \Delta EXNG_t + \sum_{I=1}^{k-1} d_{1i} \Delta INFL_t + \sum_{i=1}^{k-1} e_{1i} \Delta FDI_t + \sum_{i=1}^{k-1} f_{1i} \Delta LB_t + \sum_{i=1}^{k-1} g_{1i} \Delta GDP_t + \alpha_{1i} ECT_t + e_t$$

$$\Delta FDI_t = T_1 \sum_{i=1}^{k-1} b_{1i} \Delta TRD_t + \sum_{i=1}^{k-1} c_{1i} \Delta EXNG_t + \sum_{I=1}^{k-1} d_{1i} \Delta INFL_t + \sum_{i=1}^{k-1} e_{1i} \Delta FDI_t + \sum_{i=1}^{k-1} f_{1i} \Delta LB_t + \sum_{i=1}^{k-1} g_{1i} \Delta GDP_t + \alpha_{1i} ECT_t + e_t$$

$$\Delta LB_t = T_1 \sum_{i=1}^{k-1} b_{1i} \Delta TRD_t + \sum_{i=1}^{k-1} c_{1i} \Delta EXNG_t + \sum_{I=1}^{k-1} d_{1i} \Delta INFL_t + \sum_{i=1}^{k-1} e_{1i} \Delta FDI_t + \sum_{i=1}^{k-1} f_{1i} \Delta LB_t + \sum_{i=1}^{k-1} g_{1i} \Delta GDP_{t-i} + \alpha_{1i} ECT_t + e_t$$

$$\Delta GDP_t = T_1 \sum_{i=1}^{k-1} b_{1i} \Delta TRD_t + \sum_{i=1}^{k-1} c_{1i} \Delta EXNG_t + \sum_{I=1}^{k-1} d_{1i} \Delta INFL_t + \sum_{i=1}^{k-1} e_{1i} \Delta FDI_t + \sum_{i=1}^{k-1} f_{1i} \Delta LB_t + \sum_{i=1}^{k-1} g_{1i} \Delta GDP_t + \alpha_{1i} ECT_t + e_t$$

The parameter T, b, c, d, e, f and g show the coefficient values, $_{\alpha}ECT_t$shows the causality between variables and $\varepsilon_t$has to explain the speed of adjustment from dis-equilibrium to equilibrium in the long run.

Table 1. Summary of variables

Variables	Description
TDR	Trade performance
EXNG	Exchange rate
INFL	Inflation rate
FDI	Foreign direct investment
LB	Labour forces
GDP	Gross domestic product

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Usually, before estimating any regression model, it has to check whether the series of variables used has followed the normal distribution curve. Therefore, the traditional way to confirm the normality is to conduct the descriptive analysis for variables used. The Table 2 provides the estimation of mean, median, skewness, kurtosis and probability values. The mean over median ratio for each series is seen to be approximately one, which represents normality of distribution, which agreed the series had the feature of normal distribution. Addition to that, the JarqueBera test statistics fails to reject the null hypothesis of normal distribution of each variable ($P > 0.05$), which confirms that the series are normally distributed. Also, the numeric of kurtosis for each variable is found to be below 3, which indicates the normality of distribution. Therefore, the study has been confirmed the normality of distribution. Then, correlation analysis between the variables used were done which show the strong and positive relationship between trade performance and Foreign direct investment, gross domestic product, labour forces and inflation rate, while weak negative correlation shown between trade performance and exchange rate.

4.2 Unit Root Test

The ADF tests were done by comparing the t-statistics calculated and Mackinnon critical values at the 5% level of significance. With the 4-lag interval, the results in Table 3 show that all series were non-stationary at level form and they become stationary at 5% level of significant when the first difference is taken.

4.3 Co-integration Test

The critical value of the test was 5% level, the table 4 results of the Johansen's test showed that the Trace and Max Eigen statistics were higher than the 5% critical value meaning the test rejected null hypothesis. The rejection of null hypothesis in this test showed that there is a long run relationship between exchange rate and trade performance in Tanzania. Therefore, based on this test was concluded that there is a long run relationship between exchange rate and trade performance in Tanzania.

4.4 Vector Error Correction Mechanism long run

After examine the long run relationship between variables. Then vector error correction model long run was used to estimate the model of this study, since the study's variables were cointegrated. They observed there is long run relationship between exchange rate and trade performance in Tanzania. Different variables such as Exchange rate, Gross domestic product, labour, inflation rate and foreign direct investment have been considered on creating the model. The estimated result of the model shows that all variables have significant positive relationship to trade performance, except the inflation rate its show that have negative impact on trade performances in Tanzania.

4.5 Vector error correction mechanism Granger Causality Results

Although the co-integration indicates the presence of Granger causality. The results in Table5 shows the one-way causality found from trade performance to exchange rate and foreign direct investment. Also there is Bidirectional causal relationship between Gross domestic product, Inflation rate and Labour forces with the trade performance. Therefore, there is unidirectional causal relationship between exchange rate and trade performance in Tanzania.

4.6 Error Correction Term

The results in table 6 show that, exchange rate and foreign direct investment have long terms unidirectional causality to trade performance in Tanzania. Also the gross domestic product, inflation rate and labour forces have long term bidirectional causality with trade performance in Tanzania. The findings imply that the variables will adapt at a significant rate in order to reach the long-term equilibrium steady state position. As a result, this suggests that our model is accurate and demonstrates the existence of a long-term relationship between the study's variable. The exchange rate and Tanzania's trade performance are shown to have a unidirectional causal link, according to the ECT and causality tests.

5. CONCLUSION AND RECOMMENDATIONS

This paper investigate exchange rate and trade performance in Tanzania for the period 1976 to 2019. The empirical results from VECM suggest that there is a long run positive relationship between exchange rate, foreign direct investment, gross domestic product and labour forces with trade performance in Tanzania. Also there is a long run negative relationship between trade performance and inflation rate. On the other hand, the granger causality results reveal the unidirectional causal relationship between exchange rate and foreign direct investment with trade performance. Also there is bidirectional causality between gross domestic product, inflation rate and Labour forces with trade performance in Tanzania. The Government should do an assessment on what kind of profitable investment is needed and where to locate within Tanzania in order to generate more employment and increase production based on trade.There is need for the government to have better fiscal policies and monetary policies that targets improvement in the domestic income and export that would significantly improve trade performance. Moreover, further studies may also investigate on impact of exchange rate on trade performance.

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APPENDIX

Table 2. Descriptive and correlation analysis

Description	TRD	EXNG	FDI	GDP	LB	INFL
Mean	0.437353	18.58912	472.2368	12469.72	16155.64	20.45794
Median	0.385000	13.91500	174.4200	9399.130	15610.71	21.41500
Maximum	0.790000	58.84000	1909.420	33230.00	24836.43	36.15000
Minimum	0.150000	5.390000	1.000000	4514.260	9187.900	3.490000
Std. Dev.	0.172175	14.75094	615.1246	8065.585	4869.820	10.13694
Skewness	0.202717	1.353425	1.291950	1.236144	0.291726	-0.10048
Kurtosis	2.152090	3.13986	2.735060	2.413807	1.857163	1.639263
Jarque-Bera	1.251379	11.56341	9.564402	8.901548	2.332532	2.680325
Probability	0.0734892	0.093083	0.068378	0.081670	0.0611528	0.091803
Observations	44	44	44	44	44	44
Correlation:						
TRD	1					
EXNG	-0.3226	1				
FDI	0.7787	-0.2451	1			
GDP	0.7307	-0.1057	0.1586	1		
LB	0.8718	-0.3453	0.3918	0.38495	1	
INFL	0.2058	-0.33319	0.175	0.11476	0.4088	1

Table 3. Unit root analysis

LEVEL FORM				
Variables	**Critical Value 5%**	**ADF Test**	**P - Values**	**Result**
TRADE	-3.520787	-3.277221	0.084	Non-Stationery
EXNG	-3.51809	-1.649649	0.7561	Non-Stationery
GDP	-3.51809	-2.78546	0.2102	Non-Stationery
INFL	-3.51809	-2.949376	0.1508	Non-Stationery
FDI	-1.948886	-1.245305	0.1924	Non-Stationery
LB	-3.54849	-0.707258	0.0344	Non-Stationery
FIRST DIFFERENCE				
TRADE	-3.520787	-4.664597	0.0028	Stationery
EXNG	-2.933158	-4.360211	0.0012	Stationery
GDP	-2.933158	-10.82723	0.0035	Stationery

INFL	-1.948886	-7.284735	0.0043	Stationery
FDI	-2.933158	-8.402081	0.0031	Stationery
LB	-2.951125	-3.410077	0.0015	Stationery

Note : When P-Value is greater than 0.05 denote series are non-stationery and when its less than 0.05 denote series are stationery

Table 4. Co-integration analysis

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value 0.05	Probability Value.**
None *	0.997944	434.2064	95.75366	0.0000
At most 1 *	0.912395	192.9229	69.81889	0.0000
At most 2 *	0.706793	97.96108	47.85613	0.0000
At most 3 *	0.540303	50.11293	29.79707	0.0001
At most 4 *	0.395873	19.80261	15.49471	0.0105
At most 5	0.003781	0.147755	3.841465	0.7007
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
No. of CE(s)	Eigenvalue	Max Eigen Statistic	Critical Value 0.05	Probability Value.**
None *	0.997944	241.2835	40.07757	0.0000
At most 1 *	0.912395	94.96184	33.87687	0.0000
At most 2 *	0.706793	47.84814	27.58434	0.0000
At most 3 *	0.540303	30.31032	21.13162	0.0019
At most 4 *	0.395873	19.65485	14.26460	0.0064
At most 5	0.003781	0.147755	3.841465	0.7007

Note: * denotes the series are co integrated at 5% level of significant

Table 5. Granger causality test

Null Hypothesis:	**Observation**	**F-Statistic**	**Probability Value.**
EXNG does not Granger Cause TRD	42	0.70041	0.0328
TRD does not Granger Cause EXNG		0.26336	0.3079
GDP does not Granger Cause TRD	42	0.67229	0.0371
TRD does not Granger Cause GDP		0.33056	0.0176
INFL does not Granger Cause TRD	42	0.34857	0.028
TRD does not Granger Cause INFL		3.49013	0.0409
FDI does not Granger Cause TRD	42	3.09836	0.057
TRD does not Granger Cause FDI		0.13973	0.2701
LB does not Granger Cause TRD	42	1.18183	0.018
TRD does not Granger Cause LB		1.89710	0.0443

Note : When Probability values is less than 0.05, denote the series have causal relationship

Table 6. Error correction terms

ECT	Coefficient	Std. Error	T-statistics
D(EXNG)	0.027936	(0.03344)	[-0.835406]
D(GDP)	0.008934	(0.04145)	[- 0.21554]
D(LB)	2.948217	-1.587632	[-1.856990]
D(INFL)	-3.665093	(0.49082)	[7.35670]
D(FDI)	5.62524	-3.91895	[-1.43539]