



RURAL PLANNING JOURNAL  
Website: <https://journals.irdp.ac.tz/index.php/rpj>  
DOI: <https://doi.org/10.59557/rpj.26.2.2024.85>



## The Impact of Exports and Imports on Gross Domestic Product (GDP) Dynamics

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### Abstract

The study shows how international trade contributes to the gross domestic product dynamic in Tanzania. It employs the Autoregressive Distributive Lag Error Correction model to capture the dynamic relationship between long-term and short-term cointegration. The study used annual data ranging from 1991 to 2022 for time series model analysis. The results of the analysis show that the variables used have long-term equilibrium associations with GDP. After differencing once and considering three periods back goods and services exported revealed a significant and positive sign connection with GDP in the short term. Furthermore, imports show a significant and positive relationship with GDP in the short term. The paper also recommends that more investment should be made in production areas to promote exports; this enables maintainable and inclusive growth.

**Keywords:** Gross domestic products, Export, Import, Time series, ARDL-ECM

### 1. Introduction

The theory of comparative advantage, discussed by Maneschi (2008), states that trade between countries can benefit if each country exports the goods for which it has a relative comparative advantage. Thus, no country possesses the capability to be entirely self-sufficient, necessitating the importation of goods from other nations. Likewise, a country that generates a surplus of products must seek international markets to sell these excesses. This trade interaction influences the country's revenue, as dictated by supply and demand dynamics in global markets.

Gross Domestic Product (GDP) is widely used as a measure of economic performance, though it has significant limitations when it comes to assessing the well-being of people because it is not a comprehensive indicator of societal

welfare. Gross Domestic Product is the total financial worth of all produced goods and services over a defined period within a nation. Business across a nation's borders plays a significant role among the many factors influencing GDP. According to the World Bank statistics revealed in 2023, Tanzania's Gross Domestic Product was worth 79.16 billion US dollars, which marked an increase of 3.39 billion US dollars compared to 2022. The selling of goods and services produced locally to other countries is termed exports, bringing an inflow of foreign currency to the seller's country. On the other hand, the outflow of funds is caused by the country's residents purchasing goods and services outside of their country. The import transactions need the residents' country to have a currency similar to the seller's to manage the purchase of goods and

services required. According to OECD (2014), exports of goods and services consist of sales of goods and services (included in the production boundary of GDP) from residents to non-residents. These also include transactions in barter or goods exported as part of gifts or grants. Equally, imports reflect the duplicate transactions from non-residents to residents.

Theoretically, there is a close relationship between exports, imports, and gross domestic product. It is asserted that a country's exports contribute significantly to its gross domestic product since they bring in substantial amounts of foreign currency, while imports need foreign currency to purchase from a specific country. Consider the following GDP function:

$$GDP = C + I + G + (X - M)$$

The above function shows that changes in exports and imports will directly affect the country's gross domestic product. For a nation to benefit from international trade, the goods and services exported should be worth more than those imported. Kim et al. (2007), in the study titled "Could imports be beneficial for economic growth?" The study conducted in the Republic of South Korea revealed positive and significant contributions of imports to economic growth and development, and this only happens if trade liberalization is implemented.

Furthermore, governments can decrease imports and increase exports of goods and services through different strategies. One method is the imposition of tariffs and quotas on imported goods and services; this raises the price of foreign goods, which makes them more expensive and decreases purchasing power compared to domestic products. The approach helps to improve a

country's balance of trade by reducing excessive import activity. Debaere (2010) argued that both tariffs and quotas serve as protective mechanisms but come with significant trade-offs. While they may shield domestic industries in the short term, they can reduce economic efficiency, harm consumers, and strain international relations in the long run. Additionally, providing subsidies to domestic businesses helps lower their production costs, making their goods and services cheaper. This can encourage consumers to buy domestically produced items, and it can also make these goods more competitive in international markets, potentially boosting exports. Also, the perceived quality of goods plays a significant role in consumers' choices. Despite higher prices, some products are preferred by consumers for their superior quality, indicating that even with subsidies, lower-priced goods may not always displace higher-quality imports. On the other hand, the theoretical analysis conducted by Koo & Kennedy (2006) indicates that both domestic and export subsidies distort trade flows of agricultural goods from exporting countries to importing countries. Trade agreements and currency devaluation are also effective strategies for managing imports and exports. This helps to facilitate the regular flow of goods and services, often boosting the economy's stability for both parties who engage in trade.

The research focuses on understanding how exports and imports shape the dynamics of a country's Gross Domestic Product (GDP). Exports drive economic growth by generating foreign exchange and fostering production, while imports influence domestic consumption and access to global goods and technologies. The balance between these two factors directly impacts a nation's economic performance and trade balance.

Analyzing their roles helps explain fluctuations in GDP and provides insights for policy-making to optimize economic growth. This study highlights the interdependencies between trade activities and overall economic health.

Econometrically, this study explores the role of international trade in shaping gross domestic product dynamics in Tanzania, using the time series data from 1991 to 2022. Specifically, the paper empirically reveals a response to the question of whether exports and imports lead to gross domestic product dynamic or not. To achieve the above objective, the work will be organized as follows.

Section 2 discusses literature reviews on the relationship of exports and imports to gross domestic products. Section 3 presents the methodology, model specification, and data used. Section 4 presents the results and discusses them, and section 5 deals with the conclusion and recommendations.

## 2. Empirical Literature Review

Numerous studies and research efforts by policymakers and scholars have explored the dynamics between exports, imports, and gross domestic products. These studies have yielded varying findings regarding the relationships among these three variables. Recently, the emphasis in most research has shifted toward utilizing vector error correction, vector autoregressive models, and cointegration techniques. This section will review different studies based on exports, imports, and gross domestic product/ economic growth.

Ali (2021) employs Johansen Cointegration and Granger Causality for data analysis to examine the association between export, import, and economic

growth in a study conducted in Bahrain using data from 1986 to 2018. The study findings reveal that there is cointegration between all variables at a 5% significant level. For Granger Causality, on the other hand, the results show that there is no causality between export, import, and economic growth.

Bakari and Mabrouki (2017) studied the impact of exports and imports on economic growth in Panama. The study employed Johansen Co-integration analysis of the Vector Auto Regression model and the Granger-Causality tests. The cointegration test findings show the absence of a cointegration relation, which suggests using the VAR model. Also, the estimation of the VAR model shows that exports and imports do not affect Panamanian economic growth. On the other hand, the estimation based on Granger causality results indicates that exports and imports contribute to economic growth. Millia et al. (2021) investigate the effects of exports and imports on economic growth in Indonesia using quarterly data from 2004 to 2018. The study used autoregressive distributed lag model estimation, and the results indicate that exports and imports have an effect on economic growth in the short and long run. This means that imports and exports affect Indonesia's economic growth in both periods.

Kartikasari (2017) studied the effect of export, import, and investment on economic growth in Riau Islands, Indonesia. The data were extracted from the quarterly regional economic report of Riau Islands Province, Indonesia, in the period of 8 years from 2009 to 2016. A random effect panel data regression analysis was employed to investigate the

influence of exports, imports, and investment on economic growth. The results found that the three variables statistically affected the economic growth in Riau Islands Province, Indonesia. More specifically, the study found that partially, exports had an insignificant negative effect on economic growth, imports had a significant negative impact, and investment had a significant positive impact.

Muhammad Adnan Hye (2012) uses autoregressive distributed lag (ARDL) to determine the long-run and short-run relationship between export, import, and economic growth. Moreover, the causal relationship is examined by using a modified Granger causality test. The results confirm the bidirectional long-run relationship between economic growth and exports, economic growth and imports, and exports and imports. The findings concluded that the export-led growth, growth-led exports, import-led growth, and growth-led imports hypotheses are valid, and the foreign deficit is sustainable for China.

The study by Bbaale and Mutenyo (2011) employs the generalized methods of the moments estimator to examine the export composition and economic growth in Sub-Saharan Africa. The findings revealed that the growth in agricultural exports and not manufactured exports is significantly associated with per capita income growth. The results show the adoption of policies that increase agricultural exports in the medium term as they design strategies for increasing manufactured exports in the long term. Moreover, other factors significantly influencing growth are capital formation,

capital goods imports, infrastructure, government consumption, inflation rate, political systems and governance, and education.

Also, Kukaj& Hameli (2022) use Granger causality and Vector Autoregression to examine the nexus between exports, imports, and economic growth for Kosovo's economy ranging from 2010 to 2021. The findings revealed that there is a bidirectional causality relationship between exports and economic growth. Moreover, using the Johansen cointegration test showed that variables are cointegrated in the short run. On the other hand, Hashim& Masih (2014), by using quarterly time series data from 2005 to 2014, found a bidirectional causal relationship between exports and economic growth in Malaysia, where exports lead to economic growth and vice versa is true.

### 3. Materials and Methods

#### 3.1. Data

This study analyzes annual time series data from 1991 to 2022 in Tanzania. Time considerations made based on the balance of information in each year focus on the variables. Data were sourced from the World Bank and the International Monetary Fund (IMF). Pesaran et al. (2001) and Narayan (2005) suggest that a sample between 30 and 80 data points is generally considered suitable for time series analysis. The following equation represents the approximate model that will be applied in this analysis:

$$GDP_t = \alpha_t + \beta_1 EXP_t + \beta_2 IMP_t + \beta_3 GCF_t + \beta_4 FCE_t + \varepsilon_t$$

In this model, GDP represents gross domestic product; EXP stands for exports of goods and services; IMP denotes imports of goods and services; GCF refers

to gross capital formation; FCE indicates final consumption expenditure; and  $\epsilon_t$  Refers to error term (unobservable zero mean white noise vector process).

### 3.2. Model Specification

The study used the ARDL-ECM model, and the equation is specified as follows:

$$\begin{aligned} \Delta GDP_t = & \alpha_0 + \sum_{i=0}^1 \lambda_{1i} \Delta EXP_{t-i} \\ & + \sum_{i=0}^1 \lambda_{2i} \Delta IMP_{t-i} \\ & + \sum_{i=0}^1 \lambda_{3i} \Delta FCE_{t-i} \\ & + \sum_{i=0}^1 \lambda_{4i} \Delta GCF_{t-i} \\ & + \sum_{j=1}^1 \delta_j \Delta GDP_{t-j} \\ & + \beta_{ECM} (GDP_{t-1} - \gamma_0 \\ & - \gamma_1 EXP_{t-1} - \gamma_2 IMP_{t-1} - \gamma_3 FCE_{t-1} - \gamma_4 GCF_{t-1}) \\ & + \epsilon_t \end{aligned}$$

Where,

$\Delta GDP_t$  Is the change in GDP at the time t

$\Delta EXP_{t-i}$  Are the changes in exports at time lags i

$\Delta IMP_{t-i}$  Are the changes in imports at time lags i

$\Delta FCE_{t-i}$  Are the changes in final consumption expenditure at time lags i

$\Delta GCF_{t-i}$  Are the changes in gross capital formation at time lags i

$\Delta GDP_{t-j}$  Are the changes independent variable GDP at time lags j

$\alpha_0$  is the constant term

The coefficients  $\lambda_{1i}$ ,  $\lambda_{2i}$ ,  $\lambda_{3i}$ , and  $\lambda_{4i}$  represents the short-run impacts of the changes in EXP, IMP, FCE, and GCF, respectively.

The coefficient  $\delta_j$  represents the short-run effects of changes in GDP

The coefficient  $\beta_{ECM}$  Represents the error correction term, indicating the speed at which deviations from long-run equilibrium are corrected in the short run.

The term  $\gamma_0$  represents the intercept of the long-run relationship

The coefficients  $\gamma_1$ ,  $\gamma_2$ ,  $\gamma_3$ , and  $\gamma_4$  represents the short-run impacts of the changes in EXP, IMP, FCE, and GCF, respectively.

The term  $\epsilon_t$  represents the error term

Table 1 below provides a concise overview of the key variables used in this analysis. Each variable is defined and described to offer a clear understanding of their roles in the context of this study.

**Table 1. Variable Definition**

Variable Name	Variable Description	Role of Variable	Variable Measurement
GDP <sub>t</sub>	Gross Domestic Product	Dependent Variable	Continuous
EXP <sub>t</sub>	Export of goods and services	Independent Variable	Continuous
IMP <sub>t</sub>	Import of goods and services	Independent Variable	Continuous
FCE <sub>t</sub>	Final Consumption Expenditure	Independent Variable	Continuous
GCF <sub>t</sub>	Gross Capital Formation	Independent Variable	Continuous

### 3.3. Stationarity Test (Unit root test)

Variable stationarity is checked at a level using a unit root test to see if there is a need for differencing or not. A time series is considered stationary if its mean and

variance remain the same no matter at what point we measure them. Where the Augmented Dickey-Fuller test was used to check for stationarity. The unit root test was conducted to check for variables'

stationarity at the level and see if there is a need for differencing by using Augmented Dickey-Fuller (ADF). The hypothesis for this test is as follows:

Null hypothesis ( $H_0$ ):  $\delta = 0$  (indicating the presence of unit root or non-stationarity.)  
 Alternative hypothesis ( $H_1$ ):  $\delta \neq 0$  (indicating the absence of unit root or stationarity.)

To test these hypotheses, the Augmented Dickey-Fuller (ADF) test is commonly employed:

$$\Delta Y_t = \beta_0 + \sum_{r=1}^c \theta_r Y_{t-1} + \sum_{s=1}^d \phi_s Y_{t-1} + \mu_t$$

Table 3 shows that all the variables tested with ADF at level form are non-stationary. However, after first differencing, all the variables become stationary, as shown in Table 4.

## 4. Results and Discussion

### 4.1. Descriptive Analysis

Table 2 provides an overview of the descriptive statistics for the variables included in the analysis, spanning the period from 1991 to 2022, with 32 observations. They involve summarizing and interpreting raw data to provide meaningful insights. The gross domestic product ranges from 13.2 billion to 73.0 billion, with an average value of 33.9 billion and a relatively high standard

deviation of 18.6 billion. On the other hand, the contribution of exports in foreign currency varies from 658 million to 10.2 billion, with an average value of 4.88 billion and a standard deviation of 3.04 billion. Imports, which lead the country to purchase goods and services vary from 1.24 billion to 16.5 billion, with an average value of 6.38 billion and a standard deviation of 4.58 billion. Final consumption expenditure measures expenditure on goods and services intended to directly fulfil individual needs ranging from 9.82 billion to 46.2 billion with an average value of 24.3 billion and a relatively high standard deviation of 11.8 billion. Gross capital formation measures of fixed capital formation by households and corporations range from 2.31 billion to 31.6 billion, with an average value of 10.4 billion and a standard deviation of 8.9 billion. This descriptive statistic highlights the dataset's characteristics and identifies potential issues and anomalies in the data. Miku et al. (2023) discussed a descriptive analysis and commented that this provides insight into the dataset's characteristics and enables the identification of necessary issues.

**Table 2. Descriptive Statistics Analysis**

Variable	Obs	Mean	Std. dev	Min	Max
GDP	32	3.39e+10	1.86e+10	1.32e+10	7.30e+10
EXP	32	4.88e+09	3.04e+09	6.58e+08	1.02e+10
IMP	32	6.38e+09	4.58e+09	1.24e+09	1.65e+10
FCE	32	2.43e+10	1.18e+10	9.82e+09	4.62e+10
GCF	32	1.04e+10	8.90e+09	2.31e+09	3.16e+10

### 4.2. Test for Stationarity (Unit root test)

The study undertakes a unit root test based on the series of observations for each variable. The test aimed to identify whether the variables had a unit root or

not. For stationarity or non-stationarity determination, the study employs the Augmented Dickey-Fuller (ADF) test, and the results are presented in Table 3 and Table 4 below. With a null hypothesis that

states that the series shows a unit root suggesting non-stationarity. Considering Table 3 below, the results found that there was insufficient evidence (such that the p-value of all variables is greater than the 0.1 significant level), leading to null hypothesis rejection for all variables

in the study. According to Chen and Tu (2019), non-stationarity variables lead to spurious regression results and incorrect inferences. This forces us to undergo differencing on each variable to change non-stationarity variables into stationarity.

**Table 3. Unit Root Test Before Differencing**

Variable	No. of Obs	No. of Lags	Test Statistics	Dickey-Fuller critical value			
				1%	5%	10%	P-value
GDP	31	0	0.540	-4.325	-3.576	-3.226	0.9969
EXP	31	0	-2.900	-4.325	-3.576	-3.226	0.1623
IMP	31	0	-1.705	-4.325	-3.576	-3.226	0.7485
FCE	31	0	-2.523	-4.325	-3.576	-3.226	0.3167
GCF	31	0	-0.195	-4.325	-3.576	-3.226	0.9916

After performing ADF without differencing at the first stage, the results indicated that all variables are non-stationary, so there is a need for differencing to convert a time series to make it stationary. In a particular section, after the first difference, four variables, GDP, EXP, FCE, and GCF, exhibit stationarity, while one variable, IMP,

exhibits stationarity at the second differencing. This was revealed differently in the study conducted by Millia et al. (2021), where exports and imports are stationary at the first difference. This is evidenced by the obtained p-value being less than 1% significant level, as indicated below in Table 4

**Table 4. Unit Root Test After Differencing**

Variable	No. of Obs	No. of Lags	Test Statistics	Dickey-Fuller critical value			
				1%	5%	10%	P-value
d.GDP	30	1	-4.368	-4.334	-3.580	-3.228	0.0025
d.EXP	30	1	-7.359	-4.334	-3.580	-3.228	0.0000
dd.IMP	29	2	-6.416	-4.343	-3.584	-3.230	0.0000
d.FCE	30	1	-5.791	-4.334	-3.580	-3.228	0.0000
d.GCF	30	1	-6.484	-4.334	-3.580	-3.228	0.0000

#### 4.3. Optimal Lag Selection for the Model

The optimal lag is selected using the Vector Autoregressive (VAR) lag order selection criteria to determine the number of lags to be used in the model. The lag chosen is the one with stars, where Akaike Information Criteria (AIC) have the lowest value compared to other criteria. The AIC is superior to the Likelihood Ratio test (LR) in the case of a

small sample of sixty observations and below, in the sense that they minimize the chance of under-estimation while maximizing the chance of recovering the true lag length (Liew, 2004). In this study, lag selections will be considered by cautiously using the access number of lags to avoid the risk of multicollinearity, which may impact the accuracy of the study findings and lead to less precise coefficient estimates. The results of Table

5 below customize the optimal Vector Autoregressive (VAR) lag order selection criterion for all five variables used in the analysis. Furthermore, using too few lags could bias the estimates, resulting in the

analysis's specification error. This study uses Akaike Information Criteria (AIC) to determine the number of lags, as shown in Table 5 below.

**Table 5. Lag order selection criteria results (AIC)**

Variable	Lag	LL	LR	df	p-value	FPE	AIC
GDP	0	-700.586				3.4e+20	50.1133
	1	-596.23	208.71	1	0.000	2.1e+17	42.7307
	2	-593.988	4.4835*	1	0.034	1.9e+17*	42.642*
	3	-593.345	1.285	1	0.257	2.0e+17	42.6675
	4	-592.623	1.4453	1	0.229	2.0e+17	42.6873
EXP	0	-648.443				8.2e+18	46.3888
	1	-605.201	86.485	1	0.000	4.0e+17	43.3715
	2	-602.948	4.5055*	1	0.034	3.7e+17	43.282
	3	-601.868	2.1608	1	0.142	3.7e+17	43.2763
	4	-600.199	3.3362	1	0.068	3.5e+17*	43.3013*
IMP	0	-661.296				2.1e+19	47.3068
	1	-623.138	76.316*	1	0.000	1.4e+18*	44.6527*
	2	-622.37	1.5351	1	0.215	1.5e+18	44.713
	3	-621.378	1.9858	1	0.159	1.5e+18	44.728
	4	-620.455	1.8445	1	0.174	1.5e+18	44.7481
FCE	0	-687.159				1.2e+20	49.1688
	1	-600.427	173.46	1	0.000	2.9e+17*	43.0305*
	2	-600.307	0.24001	1	0.624	3.0e+17	43.0934
	3	-600.124	0.36652	1	0.545	3.2e+17	43.1517
	4	-598.187	3.8735*	1	0.049	3.0e+17	43.0848
GCF	0	-621.045				8.4e+19	48.7175
	1	-621.424	119.24*	1	0.000	1.3e+18	44.5303
	2	-620.898	1.0521	1	0.305	1.3e+18	44.5642
	3	-619.256	3.2851	1	0.070	1.3e+18*	44.5183*
	4	-619.121	0.26868	1	0.604	1.3e+18	44.5801

#### 4.4. Model Estimation

##### 4.4.1. Discussion of the Long-Run and Short-Run Effects of Exports and Imports in Shaping Gross Domestic Product Dynamics

The negative and significant coefficient indicates that about 85 percent of any deviation from the long-run equilibrium is corrected each period. This suggests that the system quickly adjusts back to its long-run equilibrium after unexpected or external forces such as economic crises, policy shocks, and demand and supply shocks.

The long-run coefficient for exports (EXP) is positive and statistically significant (at a 95 percent confidence

interval), showing a long-run impact on gross domestic product. This positive and significant relationship indicates that a one percent increase in exports is associated with an approximately 2.513251 increase in GDP on average. The long-run coefficient of imports (IMP) is negative and significant at a 95 percent confidence interval on GDP. This means that a one percent increase in imports is associated with an average 1.424045 decrease in GDP, considering other factors constant. This is supported by the study of Guntukula (2018), Mogoe & Mongale (2014), and Taghavi (2012), who found that export has a positive effect on economic growth and imports



have a negative effect. The final consumption expenditure has a positive coefficient and a significant impact on GDP as the p-value is less than 0.05. This result shows that a percent increase in final consumption expenditure is associated with an average of approximately 0.672106 increase in GDP. Also, gross capital formation (GCF) has a positive and significant coefficient at a 95 percent confidence interval. A percentage increase in gross capital formation is associated with an average of 0.0312125 increase in GDP. The results revealed that all explanatory variables have a positive and significant impact on GDP, except imports, which have a negative and significant impact on GDP. On the other hand, this is supported by the study conducted by Velaj and Bezhani (2022), which found that final consumption expenditure exhibits a long-run relationship with GDP. Generally, in the study by Ntthemuka (2021), which was conducted to analyze the impact of international trade on economic growth by using the ARDL cointegration approach, the results revealed that foreign trade has a positive impact on economic growth in Rwanda both in the short run and long run. Furthermore, the results show the short-run relationship between explanatory and dependent variables (GDP). The exports had a coefficient of -0.9472573 with a p-value of 0.027 (p-value < 0.05) indicating statistically significant. This significant negative relationship suggests that a 1 percent increase in the previous year's exports is associated with an approximately 0.95 percent decrease in GDP in the short term. The second and third lags are depicted as statistically significant at a 95 percent confidence

interval, with p-values of 0.014 and 0.019, respectively. A percentage increase in the second lag of exports is associated with a 0.3346855 decrease in GDP on average in the short-run, taking other factors constant. A percentage increase in the third lag of exports is associated with a 0.2684892 decrease in GDP on average in the short run. The result is similar to Mohsen (2015), which indicates bidirectional short-run causality relationships between export and GDP. The first difference of imports has a positive coefficient of 0.8050748 and a p-value of 0.014, which is less than 0.05, indicating statistical significance. With a positive and significant coefficient, a one percent increase of the first import difference is associated with an approximately 0.81 percent increase in GDP in the short term. Gross capital formation depicts negative and significant coefficients at the first difference, first lag, and second lag. This means that gross capital formation has a short-term impact on GDP in all stages. At first glance, a percentage increase in gross capital formation is associated with an average 0.6520843 decrease in GDP. A 1(one) percent increase in the first lag of gross capital formation is associated with an average 0.2712897 decrease in GDP. A significant negative relationship of the second lag of gross capital formation suggests that a one percent increase in GCF is associated with an approximately 22.8 percent decrease in GDP in the short-term. Onyinye et al. (2017) studied the effect of capital formation on the growth of the Nigerian economy, and the results were almost the same: capital formation had a positive and significant impact on economic growth in Nigeria for the period under review.

**Table 6. Long-Run and Short-Run Relationship Results**

D.GDP	Coefficient	Std err	t	p> t	[95% conf. interval]	
ADJ						
GDP						
L1	-0.8499862	0.2100618	-4.05	0.002	-1.307671	-0.3923009
LR						
EXP	2.513251	0.3678222	6.83	0.000	1.711835	3.314667
IMP	-1.424045	0.1241808	-11.47	0.000	-1.694612	-1.153478
FCE	0.6721705	0.052106	12.90	0.000	0.5586412	0.7856998
GCF	1.22043	0.0312125	39.10	0.000	1.152424	1.288436
SR						
GDP						
LD	-0.1176481	0.1991623	-0.59	0.566	-0.5515854	0.3162891
EXP						
D1	-0.9472573	0.375494	-2.52	0.027	-1.765389	-0.1291261
LD	-0.0366282	0.149751	-0.24	0.811	0.3629075	0.2896512
L2D	-0.3346855	0.1166146	-2.87	0.014	-0.5887668	-0.0806042
L3D	-0.2684892	0.0992929	-2.70	0.019	-0.4848299	-0.0521485
IMP						
D1	0.8050748	0.2790493	2.89	0.014	0.1970787	1.413071
FCE						
D1	-0.1603891	0.1731981	-0.93	0.373	-0.5377554	0.2169773
GCF						
D1	-0.6520843	0.2603219	-2.50	0.028	-1.219277	-0.0848915
LD	-0.2712897	0.0898773	-3.02	0.011	-0.4671155	-0.0754639
L2D	-0.2284204	0.0643707	-3.55	0.004	-0.368672	-0.0881687
_Cons	3.13e+09	8.48e+08	3.69	0.003	1.28e+09	4.98e+09

#### 4.5. Serial Correlation Test

A serial correlation test determines whether the residuals in a time series analysis are correlated across time or order. The problem of serial correlation in time series data occurs when there is an association between variables and their lagged values. To ensure that those problems do not persist, a serial correlation test is conducted using the Breusch–Godfrey LM test for autocorrelation, where results are shown in Table 7 below, proposing a null hypothesis rejection that there is no serial correlation. This is because the p-

value is greater than 0.05, suggesting no significant serial correlation exists in the residuals.

**Table 7. Serial Correlation Test Breusch–Godfrey LM test for autocorrelation**

Lags (p)	Chi2	df	Prob> $\chi^2$
1	0.571	1	0.4498

#### 4.6. Heteroskedasticity test

Detecting heteroskedasticity is important because its presence can affect the efficiency of the estimators and the validity of the statistical tests. The study considered the White test (i.e., Cameron & Trivedi's decomposition of IM-test) to

check whether the variance of the errors (residuals) is constant or not. The result in Table 8 below shows that the p-value of the White test is 0.4110; this indicates that there is no statistically significant indication of heteroskedasticity at a 0.05

significant level. In other words, we fail to reject the null hypothesis of homoscedasticity, suggesting that the error variances are constant across observations.

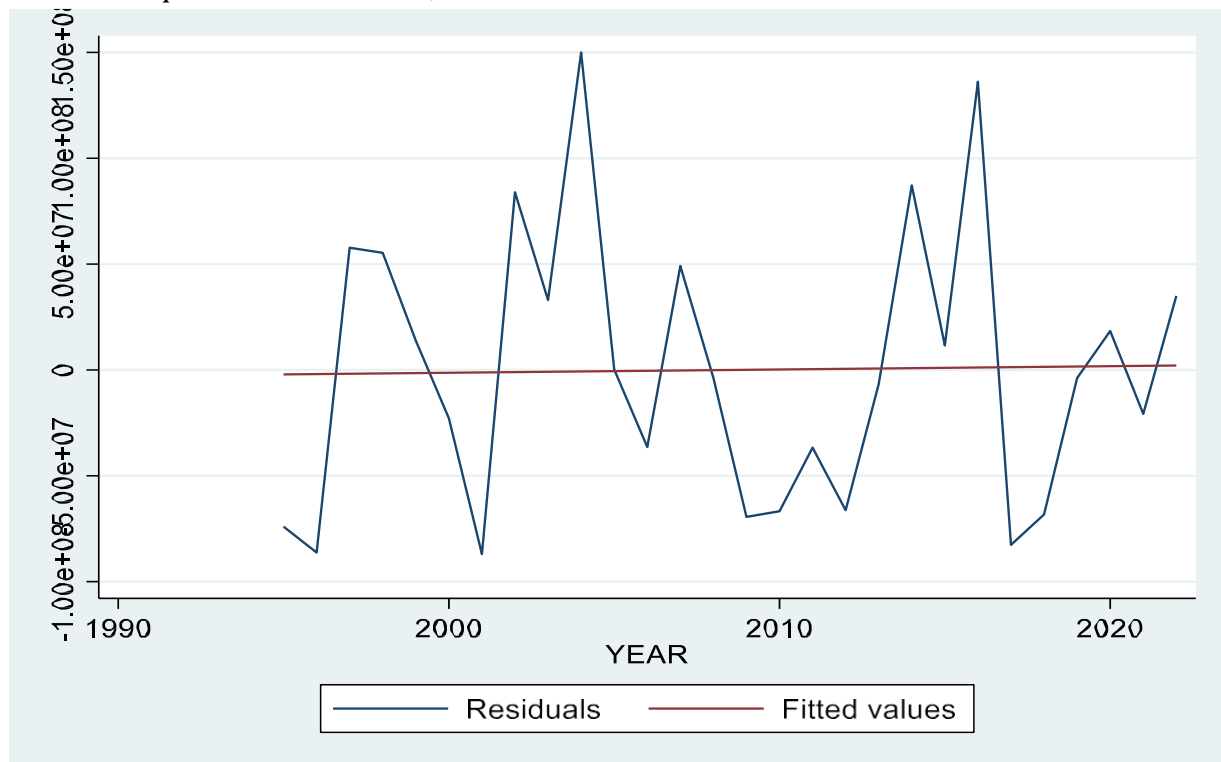
**Table 8. Cameron & Trivedi's decomposition of the IM-test**

Source	Chi2	df	p-value
Heteroskedasticity	28.00	27	0.4110
Skewness		15	
Kurtosis		1	
Total		43	

Variable	Obs	Mean	Std. dev.	Min	Max
Residual	28	-0.1473214	6.58e+07	-8.70e+07	1.50e+08

Furthermore, evaluation and visualization of whether the statistical model's residuals show any organized form or trends around the mean value are presented below in Figure 1. The mean value is equal to -0.1473214, and the

graph plots display how they fluctuate over time. The mean value of the residuals is represented by a horizontal line and used as a central reference point where residuals are expected to vary.



**Figure 1. Residuals around Mean Value**

**5. Conclusions and Recommendations**

Through data from 1991 until 2022, the study aims to discuss the role of exports

and imports in the gross domestic product dynamic in Tanzania. Data from the World Bank have been collected for

use in this study, where apart from exports and imports, the study also uses two control variables in conducting analysis: final consumption expenditure and gross capital formation. The study employs the ARDL-error correction model for the analysis of data, a suitable model for capturing the adjustment speed and long-run and short-run relationships of the independent and dependent variables. This research illustrates the role of exports, imports, final consumption expenditure, and gross capital formation in the gross domestic product dynamic. The results of the variables used in the study show a cointegration relationship, which means that they have a long-run equilibrium association. These results suggest that variables will finally converge back to the cointegrating relationship in the long term as unconventionality from a common pattern will not last longer. Moreover, the findings have indicated that exports based on first difference, second, and third lags are statistically significant and negatively affect the growth of domestic products in Tanzania in the short term. Additionally, the first difference in imports and the first difference, first lag, and second lag in gross capital formation have a short-term relationship with gross domestic products in Tanzania.

The findings of this paper have significant policy implications. It has been revealed that exports and imports are statistically significant and negatively and positively affect Tanzania's gross domestic product dynamics. The findings clearly show that in the long-term, exports show a positive impact, and imports show a negative impact on GDP in Tanzania; this is contrary to the short-

term, where exports show a negative impact while imports show a negative impact. The negative and positive impact patterns provide an alert to policy and decision-makers to create international trade policies that are relevant to the economy of Tanzania. Finally, this study recommends that production and export promotion strategies should be consistently pursued, concentrating on sustainable and inclusive growth. Consequently, the country should adopt policies that increase exports in the long term, as long-term exports contribute positively to GDP, contrary to imports, where policies should consider short-term rather than long-term periods.

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