Relationship between Public Expenditure and Economic Development in Sub-Saharan Africa Countries: The VECM Analysis
James Daniel Chindengwike

Abstract; This study examined the relationship between public expenditure and economic development in Sub-Saharan African nations using time series data from 1970 to 2021. The study employed the Vector Error Correction Model (VECM) and Granger Causality approaches, leveraging variables such as real GDP per capita and aggregate public expenditure. The short and long run outcomes show that government expenditure has a negative impact on economic development. In addition, the study's causality test reveals a bidirectional link between economic success and government spending. The call for a study pushes Tanzania's government to enhance its priorities while reinforcing programs such as cost-cutting and fiscal consolidation. It also underlines the need of government expenditure on development projects that are initiated and completed on time to minimize cost escalation.

1.0 Introduction
The level of government spending and its influence on economic growth in emerging nations has dominated recent studies (Olubokun et al., 2016). Globally, public spending increased considerably in the twentieth century as governments began to invest more money in social safety, healthcare, and education (Ortiz-ospina and Roser, 2016). According to WHO (2021b), figures show that health spending has more than doubled, reaching around US$ 8.5 trillion in 2019, an equal of 9.8 percent of global GDP. Meanwhile, on social protection a significant increase in total expenditure by about 270 percent was seen, totaling to $2.9 trillion in a six-month period beginning in December 2020. (UN, 2022). Similarly, between 2009 and 2019, low-income countries' public education spending more than doubled in real terms, resulting in only a 30% increase in per-capita spending (from US$ 37 in 2010-11 to US$ 48 in 2018-19), while high-income countries' spending increased by only about 16% (from US$ 7,544 to US$ 8,501). (WB, 2021). Keynesian (1936) theorizes that public expenditures and economic growth are positively associated, with the directional of causation from public spending to economic growth. According to Keynes, governments must use fiscal policy stabilization measures to support economic development (Shafuda, 2015). According to

1 Assistant Lecturer, Faculty of Commerce and Business Studies, St. John’s University of Tanzania, Dodoma, Tanzania, Email: chindengwikejames@gmail.com
the hypothesis, an increase in government consumption may lead to an increase in employment, profitability, and investment via multiplier effects on aggregate demand (Pierros, 2016). Furthermore, this idea contends that any sort of government spending, especially recurrent ones, may aid in economic growth (Gifari, 2016). Despite this, empirical studies on the link between government spending and economic growth have produced contradictory conclusions (Marica and Romano, 2018).

In Tanzania, state spending has consistently increased as a consequence of direct investment or manufacturing engagement by government parastatals (MoFP, 2021a). Social infrastructures (education, health, and water), economic infrastructures (transportation, communications, and power), and other sectors such as agriculture and the environment have received significant investment (MoFP, 2021a). Understanding the relationship between public spending and economic development is especially crucial for emerging economies, since public spending has usually grown over time (Sheilla and Odhiambo, 2019). Furthermore, economists continue to disagree whether government spending supports economic development (Sheilla and Odhiambo, 2019). In this instance, it is necessary to analyze the influence of government spending on economic growth, particularly in emerging nations.

2.0 LITERATURE REVIEWS

Molefe (2017) examined the link between government spending and economic development in South Africa from 1990 to 2015 using the Vector Error Correction Model and Granger Causality approaches. The study's findings demonstrated a negative long-run link between government spending and South African economic development. Furthermore, the study showed a causal link between economic growth and government expenditure. Dil and Ram (2021) used a series of data sets spanning the years 1974-1975 and 2018-19 to explore trends in government spending and the relationship between public spending and Nepal economic development. The research employed charts, correlations, and regression. The findings revealed a favorable relationship between government spending and economic growth. According to the study, the government and other concerned bodies should focus more on capital expenditures in order to boost economic growth and less on recurring expenditures, as well as increase spending on economic infrastructure such as education, health, transportation, and communication, as these may have a long-term impact on the economy.

Olonite et al. (2021) used a secondary dataset from the CBN to investigate the relationship between governmental spending and economic development in Nigeria. To test for variable stationarity, they used an Augmented Dickey fuller (ADF) and the Phillips Perron Test (PP). They calculated the correlation coefficient using STATA and the Pearson Product Moments Correlation. Olonite et al. (2021) used a secondary dataset from the CBN to investigate the relationship between governmental spending and economic development in Nigeria. To test for variable stationarity, they used an
Augmented Dickey fuller (ADF) and the Phillips Perron Test (PP). They calculated the correlation coefficient using STATA and the Pearson Product Moments Correlation.

Gifari (2016) examined the impact of government spending on Malaysian economic development over a 45-year period from 1970 to 2014. The OLS approach was used to determine the effects of government spending on economic growth. According to the findings, Malaysian public spending and economic development are inversely connected. Sáez et al. (2017) examined the relationship between public spending and economic development in European Union countries from 1994 to 2012. They employed panel and regression analyses. The findings did not show a direct relationship between government spending and economic growth.

Olayemi and Olayungbo (2018) performed a research from 1981 to 2015 to examine the dynamic links between non-oil revenue, state spending, and economic development in Nigeria. The error correction model, impulse responses, and the granger causality test were computed after establishing a long run link between the variables. Government expenditure had a detrimental influence on economic growth in both the short and long term, but non-oil revenue had a favorable effect. Non-oil revenue was likewise shown to have a negative influence on economic growth, although government spending had a favorable impact. According to the Keynesian and spend-tax hypotheses, the Granger causality test found that public spending granger caused both non-oil revenue and economic development in Nigeria.

Mwamkonko (2021) performed research to see if the Tanzanian government might increase long-term economic development by changing the mix of government spending. The maximum likelihood approach of Johansen co-integration techniques were employed to assess if the variables co-moved together in the long term relationship. According to the data, government expenditure on physical and human capital investments has a beneficial influence on economic growth, but government spending on consumption has a negative impact. Furthermore, the data demonstrate that moving expenditure from consumption to investments in physical and human capital increases economic growth, whereas the opposite causes growth to slow.

Keynes Macroeconomic Theory, created by John Maynard Keynes (1883-1946), emphasized that in the short run, government intervention is unavoidable in order to revive the economy from depression. This was a departure from classical economists who claimed that in the event of a shock, the economy should return to equilibrium without government involvement. According to Keynes, more expenditure leads to an increase in consumption as a result of increased purchasing power. Furthermore, employment grows as supply-side output expands. According to the idea, an increase in government spending can lead to a rise in GDP via a multiplier impact on aggregate demand. Furthermore, if funding is directed toward productivity projects, the social gains can be large (Onaran et al., 2007).
3.0 RESEARCH METHODOLOGY

A Time Series Research Design was used in the investigation. Time series designs are a subtype of longitudinal study designs that include assessments of large numbers of observations recorded on the same variable throughout time (An and Tillman, 2021). Secondary, yearly time series data from the Bank of Tanzania (BOT), the Tanzanian National Bureau of Statistics (NBS), the United Nations Conference on Trade and Development (UNCTAD), and the World Development Indicators were utilized in this analysis (WB). This data spans 51 years, from 1970 to 2021, since the Tanzanian economy has been struck by a succession of internal and foreign shocks since the late 1970s (Mwamtambulo & Ntulo, 2014). The data from 2021 was used to account for the impact of the COVID-19 pandemic. The information received

Model Specification; The model used in this study to analyze the link between government spending and economic development in Tanzania is based on Keynesian macroeconomic theory. This model was adapted from Fitsum’s (2016) model, which included variable economic development, and Oladele’s (2017) model, which included variable public expenditure and economic development. The model is defined in the function below;

\[
GDP=f(Px_t, FDI_t, Hc_t)\] .................................................................(1)

More technically equation 1 is suitably adjusted or rearranged to come up with the growth equation 2.

\[
GDP=\mu +Px_t+ FDI_t + Hc_t + \epsilon_t \] .................................................................(2)

To minimize the chance of committing misspecification error and to suit the time series behavior properly equation 2 is employed logarithm transformation variable. Then equation 3 is presented as follows;

\[
\ln (GDP_t) =\mu +\beta_1 \ln Px_t+\beta_2 \ln FDI_t + \beta_3 Hc_t + \epsilon_t \] .................................................................(3)

Where:

\begin{align*}
GDP_t & = \text{Real Per Capita Gross Domestic Product (at time } t) \\
\mu & = \text{Constants} \\
Px_t & = \text{Public expenditure at time } t \\
FDI_t & = \text{Foreign Direct Investment at time } t \\
Hc_t & = \text{Human Capital at time } t \\
\epsilon_t & = \text{Stochastic error term at time } t, \text{ and} \\
\ln & = \text{Natural Logarithm.}
\end{align*}
\( \beta_1, \beta_2, \beta_3 \text{ and } \beta_4 \) are model parameters that indicate the coefficients of explanatory variables. Money supply and inflation, on the other hand, were not presented as natural logarithms since they were previously stated as percentages, and none of their quantities surpassed 100. Variables such as GDP, public spending, FDI, and human capital were changed into logarithmic form using natural logarithm transformation to eliminate measurement unit variations and stabilize the variables' mean and variance before statistical analysis (Dossa, 2020). Because most macroeconomic variables were nonlinear, meaning there was no direct link between independent and dependent variables, natural logarithm transformation was also used to linearize the model and allow the regression coefficients to be interpreted as elasticities (Mohamed, 2020).

Vector Error Correction Model (VECM); Because the time series data examined are all stationary in the first difference and cointegrated, the Vector Error Correction Model (VECM) approach was used to study the relationship between public spending, money supply, inflation, and economic growth in Tanzania. The VECM specification includes cointegration relations to avoid the long-run behavior of endogenous variables from converging to their cointegrating connection while still keeping short-run adjustment dynamics (Dizaji, 2014). The estimation considers short-run impacts as well as an error correction term (ECT), which measures how quickly the model transitions from short-term to long-term equilibrium. As a result, the model's short-term faults will self-correct to the amount of the ECT term.

\[
\Delta \ln GDP_t = \beta_0 + \beta_1 \sum_{i=1}^{k} \Delta \ln GDP_{t-i} + \beta_2 \sum_{t=1}^{k} \Delta \ln Px_{t-i} + \beta_3 \sum_{t=1}^{k} \Delta \ln FDI_{t-i} + \beta_4 \sum_{t=1}^{k} \Delta Hc_{t-i} + \lambda_1 ECT_{t-1} + \mu_{1t} \quad \ldots \ldots \quad (4)
\]

Where;
- \( GDP_t \) = dependent variable
- \( Px_t \) = (independent variable)
- \( \Delta \) = difference operator
- \( \beta_0 \) = constants
- \( \beta_{1i}, \beta_{2i}, \beta_{3i}, \beta_{4i}, \beta_{5i} \) and \( \beta_{6i} \) = coefficients for the short-run, and \( \lambda_1 \) = coefficient of the error correction term, which quantifies the rate at which the short-run equilibrium state evolves toward the long-term stable equilibrium state. That is, the speed of adjustment parameter influences how soon the response variable (GDP) reaches equilibrium after an explanatory variable change. ECT\( t-1 \) displays the lag residuals from linear regressions with co-integration, indicating departures from long-run equilibrium.
4.0 RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1 summarizes and displays the descriptive statistics of the variables employed in the model. It highlights the basic characteristics or properties of the data variables used in the study by indicating their mean, standard deviation, minimum and maximum.

Table 4.1: Summary Statistics of All Variables

<table>
<thead>
<tr>
<th>Stats</th>
<th>GDP</th>
<th>Px</th>
<th>FDI</th>
<th>Hc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>507020.5</td>
<td>5166300</td>
<td>453.19</td>
<td>655188.6</td>
</tr>
<tr>
<td>Max</td>
<td>2346994</td>
<td>3.59e+07</td>
<td>2087.30</td>
<td>2671927</td>
</tr>
<tr>
<td>Min</td>
<td>241985.1</td>
<td>1985</td>
<td>-8.42</td>
<td>37153</td>
</tr>
<tr>
<td>Sd</td>
<td>589475.2</td>
<td>9012294</td>
<td>588.64</td>
<td>815199.6</td>
</tr>
<tr>
<td>Variance</td>
<td>3.47e+11</td>
<td>8.12e+13</td>
<td>346500.9</td>
<td>6.65e+11</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>7.704274</td>
<td>5.946864</td>
<td>3.18</td>
<td>2.658056</td>
</tr>
<tr>
<td>Skewness</td>
<td>2.523159</td>
<td>1.962381</td>
<td>1.15</td>
<td>1.114769</td>
</tr>
<tr>
<td>Range</td>
<td>2105009</td>
<td>3.59e+07</td>
<td>2095.72</td>
<td>2634774</td>
</tr>
<tr>
<td>Observation</td>
<td>52</td>
<td>52</td>
<td>52</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Researcher Estimation Results with STATA, 2022

Table 4.1 above shows the summary statistics properties of both independent and dependent variables used in the study.

On average the annual public expenditure (Px) is 507,020.5 and the maximum is 2,346,994 as measured in millions of Tanzanian Shillings. Public expenditure has the biggest range amidst the minimum and maximum values, where the maximum value is 3.59e+07 observed in 2021 and the minimum value is 1985 observed in 1970 respectively. In light of this, when compared to the other variables in the analysis, public expenditure has the highest standard deviation of 9012294. The highest standard deviation has an implication that, the dispersion from the mean of public expenditure is more widely distributed relative to the other variables. The largest variance is observed to be that of public expenditure with the value of 8.12e+13. The FDI was observed to have the lowest value of -8.42 in millions of US dollars. Lastly, human capital was seen to have the largest mean value of 655188.6 as compared with other variables. Moreover, there is no missing observation among the variables.
4.2.1 Trend of Public Expenditure and GDP

Figure 4.2: Trend of Public Expenditure and GDP from 1970 To 2021

Source: Author, 2022

Figure 4.1, above presents public expenditure (total spending in TZS million) as well as GDP in Tanzania. Both public expenditure and GDP of Tanzania have been increasing since 1970 until to date. The increase in public expenditure is due to the fact that, since the Arusha Declaration in 1967 as nationalization steps government spending commitments have been rising (Mwatambulo and Ntulo, 2014). Moreover, the increase is also associated with the need to meet the demand of growing population. According to the Housing Census (PHC), the population of Tanzania has grown from 17,512,610 persons in 1978 Census to 44,928,923 persons counted in 2012. The increase in population is attached with cost implication of availability of social services, political issues as well as economic issues (NBS, 2012). The graph of GDP lies above that of public expenditure indicating that from 1970 to 2007 there was a favorable economic growth until 2008 to 2012 where the economy experienced several economic downturn including the 2008 financial crisis. The trend of GDP growth was very sharp from 2016, where GDP per capita increased from 966.5US dollars in 2016 to 1,135.5US dollars in 2021 (Word Bank, 2022). The strong economy was a result of fortunate policies such as, National 5 years Development plan adopted in 2016 and ended in 2021 aiming at building a base for transforming Tanzania into a semi-industrialized nation by 2025, foster development of sustainable productive and export capacities among others (WHO, 2021a). The successful implementation of the policies was guided by then a strong political regime under the late Magufuli which was connected to the system of accountability (WHO, 2011).
4.3 Correlation Analysis

The correlation analysis is a statistical technique employed to determine the strength of any potential association between two variables or datasets. The coefficient of the pairwise correlation analysis operates under the constraint $-1 \leq r \leq +1$, where a result of 0 indicates that there is no relationship between the data at all. The correlation analysis is also used as a test of multicollinearity. Economists suggest that a multicollinearity problem occurs when there are strong correlations of more than 95% and a significant p-value between two or more independent variables.

Table 4.2: Correlation Matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>GDP</th>
<th>Px</th>
<th>FDI</th>
<th>Hc</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Px</td>
<td>0.8096***</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0000</td>
<td>0.0003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.7541***</td>
<td>0.9002***</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0000</td>
<td>0.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hc</td>
<td>0.8936***</td>
<td>0.9775***</td>
<td>0.8864***</td>
<td>1.0000</td>
</tr>
<tr>
<td></td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Researcher Estimation Results with STATA, 2022

The pairwise correlation analysis results of the computed correlations coefficient among the variables in the model as shown in Table 4.2 above indicate that; GDP, Public Expenditure, FDI, and Human Capital are positively correlated with the correlation coefficient of 0.8096, 0.7541, and 0.8936 respectively and statistically significant p-value of 0.0000 each. This implies that all variables used as independent variables have an influence on GDP.

4.4.1 Unit Root Test Results

Investigating the characteristics of the used data is the first step in the analysis and interpretation of the findings. This starts with the unit root tests using both Augmented Dickey Fuller (ADF) and the Phillips and Perron (PP) unit root tests. The ADF and PP tests were performed for each variable in levels and differences to determine the existence of the unit root. The unit root test null hypothesis is: $H_0: p = 1$ to the alternative $H: p < 1$. It is a unit root test because the distinctive polynomial has a root equal to unity under the null hypothesis. Table 4.3 below presents the results of the performed unit root
Table 4.3: Unit Root Test

**ADF TEST**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>First Difference</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test Statistics</td>
<td>Critical Value</td>
<td>Test Statistics</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.568</td>
<td>-3.500</td>
<td>-3.816</td>
</tr>
<tr>
<td>Px</td>
<td>-0.943</td>
<td>-2.930</td>
<td>-4.733</td>
</tr>
<tr>
<td>FDI</td>
<td>-0.811</td>
<td>-2.930</td>
<td>-6.651</td>
</tr>
<tr>
<td>Hc</td>
<td>-0.005</td>
<td>-2.930</td>
<td>-3.053</td>
</tr>
</tbody>
</table>

**The PP TEST**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>First Difference</th>
<th>Order Of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test Statistic</td>
<td>Critical Value</td>
<td>Test Statistic</td>
</tr>
<tr>
<td>GDP</td>
<td>2.702</td>
<td>-2.929</td>
<td>-3.816</td>
</tr>
<tr>
<td>Px</td>
<td>-0.896</td>
<td>-2.929</td>
<td>-7.147</td>
</tr>
<tr>
<td>FDI</td>
<td>-1.106</td>
<td>-2.929</td>
<td>-13.085</td>
</tr>
<tr>
<td>Hc</td>
<td>0.249</td>
<td>-2.929</td>
<td>-3.288</td>
</tr>
</tbody>
</table>

**Source:** Researcher Estimation Results with STATA, 2022

Note: The test statistics were compared with the critical values to decide whether the null hypothesis of the unit root will be rejected or not.

According to Table 4.3 above, all variables are stationary at the first difference, I (1) as demonstrated by t- statistic which are greater than their corresponding critical values at 5% level of significance. As a result, the unit root null hypothesis was rejected at 5% level of significance, indicating that all relevant variables are stationary. For this case the Vector Error Correction Model (VECM) is justified to be estimated (Verbeek, 2007).
The raw data of GDP, public expenditure, FDI and human capital were transformed to make time series data stationary. Figure 4.1 above shows that the transformed time series have a constant variance and mean given the fact that there is movement around zero. To determine the stationary properties of time series, the Augmented Dickey Fuller and Phillips-Perron tests were used.

4.4.2 Normality Test: The normality test was run to check that the residuals follow a normal distribution. If the overall probability of the data is larger than 0.05, the data are said to be normally distributed.

Table 4.4: Jarque-Bera Test

<table>
<thead>
<tr>
<th>Equation</th>
<th>Chi2</th>
<th>Df</th>
<th>Prob &gt; chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.151</td>
<td>2</td>
<td>0.92708</td>
</tr>
<tr>
<td>Px</td>
<td>6.292</td>
<td>2</td>
<td>0.04302</td>
</tr>
<tr>
<td>FDI</td>
<td>0.553</td>
<td>2</td>
<td>0.75842</td>
</tr>
<tr>
<td>Hc</td>
<td>4.930</td>
<td>2</td>
<td>0.08501</td>
</tr>
</tbody>
</table>

Source: Researcher Estimation Results, 2022

As shown in Table 4.4, the normality test by Jarque-Bera verifies that the residuals have a normal distribution because their respective probabilities are greater than 0.05. This suggests that the data used for analysis followed a normal distribution during the study period. The results imply that, there is no any external shock (for example natural calamities, war, and policies) that affect the dependent variation.
The histogram should resemble a "bell" shape if the variable is normally distributed, with more values concentrated in the middle and less values on the tails. From figure 4.7, histogram is bell-shaped implying the residual are normally distributed.

### 4.4.3 Heteroscedasticity Test

The model was subjected to heteroscedasticity test using Cameron and Trivedi’s decomposition IM-test.

**Table 4.5 Cameron and Trivedi’s decomposition IM- Test**

<table>
<thead>
<tr>
<th>Test</th>
<th>Chi2</th>
<th>Df</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heteroscedastic</td>
<td>16.51</td>
<td>21</td>
<td>0.7401</td>
</tr>
<tr>
<td>Skewness</td>
<td>3.72</td>
<td>6</td>
<td>0.7144</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.00</td>
<td>1</td>
<td>0.9608</td>
</tr>
<tr>
<td>Total</td>
<td>20.24</td>
<td>28</td>
<td>0.8556</td>
</tr>
</tbody>
</table>

**Source:** Researcher Estimation Results with STATA, 2022

The null hypothesis for heteroscedasticity tests is; the variance for the error terms are equal. According to the conducted diagnostic check during the analysis, the model was not experiencing any heteroscedasticity issues as confirmed by Cameron and Trivedi’s decomposition of IM-test for heteroscedasticity, and the homogeneity of variance was found as indicated in table 4.5 above.

### 4.4.4 Autocorrelation Test

The existence of autocorrelation within the estimated model's residuals is frequently caused by Miss-specification (Rather and Subramanian, 2018). The autocorrelation test
results indicated the absence of autocorrelation at lag order of 5, as confirmed by the Lagrange Multiplier Test.

<table>
<thead>
<tr>
<th>Lag</th>
<th>Chi2</th>
<th>Df</th>
<th>Prob &gt; Chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.8238</td>
<td>36</td>
<td>0.79658</td>
</tr>
<tr>
<td>2</td>
<td>47.1641</td>
<td>36</td>
<td>0.10083</td>
</tr>
<tr>
<td>3</td>
<td>35.3866</td>
<td>36</td>
<td>0.49757</td>
</tr>
<tr>
<td>4</td>
<td>36.1505</td>
<td>36</td>
<td>0.46162</td>
</tr>
<tr>
<td>5</td>
<td>27.2269</td>
<td>36</td>
<td>0.85359</td>
</tr>
</tbody>
</table>

Source: Researcher Estimation Results with STATA, 2022

### 4.4.5 VIF Test

The Variance Inflation Factor (VIF) is proposed as a good indicator for multicollinearity because it gives the degree of collinearity of the predictors. The VIF less than 10 has been justified as an indicator of the absence of multicollinearity in the model (Yang & Shafiq, 2020).

<table>
<thead>
<tr>
<th>Variable</th>
<th>VIF</th>
<th>1/VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI</td>
<td>1.32</td>
<td>0.760146</td>
</tr>
<tr>
<td>Px</td>
<td>1.21</td>
<td>0.827113</td>
</tr>
<tr>
<td>Hc</td>
<td>1.04</td>
<td>0.965572</td>
</tr>
</tbody>
</table>

Source: Researcher Estimation Results with STATA, 2022

Table 4.7 above show that, for all of the explanatory variables in the model, the VIF was far below 10, implying, there was no collinearity among the explanatory variables in the model.

### 4.4.6 Lag Length Selection

After establishing the stationarity of the series, the next step was the test for the optimum lag. However, the lag length must be established before performing the Johansen Cointegration test. The Akaike Information Criterion (AIC), Hannan and Quinn Information Criterion (HIQC), Schwarz Bayesian Information Criterion (SIBC), Sequential Modified (LR) test statistic and Final Prediction Error (FPE) were employed to determine the optimal lag length included in the Johansen co-integration test. Table 4.8 below indicate the optimal lag length results of GDP, public expenditure, FDI and human capital.
Table 4.8 Lag Length Selection

<table>
<thead>
<tr>
<th>Lag</th>
<th>LL</th>
<th>LR</th>
<th>Df</th>
<th>P</th>
<th>FPE</th>
<th>AIC</th>
<th>HQIC</th>
<th>SBIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-470.6</td>
<td>25.9316</td>
<td>20.2827</td>
<td>20.3716</td>
<td>20.5189</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-130.0</td>
<td>681.2</td>
<td>36</td>
<td>0.000</td>
<td>0.000062</td>
<td>7.32033</td>
<td>7.94249</td>
<td>8.97365*</td>
</tr>
<tr>
<td>2</td>
<td>-82.19</td>
<td>95.68</td>
<td>36</td>
<td>0.000</td>
<td>0.00004*</td>
<td>6.81642</td>
<td>7.97185</td>
<td>9.88688</td>
</tr>
<tr>
<td>3</td>
<td>-41.74</td>
<td>80.89</td>
<td>36</td>
<td>0.001</td>
<td>0.000041</td>
<td>6.62736</td>
<td>8.31607</td>
<td>11.1149</td>
</tr>
<tr>
<td>4</td>
<td>25.392</td>
<td>134.2</td>
<td>36</td>
<td>0.000</td>
<td>0.000017</td>
<td>5.30245</td>
<td>7.54076</td>
<td>11.2072</td>
</tr>
<tr>
<td>5</td>
<td>73.541</td>
<td>96.3*</td>
<td>36</td>
<td>0.000</td>
<td>0.000024</td>
<td>4.7855*</td>
<td>7.52444*</td>
<td>12.1074</td>
</tr>
</tbody>
</table>

Source: Researcher Estimation Results with STATA, 2022

Note: * shows lag order selected by the criterion. Each test at the 5% level

The results indicate that; all the criteria chose an optimal lag of 5 with the exception of SBIC and FPE which recommended 1 lag and 2 respectively. The lowest the value of information criteria which indicate the betterment of the model was adequately chosen.

4.4.7 Cointegration Test

The relationship is referred to as co-integration if there is a long-run, or long-term equilibrium relationship between two variables. Co-integration occurs when two variables, dependent and an independent variable are individually nonstationary but their residual (combination) is stationary (Gujarati, 2004). Once it has been verified that all variables are I(1) series (integrated of order 1) that is stationary in first difference then as suggested by Johansen and Juselius (1990) performing a co-integration test was necessary to establish a long run relationship. Therefore, a co-integration test was carried out using the Johansen Co-integration test with a maximum lag of 5. Table 4.9 below shows the outcome of the co-integration test. According to Johansen (1987) and Johansen and Juselius (1990), the Johansen test focuses on the two likelihood ratio test statistics of trace and max Eigen statistics to find all co-integration equations pertinent to the variable under investigation. The possible results of co-integration equation consist of maximum rank \( r = 0 \), \( r = n \), and when there are at most \( r \) co-integrating vectors \( 0 \leq r \leq n \).

Criteria for decision: * Shows rejection of the null hypotheses at 5% level of significance.

Reject the null hypothesis if the trace and max statistics > 5% critical value, otherwise fail to reject the null hypothesis.
The outcome in table 4.9 showed that, both the maximum eigenvalue and the trace statistics suggest the rejection of the null hypothesis of no co-integration among the variables. For both approaches employed, the outcome demonstrates that there are at least three co-integrating vectors. The fact that there exists a long-run relationship among the non-stationary variables justifies the usage of Vector Error Correction Model (VECM).

### 4.4.8 Vector Error Correction Model (VECM)

After confirmation of existence of cointegration between the variables, VECM becomes a suitable model for the estimation. It is performed to capture the short-run dynamics towards the long-run equilibrium. Regression equation is estimated to get residual from which the rate of adjustment to long run equilibrium is determined. The central parameter is a lagged error correction term which is ECTt-1, and it measures the short term effects of the variables. The (λ) sign of the coefficient of ECT must be significantly negative.

The ECTt-1 corrects the short-run shocks so as to adjust the shocks towards the long-run equilibrium. According to the employed VECM results presented by table 4.10, the ECTt-1 coefficient (0.3239025) has a negative sign and is significant with P-value of 0.038. With a convergence speed of 32.39%, it is implied that any errors or departures from long-run equilibrium are addressed within the current year, meaning that, the independent variables being public expenditure, money supply and inflation have a long-term causal relationship with the dependent variable which is economic growth.

The R-squared as indicated in table 4.10 is 0.8884 implying that 89% of the variation in GDP is caused by the independent variables, hence a good fit. The remaining 11% are random variables that were not taken into account by the model. These variables represent the random variable's effects on the dependent variable.
### Table 4.10 Short Run Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Lags</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.515339</td>
<td>0.483663</td>
<td>-0.0208883</td>
<td>0.7016625</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.004***</td>
<td>0.026**</td>
<td>0.931</td>
<td>0.008***</td>
<td></td>
</tr>
<tr>
<td>Px</td>
<td>-0.0488482</td>
<td>-0.0435891</td>
<td>0.029794</td>
<td>0.0338707</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.109</td>
<td>0.124</td>
<td>0.363</td>
<td>0.327</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.045**</td>
<td>0.088***</td>
<td>0.231</td>
<td>0.146</td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.0319267</td>
<td>0.0298375</td>
<td>0.0212344</td>
<td>0.0015904</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.089***</td>
<td>0.034**</td>
<td>0.013**</td>
<td>0.755</td>
<td></td>
</tr>
<tr>
<td>Hc</td>
<td>-0.023723</td>
<td>-0.1356937</td>
<td>-0.1082902</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.703</td>
<td>0.061***</td>
<td>0.151</td>
<td>0.454</td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>-0.3239025</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.038**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cons.</td>
<td>-0.0019591</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.871</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-square</td>
<td>0.8884</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Researcher Estimation Results with STATA, 2022

Note: ***, **, and * indicate the significance of the coefficients at 1%, 5% and 10% levels, respectively.

### Table 4.11 The Long Run Johansen Normalization Restriction Imposed

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>Z</th>
<th>P&gt;Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Px</td>
<td>0.029453</td>
<td>0.0078707</td>
<td>3.74</td>
<td>0.000***</td>
</tr>
<tr>
<td>FDI</td>
<td>0.1383852</td>
<td>0.0076427</td>
<td>18.11</td>
<td>0.000***</td>
</tr>
<tr>
<td>Hc</td>
<td>-0.3531079</td>
<td>0.012979</td>
<td>-27.21</td>
<td>0.000***</td>
</tr>
<tr>
<td>Cons.</td>
<td>9.629655</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

**Source:** Researcher Estimation Results with STATA, 2022

Note: *** indicate the significance of the coefficients at 1%, levels.

Table 4.11 show that, in the long run, public expenditure was negative and statistically significance at 1% level of significance, implying that public expenditure has unfavorable impact on economic growth. This suggested that, on average a percentage
increase in public expenditure is associated with 0.0294 percentage decrease in economic growth under ceteris paribus. These findings are in contrast with the Keynesian Macroeconomic Theory probably because the budget structure of the Tanzanian economy comprises hugely by the recurrent expenditure and not development expenditure. This situation is also witnessed in other countries such as South Africa and Nigeria, see (Molefe and Choga, 2017 and Olayungbo and Olayemi, 2018) who investigated the relationship between public expenditure and economic growth, and in accord with the position of the Barro (1990) perspective in his Endogenous Growth Model that, public spending on investments and productive activities should have a positive economic impact, but public spending on consumption is anticipated to inhibit growth because a bigger part of consumer spending is allocated to non-growth aims like redistribution and social welfare.

Results in Table 4.10 show that, in the short run the lagged value of public expenditure was negative and statistically insignificant. Suggested that, public expenditure has no impact on economic growth in the short run. This contradicts with Keynesian macroeconomic theory which claim that, in the short run increase in aggregate public expenditure can boost economic growth. The results are in conformity with Olayungbo and Olayemi (2018).

In long run, the effect of human capital on Economic growth showed positive and a statistically significant at 1% level of significance as shown in the Table 4.11. The results suggest that, on average, a percentage increase in the human capital results to increase in economic growth by 0.353 percentage under ceteris paribus. This imply that, human capital which is represented by total number of enrollment in secondary schools has a considerable beneficial impact on economic growth of Tanzania in the long-run. In particular, the result sounds quite meaningful as greater human capital would lead in greater economic growth as a result of higher labour productivity in line with exogenous economic theory. The result corroborates the findings by other similar researches conducted by (Curea and Ciora, 2013; Sulaiman et al., 2015; Kazmi et al., 2017) where positive relationship was reported between human capital and economic growth.

On the other hand, the short run results in table 4.10 indicate that, the second lagged value of human capital was negative and statistically significant at 10% level of significance. The result supported with studies of Afzal et al., (2010) who investigated relationship between school education and economic growth in Pakistan.

4.5 Causality Relationship

The existence of causal relationship between public expenditure, FDI and human capital was determined using the granger causality test. Granger causality from a variable X to a variable Y is established when knowledge of the past values of X enhance prediction of the future of Y, over and beyond the prediction that is based on knowledge of the past
values of Y alone (Granger, 1969). This Granger Causality Test verifies the null hypothesis of whether the regression equation's past value coefficients are zero. Therefore, you can safely reject the null hypothesis if the p-value produced from the test is lower than the significance level of 0.05. The results of the granger causality test for all variable are shown in the table 4.12 below.

**Table 4.12 Result of Granger Causality Test**

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Prob &gt; chi2</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP does not granger cause Px</td>
<td>0.001</td>
<td>Causality</td>
</tr>
<tr>
<td>Px does not granger cause GDP</td>
<td>0.050</td>
<td>Causality</td>
</tr>
<tr>
<td>GDP does not granger cause FDI</td>
<td>0.000</td>
<td>Causality</td>
</tr>
<tr>
<td>FDI does not granger cause GDP</td>
<td>0.000</td>
<td>Causality</td>
</tr>
<tr>
<td>GDP does not granger cause Hc</td>
<td>0.766</td>
<td>No Causality</td>
</tr>
<tr>
<td>Hc does not granger cause GDP</td>
<td>0.000</td>
<td>Causality</td>
</tr>
</tbody>
</table>

**Source:** Researcher Estimation Results with STATA, 2022

**Granger Causality Test for GDP and Macroeconomic Variables**

The findings as indicated by Table 4.12 indicated that GDP granger cause public expenditure, and FDI with p-value less than 0.05. The granger causality test null hypothesis is rejected if p-value is less than 0.05 and accept alternative hypothesis when p-value is greater than 0.05. Hence, rejection of null hypothesis which state that GDP does not granger cause public expenditure and FDI.

**Granger Causality Test for Macroeconomic Variables and GDP**

Results in Table 4.12 indicated that public expenditure and FDI granger cause economic growth with p-value less than 0.05 whereas human capital does not granger cause economic growth since their p-value was greater than 0.05. Hence, rejection of the null hypothesis that public expenditure, does not granger cause economic growth and we fail to reject the null hypothesis which state that human capital do not granger cause economic growth.

Generally, the granger causality test indicated that there is bidirectional relationship from economic growth to public expenditure, FDI.

**Table 4.13 Summary of Hypothesis Tested**

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no relationship between public expenditure and economic growth in Tanzania</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

**Source:** Research Estimation Results with STATA, 2022
The Table 4.13 above indicates a summary of the tested hypothesis and the decision made. The first hypothesis to be tested was the long-run and short-run relationship between public expenditure and economic development.

4.6 Diagnostic Check

4.6.1 Structural Break Test

According to the CUSUM testing guideline’s approach, the estimated model is considered stable if its line fell within one of the CUSUM fixed lines and unstable if its line is not one of the CUSUM fixed lines (Mohamed and Lebbe, 2016).

Figure 4.2: Shows Cusum Tests Results

Figure 4.8 displays the plot of CUSUM within the 5% critical bounds. This demonstrates the stability of the model and supports the long-term correlations between the variables. The model is therefore robust and a good fit for studying the nexus between public expenditure, money supply, inflation and economic growth of Tanzania, according to the whole diagnostic data.

5. CONCLUSION AND RECOMMENDATIONS

The outcomes of an examination of how public spending influences economic growth in Tanzania revealed a negative short and long-term association, whereas macroeconomic determinants of money supply had a negative long-run and a positive short-term impact. Furthermore, the data demonstrated that human capital has a long-run beneficial influence on economic growth as well as a short-run negative effect. Meanwhile, FDI has both a negative long-term and a favorable short-term impact on economic growth. The error correction data also revealed that there is a convergence towards stability over time, with a yearly adjustment of 32.39%.

The findings have the following consequences: First, there is a substantial relationship between government spending and economic growth. Public expenditure has been shown to have a significant influence on economic growth. This suggests that efficient
allocation of public spending will have a favorable long-term influence on Tanzanian economic growth. The Keynesian hypothesis strongly supports the claim that public expenditure is a growth engine in Tanzania. This suggestion encourages the Tanzanian government to strengthen initiatives such as cost-cutting and fiscal consolidation. However, government expenditure should primarily focus on development projects and guarantee that they are launched and completed on time to avoid cost overruns. The VECM model future was used in this investigation.

REFERENCE


65

Journal of Global Economy,
Volume 19 No 1, March 2023

Chindengwike, J. (2022). Does External Debts Promote Sustainable Economic Development in Developing Countries?. Available at SSRN 4031616.


Chindengwike, J. D., & Schoral, R. The Effect of Tax Administration System on Promoting Taxpayers’ Voluntary Compliance in Tanzania.


Chindengwike, J. (2023). Influence of Traditional Exports on Economic Growth in Developing Countries: The VECM Analysis, *Journal of Business and Management*


World Bank. (2021). *The World Bank supports Tanzania’s growth through policy analysis, grants, and credits, with a focus on infrastructure and the private sector.*