The Effect of Inflation on Economic Growth in Tanzania for the Period from 1970 to 2020

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Abstract

The research examines the effect of inflation on economic growth in Tanzania. The study employs the secondary time series data from 1970 to 2020 taken from the Bank of Tanzania, and the VECM is used to find the cointegration between variables to show the short-run and long run dynamics. Graphical analysis and Augmented Dickey-Fuller tests were conducted to find the unit root in the model. All variables were stationary and integrated in the same order I(1). The results show that the error correction was significantly negative. That is, the annual rate of adjustment required to achieve long-run equilibrium was 28.31 percent. Based on the findings in the short-run, the extended money supply and interest rates had negative and insignificant effects on GDP, while the exchange rate had an inversely significant effect on GDP. Inflation targeting had a favourable insignificant effect on GDP. Long-run results show that extended money supply, exchange rates, and interest rates had positive significant effects on economic growth, whereas inflation targeting had negative significant effects on GDP. It is recommended that the government, policymakers, and financial institutions focus on managing inflation by the prudent implementation of fiscal and monetary policies, and maintaining a regulation of interest rates, the extended money supply, and real exchange rates also inflation targeting should be emphasized by improving the central bank's communication, transparency, and accountability to avoid inflation volatility and stimulate economic growth.

Keywords: Economic Growth, Inflation, Inflation Targeting, Tanzania

1. Introduction

Achieving sustainable economic growth, tied with price stability, continues to be the main objective of macroeconomic policies for the majority of nations in the globe (Mukoka, 2018; Joshi, 2021). Inflation has been described as the total increase in the economy's charge of commodities and services over a specific period (Abdallah, 2020; Mukoka, 2018). It has categories such as low inflation, moderate inflation, chronic inflation, severe inflation, extremely high inflation growth, and hyperinflation (Kotsokoane, 2021; Charles & Marie, 2021).

Several factors, including a rise in money supply, an increase in government expenditure, financing a budget deficit, tax evasion, exports, a lack of key commodities, volatility in interest rates, and exchange rates, caused the inflation rate to rise (Preethi, 2021).

The oil embargo that followed the Arab-Israel war in 1973 resulted in a runaway charge level in Latin America in the 1970s. Meanwhile, a floating exchange rate system replaced the Bretton Woods structure of fixed exchange rates in the 1970s because of the end of trading of the gold standard at the fixed price of $35 per ounce (Tatliyer, 2017; Hussain, 2018).

Hyperinflation is harmful to the country because of the negative effects it has on financial activity; zero price increases are the damaging result of eventual economic decline. Nevertheless, on the other hand, it's general price increases due to the scarcity of vital commodities and services in the economy, which in turn diminishes the purchasing power of communities (Adaramola, 2020; Abdallah, 2020).

The runaway price level worldwide, particularly in Latin America, persisted into the 1970s, contributing to heightened instability in many countries (Hussain, 2018). For example, in Zimbabwe, hyperinflation in 2008 reduced purchasing power, reduced productivity, discouraged saving and investment, and exacerbated balance-of-payment instability by focusing on imports rather than exports (Mukoka, 2018).

According to Turkay (2019), in the 1990s, New Zealand was the earliest nation to adopt a monetary strategy that targeted inflation. Other countries had chosen a price level rise intention regime as their financial strategy. The government and policymakers were interested in inflation targeting. Inflation-targeting central banks declare an explicit inflation target and implement financial strategies to sustain economic price permanence (Montes, 2018).

Tanzania's economy had been affected by internal and external shocks since the late 1970s. Shocks had discouraged every sector of the nation; these included the 1973-74 oil crises and drought in the year 1974-75 with global recession; the 1975-76 coffee-price bubble; and the 1979 oil crisis. The oil crisis caused a 350 percent increase in global prices; the recession caused a 10 percent drop in global trade and a considerable drop in export prices for commodities; and the second oil crisis escalated by 130 percent. The famine in 1973, the breakdown of the EAC in 1977 and the conflict by Uganda in 1978/79 were the internal shocks (Mkubwa & Babiker, 2014; Laryea, 2001; Kasidi, 2013; Nyorekwa, 2014).

Implementing an effective anti-inflation policy with the primary goal of achieving anencouraging link among price rises level and GDP based on the price targeting mechanism remained critical for central banks, government as well as policymakers in many nations around the globe (Uddin, 2021; Mishchenko&Mishchenko, 2018).
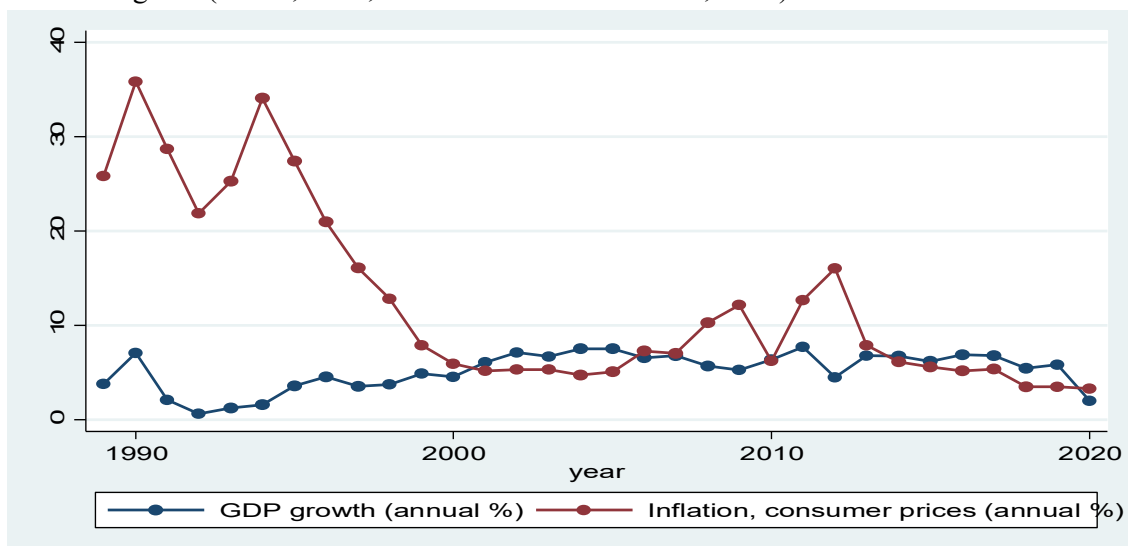

Figure 1: *Movement of inflation and GDP in Tanzania from 1988 to 2020*

Source: (World Development Indicator, 2022)

Figure 1 demonstrates the minimum general price level ever recorded at 3.3 percent in 2020, whereas the maximum was 36.1 percent in 1984 for Tanzania's economy. In 1977, the GDP grew by 0.4 percent, the lowest ever. In 2011, the GDP growth rate was 7.7 percent, the highest ever recorded. The influence of changes in monetary and fiscal policy might have been responsible for the upward and downward movement of the inflation trend as well as internal and external shocks contributed to the significant climb at the price level in the late 1970s.

The study was motivated by the fact that inflation seems to be dynamic in Tanzania. Despite Tanzania's economy adopting an inflation targeting regime, the inflation rate deviated from the target regime from 1970 to 2020. However, inflation seems to be having a great effect on economic growth. Therefore, the inflation rate in Tanzania's economy has been caused by several factors, including increased money supply in the economy, increased government expenditure, the budget deficit, the deficit, the shortage of critical goods, the exchange rate, and interest rate volatility. Thus, through this study, the researcher will be in a good position to deduce an appropriate solution from the factors that cause inflation in the Tanzanian economy. The result of this study will help the central bank, policymakers, and government to understand the connection between prices raises level on GDP and thus come up with the appropriate guidelines to regulate inflation in order to emphasize the stimulation of economic growth.

1.1 Specific Objectives

This study was guided by the following objectives:

1. To find out the contribution of the extended money supply to the economic growth.
2. To determine the relationship between interest rate and the economic growth.
3. To identify the influence of the real exchange rate on economic growth.
4. To find out the effect between inflation targeting regime on the economic growth.

1.2 Research Hypothesis

The following null hypotheses were tested:

H1: Extended money supply has no significant influence on economic growth.
H2: Interest rate has no significant influence on economic growth.
H3: Exchange rate has no significant influence on economic growth.
H4: Inflation targeting regime has no significant influence on economic growth.

2. Literature Review

Various studies have been conducted outside Africa on the effect of inflation, extended money supply, real exchange, interest rates, and inflation targeting on GDP. Uddin (2021) used the Johansson co-integration test and time-series secondary statistics from 1990 to 2015 to examine the effect of inflation on GDP in Pakistan. The results revealed inflation encouraging the GDP, the results are similar as those of Joshi (2021) employed the ARDL approach and the bound test, on investigating the Inflation and GDP Paradox: A Co-integration Analysis, found a positive association between price rises and GDP in Nepal. Yetty and Waibot (2021) employed route investigation methods to explain the fundamental association among connectivity variables, inflation, GDP, and poor quality of life in the Islands of North Maluku province. The results suggested that inflation and GDP had a negative association. Hussain (2018) employed the VECM technique to examine the influence of the link between extended money supply and GDP in Bangladesh. The conclusion implies that stable extended money was linked to a stable GDP.Vasani and Kathiravan (2019) investigated the association between the exchange rate and India's GDP for 2005QI to 2017Q4. The ADF method was employed to determine the unit root in the study, the result revealed that real exchange rate supported a country's economic growth. Eroglu and Eroglu (2017) examined the efficiency of an inflation targeting approach in

Turkey, which was analyzed using the LSM and a regression form for financial, the empirical findings revealed that inflation targeting was harmful to economic growth.

Furthermore, different studies have been conducted in Africa on the effects of inflation, extended money supply,real exchange, interest rates, inflation targeting on GDP. Mukoka (2018) examined the pressure of inflation on Zimbabwe's GDP. The research employed secondary time series data of annual statistics for price raises level and GDP. The influence of inflation on GDP was calculated by employing OLS. In addition, these researchers performed several stationarity and cointegration tests. Zimbabwe has demonstrated that price rises were unfavourable and statistically insignificant to GDP. Omodero (2019) examined the effect of extended currency supply on GDP in Nigeria and Ghana. The study employed panel statistics and analyzed the data using a panel OLS regression method. The outcomes revealed that the extended currency had a negligible beneficial impact on economic growth in Nigeria but has a considerable unfavourable effect in Ghana. Obamuyi (2009) used time series information, and the research explored the association among interest rates and GDP in Nigeria. The long-run and short-run dynamics of the variables in the model employed ECM. The empirical findings suggest that interest rate behaviour was vital for GDP. Mwinlaaru (2017) employed annual series data from 1984 to 2014; the research aims to quantify the effect of the real effective exchange rate on Ghanaian GDP. The study discovered that the real exchange rate and GDP were cointegrated using the ARDL cointegration estimate technique. Furthermore, the findings observed that the real exchange rate was favourable and significant on GDP.

Additionally, few studies have been accomplished in East Africa on the effects of inflation on GDP.Youse (2021) used time-series information. The research investigated the price rises on GDP in Ethiopia, Kenya, and Sudan. The research employed the ARDL approach. The findings revealed that Sudan's and Kenya's inflation had positively effect on GDP.

Moreover, various studies have been done in Tanzania on the effects of inflation, extended money supply, and real exchange on GDP. Kasidi (2013) investigated the outcome of a general increase at price level on Tanzanian GDP and discovered a correlation between the two. The effect of price rises on GDP was studied using time-series information from 1990 to 2011 and revealed that one percent inflation increased resulting in a 0.54 percent fall in GDP. Makwandi (2018) evaluated the effects of management spending, currency supply, and price rises on GDP in Tanzania. The ADF test was employed to check for information stationery, and the ARDL bounds test was utilized to check for cointegration. To evaluate the influence of management expenditure extended currency supply, price rises, and their association with Tanzania's GDP, the ARDL model was used. The findings imply that inflation and extended money supply were unfavorable to GDP.

3. Materials and Methodology

The study employed secondary time series data to examine the effect of inflation on GDP in Tanzania's economy from 1970 to 2020. The Bank of Tanzania provided the information.

For an in-depth investigation of the effect of inflation and the GDP nexus in Tanzania, the study used quantitative research methods during its regression analysis. VECM was employed when graphical analysis, ADF unit root, and co-integration test results supported its use.

3.1 Model Specification

The study had made a determination of which independent variables should be included in or excluded from a regression equation. In general, the specification of a regression model should be based primarily on theoretical considerations.

3.2 Empirical Model

This study adopted the Kasidi (2013) model to investigate the effects of inflation on GDP inTanzania.

The Kasidi (2013) empirical model that was adopted by this study is as follows:

$$LogGDP = \beta0 + \beta1logINFL_t \quad\quad\quad (1)$$

where:

GDP = Gross Domestic Product, B_0 = Intercept, β_1= Parameter, INFL = Inflation, t = Time trend

Based on equation (1) above and adding the other variables and error term, we can specify the following empirical model;

$$GDP_t = \beta0 + \beta1M3_t + \beta2INTR_t + \beta3EXR_t + \beta4DU90 + \mu_t \quad\quad\quad (2)$$

Where: GDP_t = Gross Domestic Product, B_0 = intercept, β_1, β_2, β_3 = parameter of independent variables, β_4 = parameter of the dummy variable, μ_t = error term

$$DU90 = \begin{cases} 0 \ for \ t = 1970 - 1989 \\ 1 \ for \ t = 1990 - 2020 \end{cases}$$

For this study, GDP is denoted as a dependent variable, while extended money supply (M3) and interest rate (INTR), and exchange rate (EXR) are explanatory variables. At the same time, Inflation targeting (DU90) is the dummy variable.

Table 1*: Variables employed and predictable signs*

Variables	Variable Name	Measurement	Expected sign	Source of Data
GDP	Gross Domestic Product	GDP growth (annual %)	Dependent	Bank of Tanzania (BOT)
M3	Extended Money Supply	Broad Money growth (annual %)	+	Bank of Tanzania (BOT)
INTR	Interest Rate	Average lending (%)	_	Bank of Tanzania (BOT)
EXR	Exchange Rate	Exchange rate (LCU per US$ per period average)	+	Bank of Tanzania (BOT)
DU90	Inflationary Targeting	Dummy 1 after a country adopts an inflation target, 0 otherwise	+	Bank of Tanzania (BOT)

Source: *(Adaramola, 2020)*

3.3 Pre-Estimation Tests

The study estimates the presumptive tests in the regression, for example, the Unit Root test and the Cointegration test.

3.4 Unit Root Test

The study looked for the unit root problem to see if the data was stationary Gujarati (2004) illustrates the series generation process. Consider the following equation:

$$Yt = \rho Yt - 1 + ut \ (-1 \leq \rho \leq 1) \quad\quad\quad (3)$$

Where U_t is the white noise error term:

When rho from equation (3) is exactly equal to one, then we have a non -stationary problem, and the equation develops into a random walk model exclusive of drift and is a non-stationary stochastic procedure. Due to the biasness of OLS, in the case of unit root, equation (3) cannot be estimated, and the hypothesis that $\rho=1$ cannot be tested. So, equation (4) is manipulated to get:

$$Yt - Yt - 1 = (\rho - 1)Y t - 1 + ut \quad\quad\quad (4)$$

Since Dickey-Fuller (DF) test assumes no correlation of the error term, the study used the ADF; the ADF test here consists of estimating the following regression:

$$\Delta Yt = \beta1 + \beta2t + \delta Yt - 1 \sum_{i=1}^{m}(\alpha i \Delta Yt - 1 + \varepsilon t) \quad\quad\quad (5)$$

Where e_t is the clean white noise error term

3.5 Co-integration Test

The relationship is cointegration if present is a long-run equilibrium among two variables (Gujarati, 2004). When the residual (combination) of two dependent and independent variables is stationary but neither are the individual variables, the variables are supposed to be cointegrated. A cointegration test may be regarded as a pre-test to prevent erroneous regression. The Johansen cointegration test is the most frequently employed technique. Then a general conclusion is that their linear combination, in equation (6) below, will be $I(1)$.

$$X_t = Y_t - \alpha X_t \quad \text{..(6)}$$

3.6 Vector Error Correction Model

For this case, it claimed that the model had a long-term connection among the explained variable and the ECT with a negative sign and a probability of less than 5 percent. This indicates that the equation has been altered and now includes a term for measuring the prior period's departure from long-run equilibrium. Its short-run dynamics are affected by mistakes. As a result, VECM directly calculates the rate of return to equilibrium of a dependent variable following a change in other variables. Thus, the corresponding VECM has specified follows:

$$\Delta Y_t = \delta + \sum_{i=1}^{k-1} \beta_i \Delta Y_t - 1 + \sum_{i=1}^{k-1} \phi_j \Delta m3_t - j + \sum_{i=1}^{k-1} \omega_m \Delta intr_t - m + \sum_{i=1}^{k-1} \eth_y \Delta exr_t - y + \sum_{i=1}^{k-1} \sigma_z \Delta DU90_t - z + \lambda_1 ECT + U1_t$$

$$\text{..(7)}$$

$$\Delta m3 = \delta + \sum_{i=1}^{k-1} \beta_i \Delta Y_t - 1 + \sum_{i=1}^{k-1} \phi_j \Delta m3_t - j + \sum_{i=1}^{k-1} \omega_m \Delta intr_t - m + \sum_{i=1}^{k-1} \eth_y \Delta exr_t - y + \sum_{i=1}^{k-1} \sigma_z \Delta DU90_t - z + \lambda_2 ECT + U2_t$$

$$\text{.. (8)}$$

$$\Delta intr - \delta + \sum_{i=1}^{k-1} \beta_i \Delta Y_t - 1 + \sum_{i=1}^{k-1} \phi_j \Delta m3_t - j + \sum_{i=1}^{k-1} \omega_m \Delta intr_t - m + \sum_{i=1}^{k-1} \eth_y \Delta exr_t - y + \sum_{i=1}^{k-1} \sigma_z \Delta DU90_t - z + \lambda_3 ECT + U3_t$$

$$\text{.. (9)}$$

$$\Delta exr = \delta + \sum_{i=1}^{k-1} \beta_i \Delta Y_t - 1 + \sum_{i=1}^{k-1} \phi_j \Delta m3_t - j + \sum_{i=1}^{k-1} \omega_m \Delta intr_t - m + \sum_{i=1}^{k-1} \eth_y \Delta exr_t - y + \sum_{i=1}^{k-1} \sigma_z \Delta DU90_t - z + \lambda_4 ECT + U4_t$$

$$\text{.. (10)}$$

$$\Delta DU90 = \delta + \sum_{i=1}^{k-1} \beta_i \Delta Y_t - 1 + \sum_{i=1}^{k-1} \phi_j \Delta m3_t - j + \sum_{i=1}^{k-1} \omega_m \Delta intr_t - m + \sum_{i=1}^{k-1} \eth_y \Delta exr_t - y + \sum_{i=1}^{k-1} \sigma_z \Delta DU90_t - z + \lambda_5 ECT + U5_t$$

$$\text{.. (11)}$$

Where, k-1 = the lag length is reduced by 1, β_i, ϕ_j, ω_m, $\eth_y$, σ_z = short-run coefficient of the system regulation long-run stability, λ = speed of adjustment parameter, ECT = Error Correction Term, U_t = residuals (stochastic error terms)

The post estimation on the VECM includes the LM test for residual autocorrelation, a test for normally distributed disturbances, and a stability condition test

4. Empirical Findings and Discussion
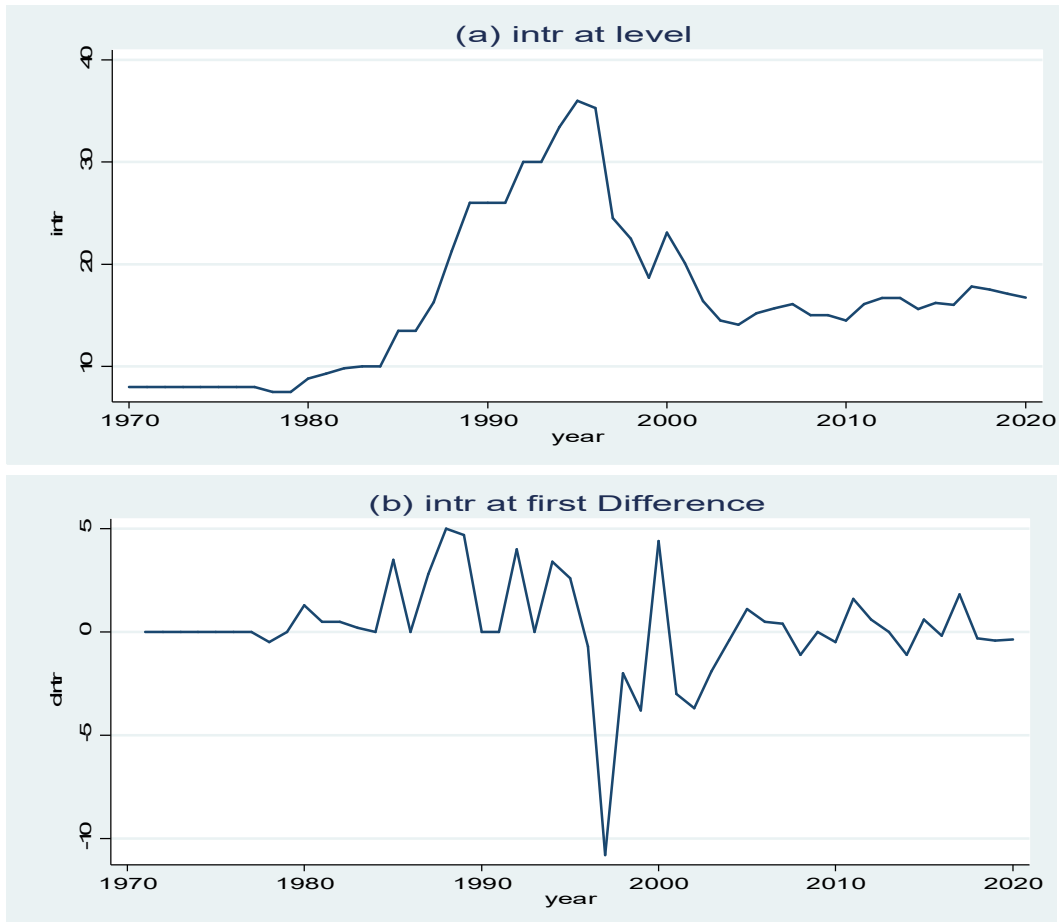
4.1 Unit Root Test

The stationarity of variables is a crucial phenomenon in time series analysis since it has a significant effect on the outcomes and their interpretations. The unit root is a characteristic of processes that change over time, and that may lead to issues with statistical inference when used with time series models, running the regression without testing a unit root resulted to spurious results. Series may be stationary or non-stationary at each level. Non-stationarity in series can be avoided by differencing the variables; if a variable is stationary in levels, it is said to be integrated of order zero $I(0)$; if it becomes stationary after differencing once, then the variable is supposed to be integrated of order $I(1)$. The informal and formal non-stationarity tests were used to inspect the stationarity of the sequence.

4.1.1 Informal Unit Root Test

The informal non- stationarity test was employed to provide a preliminary assessment of the stationarity of the variables under study. This was done by means of the illustration inspections of the line graphs and the results are presented in figures below. The findings have been separated into two panels (a) and (b) respectively. Panels (a) of each figure illustrate the results at its level or raw data while panels (b) provide the results at its first difference.
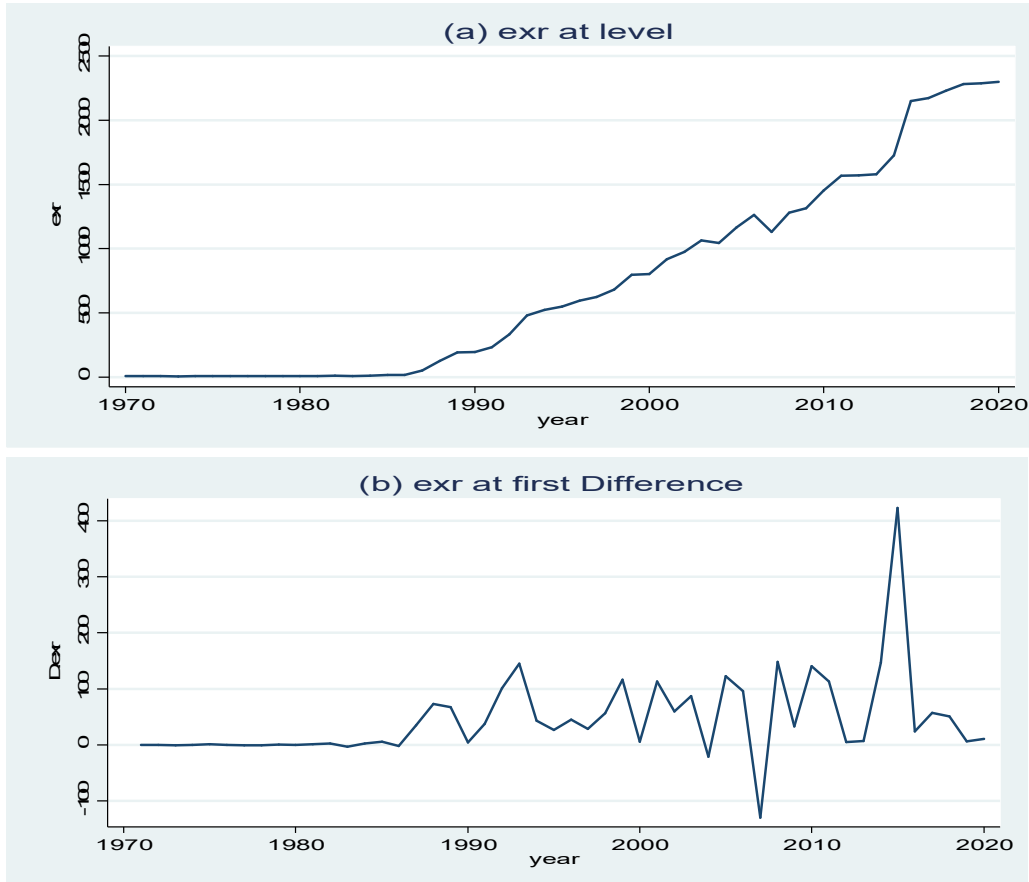
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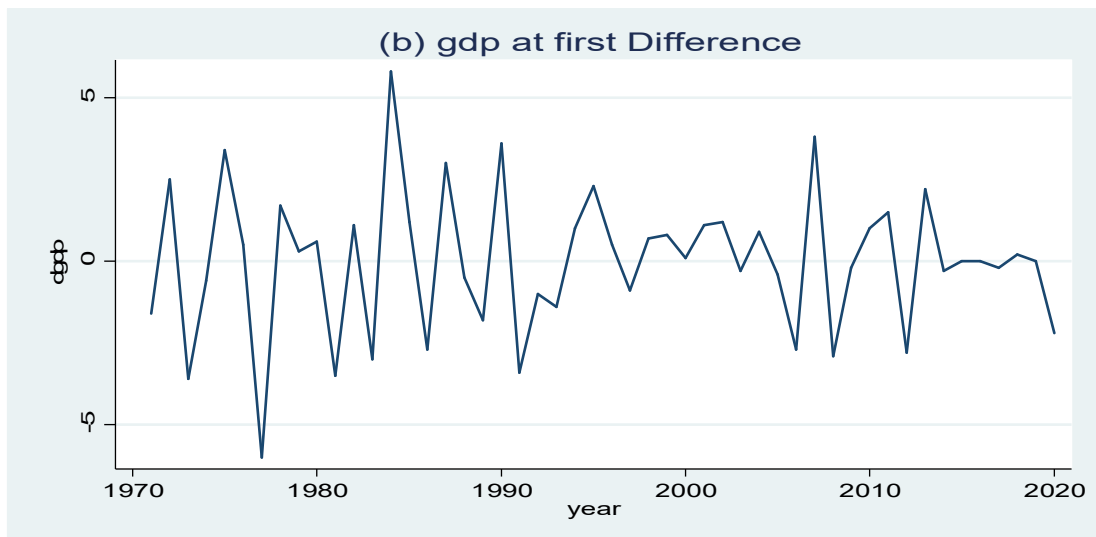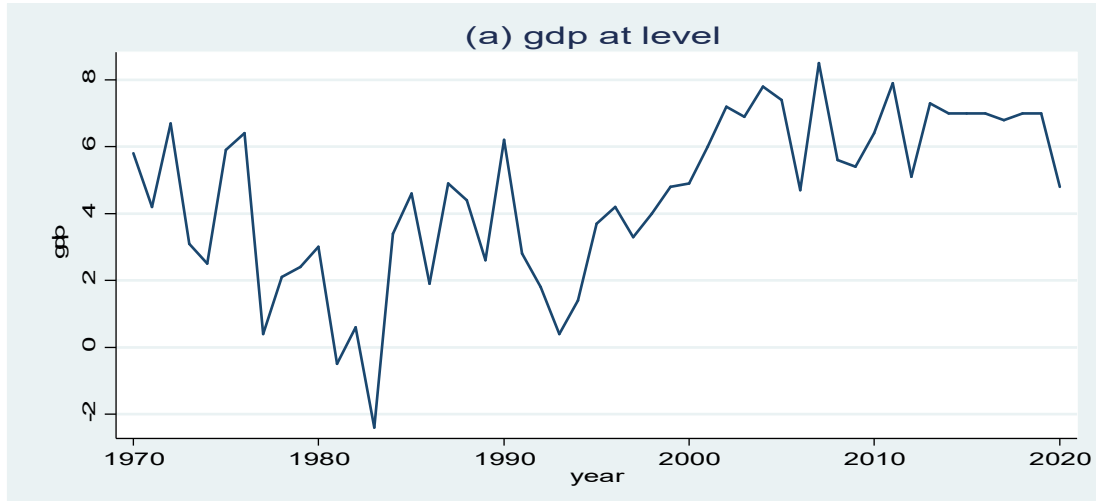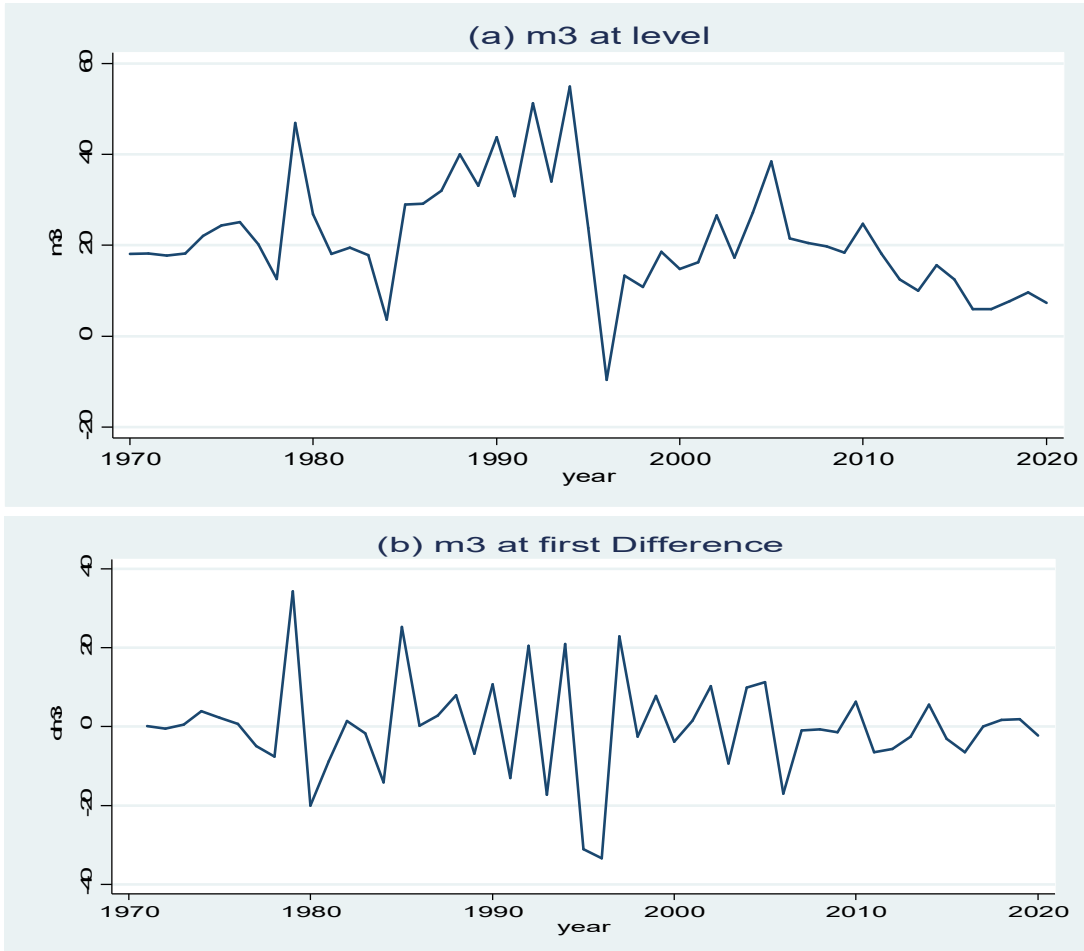
Figure 2: *Unit root Test (Graphical Analysis)*
Source: *(STATA Estimations, 2022)*

4.1.2 Formal Unit Root Test

Finally, the legibility of the results has been confirmed after running a formal non-stationarity test in form of the ADF. The results are presented in the Table 2 since the study could not rely solely on the illustration assessment analysis, the formal unit root tests in the form of ADF and the summing up of the outcomes are illustrated in Table 2

Table 2: *ADF Unit Root Test Results*

Variables	Test statistic	Test statistic	Order of integration
GDP	-2.306	-8.007	*I*(1)
M3	-2.769	-6.931	*I*(1)
INTR	-1.694	-3.820	*I*(1)
LN_EXR	-1.057	-3.748	*I*(1)
Critical value (5%)	-2.933	-2.936	

Note: HO = has unit root while H1 = has no unit root
Source: *(STATA Estimation, 2022*)

The unit root results on Table 2 show that at level, all variable test statistics values were less than the critical value at 5 percent (-2.933). Also, all the p-values were greater than 5. This means that the null hypothesis of the presence of unit root could fails to reject, and therefore, it implies that these variables are not stationary at levels.

After variables differ once, they all become stationary. This is because the test statistics for each variable are larger than the critical value and p-values are also less than 5 percent, causing us to reject the HO and sum up that the variables are now stationary. They are I (I).

4.2 Co-integration Test

Before cointegration analysis was made, the appropriate lag length selection criteria were undertaken.

4.3 Lag Length Selection Criterion

The Johansen procedure is extremely susceptible to lag selection. The research concerns chronological modified Likelihood Ratio test statistics (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hunnan–Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC) for the selection of a suitable lag length. The outcomes of the lag section criteria are presented below:

Table 3: *Lag Selection Criterion*

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-813.234				1.5e+07	34.7759	34.8352	34.9334
1	-633.536	359.4*	16	0.000	1.4e+07*	27.81*	28.1063*	28.5973*
2	-629.479	8.1136	16	0.945	2.4e+07	28.3182	28.8515	29.7354
3	-618.995	20.968	16	0.180	3.1e+07	28.553	29.3233	30.5999
4	-611.617	14.756	16	0.543	4.9e+07	28.9199	29.9272	31.5967

(*) indicates the optimal lag length for AIC, HQIC and SBIC decision criteria.
Source: *(STATA Estimation, 2022)*

Because the rationale of this study is to look the link among variables, it's critical to use a criterion that is consistent and has the right sampling techniques. SBIC and HQIC are two criteria with a lot of overlap. In all small samples (less than thirty), SBIC is a good criterion. However, HQIC surpasses SBIC in intermediate samples (more than thirty). Based on AIC, HOIC, and SBIC, the result shows that there is one lag selected.

4.4 Co-integration Test

Two or more variables seem to be co-integrated when there is long-term association, according to Engle (1987). In order to keep the long-run information intact, modeling time series through co-integration is appropriate. Results from the unit root tests showed that all the series were I(I). This might indicate that the series might be co-integrated and therefore needs to be tested in order to avoid the problem of spurious estimates.

The Johansen co-integration analysis was used to establish the nature of the combination between the variables and assess their co-integration. If two time series variables were integrated to the first order, $I(1)$, a linear combination may occur between the variables which can be integrated to the first order, I (1), Engle (1987). The technique outcomes are shown in Table 4.

Computer software usually reports two different types of test statistics: trace statistics and maximum eigenvalue statistics (Shrestha, 2018).

The null hypothesis of one co-integrating equation is rejected for the reason that the trace statistics are larger than 5 percent of the critical value, as shown in Table 4 However, the trace eigenvalue statistics failed to reject the null hypothesis of two co-integrating equations. Since the results show that there were two cointegrating equations in the analysis, this necessitated the usage of VECM in this case.

Table 4: *the Results of the Johansen Test for Co-integration*

Maximum rank	Parms	LL	Eigenvalue	Trace statistics	5% Critical value
0	30	-352.19934	-	105.1565	68.52
1	39	-324.3258	0.67944	49.4095	47.21
2	46	-311.86638	0.39863	24.4906*	29.68
3	51	-303.62722	0.28559	8.0123	15.41
4	54	-300.4215	0.12265	1.6009	3.76
5	55	-299.62107	0.03214		

(*) Denoted the null hypothesis is failed to reject

Source: *(STATA Estimations, 2022)*

The statistics report, trace eigenvalue statistics are provided in Table 4 above. The scholar rejected the HO at a 5 percent level since the trace statistics were bigger than the critical value. Because the trace statistics were less than the critical value, the researcher did not reject the HO at 5 percent. As a matter of fact, there was cointegration at the maximum rank of two co-integrating equations in the analysis necessitated by the usage of a VECM in this case.

4.5 Vector Error Correction Model

The Johansen technique for co-integration outcomes above demonstrates that there are two co-integrating equations in this study. A VECM was introduced in order to correct the disequilibrium that usually disturbs the whole system. The VECM model usually considers an additional channel of causation through the error correction term (ECT). According to Joshi, (2021), the ECT is included to investigate the dynamic behaviour of the model, that is, short-run and long-run dynamics. At times, the speed exceeds 50 percent, and the speed is extremely high, as when under 50 percent, the speed is small. All the time, the coefficient of the residual term should be negative and have significance.

Table 5: *Results of VECM Estimation*

D_gdp	Coef.	Std. Err.	Z	P>|z|	[95% Conf.	Internal]
_cel	-0.2830788	0.0883722	-3.20	0.001*	-0.4562852	-0.1098725

*Denoted the significance level 5%

The adjustment parameters are shown in the equation above. There was a negative and significant association between GDP, other variables and the speed of adjustment, i.e., a coefficient of (cel) -0.2830788 implies that all errors were corrected by 28.31 percent in the long term at a one percent level of significance. This demonstrates a long-run causal relationship between GDP and extended currency supply, interest rate, exchange rate, and inflation targeting. Because the coefficient indicates a negative adjustment to stability, the speed of adjustment to restore long-run equilibrium is 28.31 percent yearly, and due to the slower speed, it will take approximately three years to fully recover from only one shock and restore long-run stability. From the short-run analysis indicates that extended money supply and interest rate both had harmful and insignificant on GDP, whereas the natural log of exchange rate had a negative and significant effect on GDP, while inflation targeting had a favourable and insignificant effect on GDP. Nevertheless, Table 5 below illustrates the results from the VECM that explained the long-term relationship between variables.

4.6 Johansen Normalization Restrictions

The research employed the Johansen normalization from the VECM to measure the effect of inflation on GDP. The table below demonstrates the normalized co-integration in the long-run relationship among variables.

Table 6: *Long run Normalized Co-integration Imposed*

Beta	Coef	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
GDP	1					
M3	-0.1395176	0.0584228	-2.39	0.017*	-0.2540242	-0.0250109
INTR	-0.2721535	0.0838393	-3.25	0.001*	-0.4364755	-0.1078315
DU90	46.51791	4.192508	11.10	0.000*	38.30074	54.73507
LOG_EXR	-13.67554	1.227421	-11.14	0.000*	-16.08124	-11.26984
_CONS	26.31948					

(*) denotes 5% level of significance

Source: *(STATA Estimations, 2022)*

The findings discovered that in the long-run extended money supply, interest rate, real exchange rate had a favourable significant on GDP. The result implies that the GDP increased as these macroeconomic variable changes by one percent while inflation targeting regime has less effect on GDP growth compared to the GDP growth of a non-inflation targeting regime. This is an indication that poor economies, including Tanzania, had weak policies and institutions, causing inflation targeting to decline in GDP for developing economies rather than developed ones.

4.7 Post Estimation Test

The Diagnostic Test is next, followed by the section as stated below. To prove the consistency of the long-run regression equation post-diagnostic technique when run on VECM includes the LM technique for residual autocorrelation, a test for normally distributed disturbances, and a stability condition test.

4.7.1 LM test for Residual Autocorrelation

Table 7: *Lagrange –Multiplier Test*

Lag	chi2	Df	Prob> chi2
1	34.9511	25	0.08909
2	19.3508	25	0.78000

Source: *(STATA Estimations, 2022)*

From the outcomes beyond, there was no autocorrelation problems, thus the researcher failed to reject the null hypothesis by presenting that there is no serial correlation in the model in both of the lags; it shows that the prob>chi2 value of lag one was 0.08909 and that the prob>chi2 of lag two had a value of 0.78000, both with a more than 5 percent significant level.

4.7.2 Test for Normally Distributed Disturbances

Table 8: *Jarque-Bera Test*

Equation	chi2	Df	Prob> chi2
GDP	0.135	2	0.93465
M3	5.852	2	0.05362
INTR	7.655	2	0.02177
LN_EXR	0.044	2	0.97803
DU90	2.021	2	0.36406
ALL	15.707	10	0.10834

Source: *(STATA Estimations, 2022)*

The test revealed that all variables were normally distributed at 5 percent significance expect interest rate. The prob> chi2 was higher than 5 percent and thus the null hypothesis failed to be rejected. INTR was not normally distributed since the pro > chi2 rate of 0.02177 was less than 5 percent and then rejects the null hypothesis.

4.7.3 Check Stability Condition of Vector Error Correction Estimates

Table 9: *Eigenvalue Stability Condition*

Eigenvalue	Modulus
1	1
1	1
1	1
1	1
.608055	.608055
-.02838139 + .4012251i	.402228
-.02838139 - .4012251i	.402228
-.358325 + .0159568i	.35868
-.358325 - .0159568i	.35868
-03758709	.037587

Source: *(STATA Estimations, 2022)*

From the above results, the Vector Error Correction Model imposed all four units in modules. The researcher performed the Eigen-value stability test for the VECM. The results from the system were stable because all the coefficients above were less than one, as supported in the circle that all eigenvalues lay inside the unit circle.
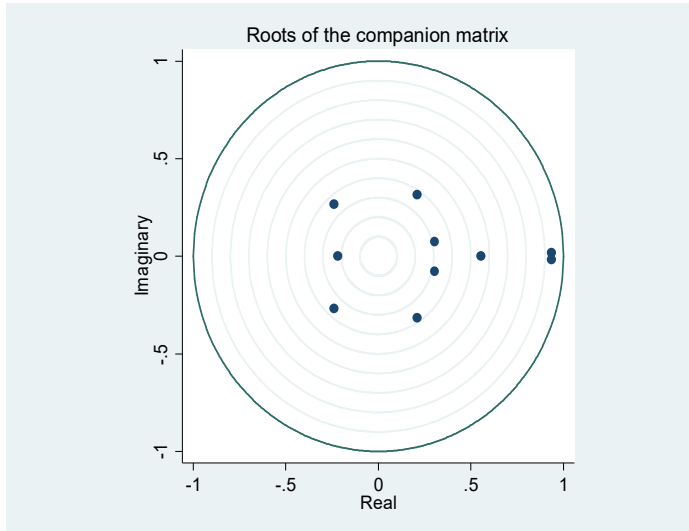

Figure 3: *Eigenvalue Stability Condition Test*
Source: *(STATA Estimations, 2022)*

The results from the figure show the VEC system model was steady because every eigenvalue lies within the unit round. This means that the model was stable in terms of the outcomes revealed because the variables had no unit root, i.e., were stationary. The essential and satisfactory circumstance for constancy was that every eigenvalue lay within the unit round.

5. Conclusion and Recommendations

5.1 Conclusions

In the short run, the findings show that extended money supply and interest rate both had unfavourable and insignificant effects on GDP, in contrast to the exchange rate, which had anunfavourable and significant effect on GDP, while inflation targeting had avourable and insignificant effect on GDP. The ECT was negative and statistically significant. In that case, economic growth will adjust at a slow rate of about 28 percent per year, and it will take about three years to fully recover from a particular shock and return to long-run stability. From the findings, in the long run, extended money supply, interest rate, and natural log of exchange rate had favourable and statistically significant effects on GDP. While the inflation targeting regime was less, and was significant for GDP growth compared to the average GDP growth of a non-inflation targeting regime.

5.2 Policy Implication and Recommendations

The findings of this study had significant implications for a variety of stakeholders, including the Bank of Tanzania, the government, policymakers, academics, and researchers. The findings have important policy implications for domestic policymakers, showing that regulating macroeconomic factors including the extended money supply, interest rate, real exchange rate, and inflation targeting is required to control inflation. As a result, authorities should focus on maintaining macroeconomic factors. The following recommendations were made for policy attention:

It is recommended that the government, policymakers, and financial institutions focus on managing inflation by the prudent implementation of fiscal and monetary policies and maintaining a regulation of interest rates, the extended money supply, and real exchange

rates. Also, inflation targeting should be emphasized by improving the central bank's communication, transparency, and accountability. This helps to avoid inflation volatility and stimulate economic growth.

Further study should be conducted on the same theme but expand the geographical coverage to include SADC and EAC countries. Moreover, the researcher should employ other methodological approaches by adding another variable to the model; government spending, investment, and trade openness, which influence the inflation pressure. Adding observations from before 1970 or after 2020 as well applies to other models like ARDL.

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