

A Revisit of the Causal Effect of Debt Burden on Inflation Dynamics in Tanzania

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Abstract

This research paper investigates the causal effect of debt burden on inflation in Tanzania. It uses the autoregressive distributed lag model and the Granger causality approach, with quarterly data from 2003 to 2023. The finding indicates that, in the long run, both total debt and public external debt have a significant negative effect on inflation, whereas private external debt has a significant positive effect on inflation. In the short run, total debt and public external debt show a significant positive effect on inflation, while domestic debt has a significant negative effect. Therefore, the results suggest that the government should focus on managing public debt when making decisions to control inflationary pressure. However, if the government needs to fund a budget deficit, it should prefer external debt over domestic debt since it helps achieve the macroeconomic goal with a reduced risk of inflation.

Keywords: *External debt, domestic debt, total debt stock, inflation.*

JEL : *E31, E40, H60, H63*

1.0 Introduction

Price stability is a crucial component in achieving a robust economic performance. Governments consider it a top priority in macroeconomic management. By ensuring price stability, governments can create an environment conducive to business growth, resulting in increased economic prosperity (Lopes da Veiga et al., 2016). However, in most developing countries, governments often need to incur debt to boost economic growth, which can lead to inflationary pressures. This, in turn, could be detrimental to economic growth. There is concern among policymakers that government borrowing can undermine the objective of reducing inflation (Aimola & Odhiambo, 2020). A nation's ability to expand its economy is significantly impaired by an ever-growing debt burden (Yusuf & Mohamed, 2023). Furthermore, government borrowing crowds out private sector investment, which can lower future national output and profits (Saungweme & Odhiambo, 2021). On the other hand, public debt serves as a crucial instrument for financing government activities such as capital formation, sustaining public expenditures, and spurring economic growth, especially when it is challenging to increase taxes and reduce public spending (Yusuf & Mohamed,

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2023). Therefore, the impact of national debt on inflation has received significant attention in recent years, particularly after the 2008 global financial crisis and the coronavirus disease (COVID-19) outbreak. Many developing countries rely on additional public debt to raise financial resources to meet government funding needs. However, a significant question remains whether public debt causes inflation.

There is no agreement among experts on how national debt affects inflation. Monetarists believe that inflation is a result of an increase in the money supply, and this can cause prices to go up in both the short and long term (Friedman, 1968). On the other hand, some studies show that debt can cause inflation through its impact on wealth (Nastansky & Strohe, 2015; Aimola & Odhiambo, 2020). Others suggest that the money supply alone is not enough to predict inflation (Kwon et al., 2006). The fiscal theory of the price level by Sargent and Wallace (1981) proposes that higher government debt adds to household wealth, boosting demand for goods and services and increasing prices. However, the Ricardian hypothesis by Barro (1989) argues that public debt does not affect inflation. Some experts believe public debt can influence inflation, especially in developing countries with advanced financial markets. Additionally, fiscal policies that increase disposable income and wealth may boost demand in the short term and result in higher inflation (Elmendorf & Mankiw, 1999).

Empirical studies on the relationship between public debt and inflation have produced mixed results. Some studies, such as those conducted by Sims (2014), Nastansky and Strohe (2015), Aimola and Odhiambo (2021), and Olaoye et al. (2023), found a positive correlation between the two variables. On the other hand, studies by Ezirim et al. (2014), Essien et al. (2016), Afonso and Jalles (2019), and Hilscher et al. (2020) suggest a negative relationship. However, some studies, including those by Essien et al. (2016), Aimola and Odhiambo (2021), and Sharaf et al. (2023), did not find any significant impact of public debt on inflation.

Several studies have explored the relationship between public debt and inflation in Tanzania. The studies indicate that public debt can have a negative impact on inflation rates (Myovella & Kisava, 2018; Saungweme & Odhiambo, 2021). However, there is a significant gap in the literature when it comes to the analysis of national debt, specifically external (public and private) and domestic debts. It is necessary to analyse the effects of both types of debt separately because they have different impacts on a country's economy. Tanzania is vulnerable to the effects of national debt due to its underdeveloped capital markets and high currency volatility. Moreover, Tanzania, similar to many other developing countries, relies heavily on external debt as a significant source of revenue. This external debt plays a crucial role in shaping the public debt structure and expanding opportunities for development. Additionally, public and private external debts come with different conditions when accessing external funding. Therefore, it is crucial to examine the impact of both types of debt separately. This study has dissected debt and tested the relative impact of each type of debt on inflation. By understanding which types of debt are more likely to cause inflation,

policymakers can implement measures to mitigate the adverse effects of debt on their economy. In conclusion, this study highlights the significance of analysing the impact of national debt separately as external (public and private) and domestic. This information can assist policymakers in Tanzania in making informed decisions about their country's economic policies and reducing the adverse effects of debt on their economy.

The following is the structure of this paper: In section 2, we discuss trends in national debt and inflation in Tanzania. In section 3, we provide a literature review of relevant theories and empirical studies. Section 4 outlines the data and methodology used in this paper. In section 5, we present the results and discussion. Finally, section 6 concludes the study.

2.0 The Trends of Debt and Inflation in Tanzania

Figure 1 shows trends in the composition of Tanzanian total debt stock from the 2005/2006 to the 2021/2022 fiscal year. As shown in Figure 1, the total debt stock is largely dominated by public external debt stock. Figure 1 also shows that domestic debt stock dominated the total private external debt stock. However, both domestic and external debt (public and private) stocks have recorded an increasing trend during the last decade (Figure 1). A substantial fraction of external debt comes from publicly guaranteed debt (Figure 1). The increase was mainly on account of government borrowing to refinance matured securities and develop projects.

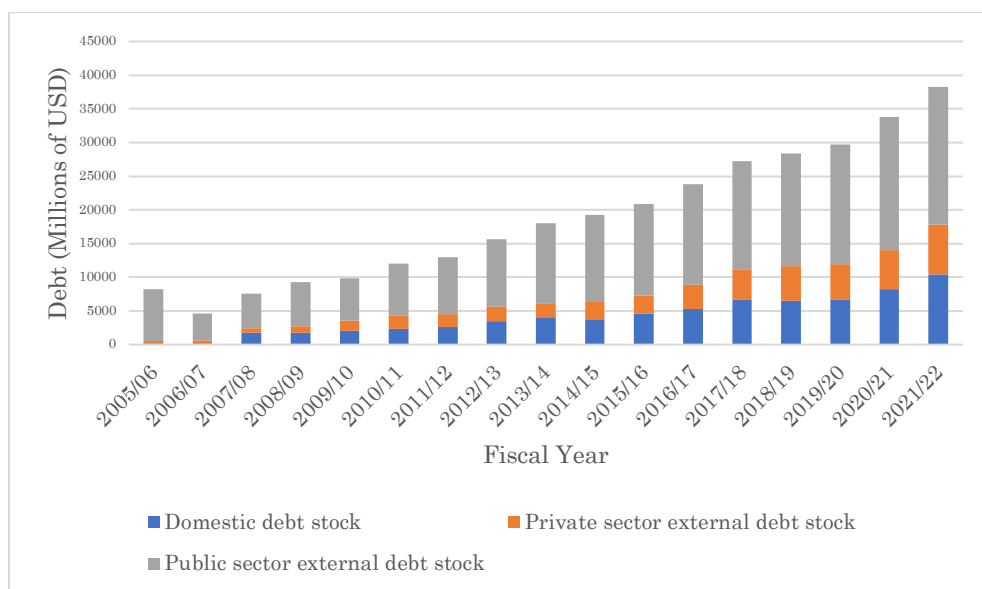


Figure 1: The Profile of Debt Stock in Tanzania, 2005/06–2021/22

Source: Extracted from International Debt Statistics (IDS), 2023

Figure 2 presents the trends of external debt and inflation in Tanzania over the 1990 to 2023 period. Despite the fact that the debt finances government programmes and projects, the high debt is not good for economic growth. As it was noted in the introduction section, financing a budget deficit through borrowing goes together with inflation.

During the 1990-1994 period, the public debt continued to worsen, reaching its peak in 1994 (Figure 2). After 1994, the public debt to GDP ratio started to decline up to the year 2008. This decrease in debt ratio was linked to the effects of the implementation of Highly Indebted Poor Countries (HIPC) and Multilateral Debt Relief (MDR) initiatives which culminated in debt cancellation. But after 2008, public debt started rising slowly but steadily, yet within sustainable limits with no signs of public debt distress (Ngasamiaku and Ngong'ho, 2022).

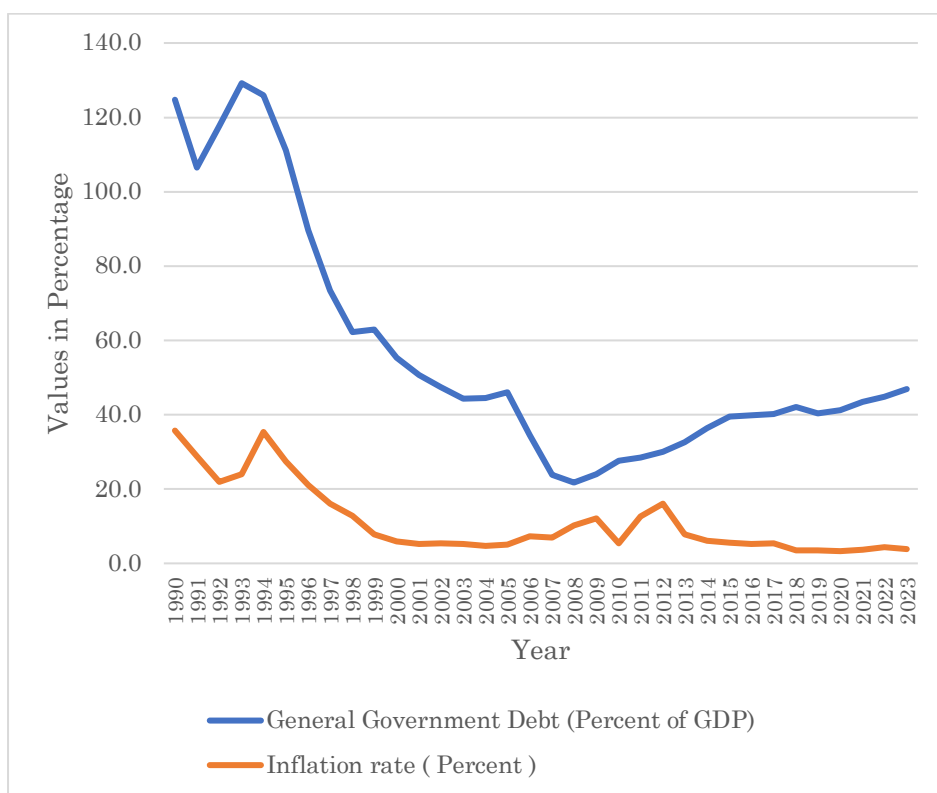


Figure 2: Trends of public debt and inflation rate in Tanzania, 1990-2023

Source: Extracted from the Global Debt Database of the IMF (2024) and BOT (2024)

However, the general rate of inflation in Tanzania shows a drop in the period 1990 to 1992; thereafter, it rose quickly up to 1994 before it shows the downward trend between the period 1994 and 2004 (Figure 2). *Tanzania's inflation* rate, which averaged about 30% in the early 1990s dropped to about 4.7% in 2004. The significant decline in inflation rates reflects the impact of tight monetary and fiscal policies pursued by the central bank (Laryea and Sumaila, 2001). Thereafter, a trend of inflation started to fluctuate over the 2006 to 2012 period, reaching 16% in 2012 from 5% in 2005, mainly driven by higher food and fuel prices. Then, the Tanzania inflation rate dropped to 3.3% in 2020 and thereafter increased to 4.4% in 2022. The rise in inflation in 2022 was mainly driven by higher food and fuel prices.

Moreover, Figure 2 shows a positive correlation between the rate of inflation and public debt as a percentage of GDP from 1990 to 2012. That is, in those years when inflation is rising and declining, we observe an increase and fall in public debt respectively. However, over the period 2012 to 2020, the relationship turned out to be negative (Figure 2). That is as inflation decreases as public debt rises.

3.0 Literature Review

3.1 Theoretical review

There are two competing views regarding the effect of public debt on inflation. The first is the Ricardian equivalence view by Barro (1989), which provided the argument that an expansionary monetary policy will positively affect the general price level since a change in price level is independent of fiscal policies (Tchamda, 2017). Under this regime, the fiscal policy is described as a passive policy. Barro (1989) has established that the budget deficit or public debt does not have a significant impact on the determination of price levels.

Contrary to the monetarist view, the Fiscal Theory of the Price Level (FTPL), also known as a non-Ricardian or fiscally dominant regime, holds that the price level is determined solely by government debt and fiscal policy, with monetary policy has at best an indirect influence. This theory was advocated by Leeper (1991), Woodford (1994) and Sims (1994). The perspective of this theory contrasts with the monetarist view, which asserts that the money supply is the primary factor affecting the price level and inflation (Tchamda, 2017; Aimola & Odhiambo, 2020). According to non-Ricardian policy, an increase in the value of government bonds impacts households' lifetime budget constraints, and fiscal disturbances influence the price level through the wealth effect on private consumption demand (Aimola & Odhiambo, 2020). In Tanzania, this theory is particularly relevant, as the country has experienced periods of high inflation and significant government debt, suggesting that fiscal factors may be influencing the price level.

3.2 Empirical Review

Globally, empirical results on the effect of debt on inflation are mixed. Despite being studied using different estimation techniques, sample sizes, and different countries, the majority of the studies tilt more towards a positive association between public debt and inflation. For example, Nguyen (2015) investigated the effects of public debt on inflation in 15 developing economies in Asia from 1990 to 2012. The estimated results from the pooled mean group estimation and panel differenced GMM regression technique showed that public debt significantly positively affected inflation. Similarly, Prasanna (2019) investigated how Sri Lanka's public debt affected inflation from 1977 to 2017. The Vector Error Correction Model's results confirmed the long-term positive correlation between inflation and public debt.

Another study by Aimola and Odhiambo (2021) investigated the effect of public debt on inflation in Ghana from 1983 to 2018. The ARDL findings demonstrate that public debt has a positive and substantial long- and short-term impact on inflation. Therefore, the study confirmed the presence of the inflationary effects of public debt in Ghana. A study conducted by Saungweme and Odhiambo (2021) found evidence in support of the positive and significant impact of public debt on inflation dynamics in Zimbabwe, particularly in the long run. This means that public debt dynamics matter for the inflation process.

Furthermore, Mehmeti and Deda (2022) used dynamic GMM to investigate the effect of public debt on inflation in Kosovo and North Macedonia over the 2008–2021 period. The results showed that public debt significantly and consistently positively impacted inflation in North Macedonia and Kosovo. Likewise, Helmy (2021) analysed the effect of external debt on inflation in Egypt's monthly data extending from 2000 M1 to 2020 M1. The results from the ARDL technique showed that external debt raises inflation in the short and long runs.

Besides, the impact of domestic debt on inflation in Pakistan between 1972 and 2009 was examined by Ahmad et al. (2012). Using the OLS estimation technique, the results showed that domestic debt and domestic debt servicing positively affected inflation in Pakistan. In addition, Aimola and Odhiambo (2022) compared the dynamic Granger causality between public external debt versus that of public domestic debt on inflation in Nigeria from 1986 to 2019. The ARDL results showed a positive and significant effect of public external and domestic debt on inflation in the long run. Still, it showed a negative significance effect in the short run. In addition, Sumba et al. (2023) examined the effects of domestic and foreign borrowing on inflation in SSA from 2005 to 2020 based on the two-step GMM system. The results showed that external and domestic borrowing have a significant favourable influence on inflation.

Meanwhile, Thahara and Washima (2019) investigated the effect of public debt on inflation in Sri Lanka from 1977 to 2015. The results of the ECM showed that public debt had a significantly negative impact on inflation in the long run. However, other scholars showed the insignificant effect of public debt on inflation. For example, Essien et al. (2016) utilised the VAR model to study the impact of public debt on inflation, interest rates, and output in Nigeria. The results showed that external and domestic debt had a negative but insignificant effect on inflation and output. Similarly, Sharaf and Shahen (2023) utilised the ARDL model to examine the impact of external debt on inflation in Sudan from 1970 to 2020. The results showed that in Sudan, external debt has no statistically significant impact on inflation in the long run. However, it has a statistically significant negative effect on inflation in the short run.

In Tanzania, insufficient studies have examined the debt-inflation nexus. For example, Nyonzo (2021) used monthly data from 2010 to 2020 and the Vector Error Correction Model (VECM) to investigate the effect of private external debt on monetary policy in Tanzania. The study found that private external debt negatively affects the inflation rate in Tanzania. Likewise, Saungweme and Odhiambo (2021) revealed a consistent long-run cointegrating relationship between public debt, inflation, money supply, and interest rates in Tanzania. However, the results fail to find evidence of causality between public debt and inflation in Tanzania, irrespective of whether the causality is estimated in the short run or the long run. Moreover, Mwamkonko (2022) investigated the effects of various modes of deficit financing on the general price level in Tanzania from 1994 to 2020. The Error Correction Model (ECM) results showed that domestic debt has a significant positive effect. In contrast, foreign debt negatively and significantly impacted the general price levels in Tanzania.

In summary, the surveyed literature focused on the relationship between public debt and inflation, which differs according to country, sample period, and estimation method. More research is needed to examine the relationship between public debt and inflation in Tanzania. Also, the existing studies have yet to analyse the effect of domestic debt on inflation in Tanzania. Therefore, it will be difficult to draw a general conclusion on the relationship between debt and inflation from the existing studies in Tanzania. This study, thus, adds to the literature on the effect of public debt on inflation in Tanzania. Nonetheless, what sets our study apart is its concurrent comparison of the impact of external (public and private) versus internal debts on Tanzanian inflation. Evidence also indicates that literature has not yet established any conclusive and consistent evidence on the direction of causality between national debt and inflation in Tanzania.

4.0 Data and Methodology

4.1 Data source and description

The study uses quarterly secondary data that spans from 2003 to 2023 and is drawn from the Bank of Tanzania, the National Bureau of Statistics and complemented by international institutions such as the World Development Indicators, International Debt Statistics and the IMF global debt database.

4.2 Description of Variables

Dependent Variable: The headline inflation rate measures *total inflation within an economy*, including commodities such as food and energy prices. It is measured in percentages.

Independent Variables: The total debt stock comprises internal and external (public and private sector) debt. Internal debt is captured as gross securitised government debt, including treasury bills, bonds, notes, and government stocks. External debt is part of a country's total debt borrowed from foreign lenders, including commercial banks, governments, or international financial institutions. It includes publicly guaranteed and private nonguaranteed debt. Every debt index has a value expressed in millions of US dollars.

Control Variables: Extended broad money supply (M3) measures the money supply, including M2, large-time deposits, institutional money market funds, and short-term repurchase agreements. It is expressed in billions of TZS. The sign is expected to be positive, as most studies indicate that money supply has a positive and significant impact on the inflation rate (Kayamo, 2021; Mtui, 2024).

GDP growth measures the size of the economy and is typically expressed as a percentage. Economic growth can impact inflation both positively and negatively. Lim and Sek (2015) found a negative effect of GDP growth on inflation, while Bedada et al. (2020) reported a positive effect of economic growth on inflation.

Interest rates represent the amount a lender charges a borrower for any debt, generally expressed as a percentage of the principal. The relationship between interest rates and inflation is complex. Monetarists perceive interest rates to have an inverse effect on inflation, whereas fiscalists argue that interest rates have a direct and positive relationship with inflation. Empirical studies, however, have reported both positive and negative effects of interest rates on inflation (Danlami & Bin Hidthii, 2018; Sihotang et al., 2024; Mtui, 2024).

Another variable is the real exchange rate, which measures the weighted average of Tanzania's currency against a basket of other major currencies. In some countries, an appreciating real exchange rate has an inflationary impact, while in others, a depreciating real exchange rate has a

contractionary effect on inflation. The expected sign remains unclear, as studies have shown contradictory results (Kayamo, 2021; Tolasa et al., 2022; Mtui, 2024).

4.3 Model Specification and Estimation Techniques

We estimate the Autoregressive Distributed Lag (ARDL) model and the corresponding error correction models and test for long run and short-run debt- inflation dynamics in Tanzania.

Similarly, like Aimola and Odhiambo (2021), we specified our model as:

$$INF_t = \alpha_0 + \alpha_1 TD_t + \alpha_2 IR_t + \alpha_3 MS_t + \alpha_4 ER_t + \alpha_5 GY_t + \varepsilon_t \dots \dots \dots (1)$$

Whereas, INF is the inflation rate, TD is total debt stock, IR is interest rate (overall lending rate); MS is extended broad money supply (M3); and ER is real exchange rate and. ε_t is a stochastic error term. All variables are expressed in logarithmic form. Total debt in Equation (1) is broken further into domestic and external (public and private) debts to capture the effects of various classifications of debt on inflation dynamics in Tanzania.

This study uses the ARDL bound approach to cointegration, developed by Pesaran et al. (2001) to estimate equation (1) because of its ability to deal with small data samples compared to Engle and Granger (1987) and Johansen and Juselius (1990) approaches. Besides, the bound test does not need our variables to be of the same order but rather a combination of integration at levels – I (0) and order one – I (1). Moreover, the ARDL method has the ability to host sufficient lags in different variables that enable the best capturing of the data generating process mechanism (Menegaki, 2019). Furthermore, the ARDL method provides unbiased estimates and valid t-statistics, irrespective of the endogeneity of some regressors (Ali et al., 2016; Menegaki, 2019). Also, compared to the Engle–Granger method, the ARDL approach estimates the short- and long-run effects simultaneously (Menegaki, 2019).

The ARDL model from equation 1 is expressed as:

$$\begin{aligned} \log INF_t = & \alpha_0 + \alpha_1 \log TD_{t-1} + \alpha_2 \log IR_{t-1} + \alpha_3 \log MS_{t-1} + \alpha_4 \log ER_{t-1} \\ & + \alpha_5 \log GY_{t-1} + \sum_{i=1}^m \beta_{1i} \Delta \log TD_{t-i} + \sum_{i=2}^n \beta_{2i} \Delta \log IR_{t-i} \\ & + \sum_{i=3}^p \beta_{3i} \Delta \log MS_{t-i} + \sum_{i=4}^q \beta_{4i} \Delta \log ER_{t-i} + \sum_{i=5}^r \beta_{5i} \Delta \log GY_{t-i} \\ & + \phi ECT_{t-1} + \varepsilon_t \dots \dots \dots (2) \end{aligned}$$

where Δ represents the difference operator, α_0 is the intercept, α_1 to α_5 represents the coefficients of long-run estimates, and β_1 to β_5 represents the coefficients of the short-run estimates. The optimal lag lengths based on the

Schwarz-Bayesian criterion (SBC) are displayed by the letters m, n, p, q, and r. The symbol φ represents the coefficient of the error correction term (ECT) that is used to estimate the speed of adjustment to equilibrium (φ should be negative and between 0 and -1), and ε_t represents the residual term, which is supposed to be well-behaved (serially independent, homoscedastic and normally distributed). The variables are as defined in Eq (1).

Moreover, the Augmented Dickey-Fuller (ADF) unit root test was employed to assess the presence of a unit root within the series, thereby aiding in the evaluation of the level of stationarity among the variables. Following the stationarity analysis, we applied the Autoregressive Distributed Lag (ARDL) method, which consists of two distinct steps to estimate long-run effects (Pesaran et al., 2001). The initial step involves examining the existence of cointegration among the variables utilised in the estimation. To achieve this, we calculated the F-statistic, with the null hypothesis asserting that no cointegration exists, while the alternative hypothesis posits that cointegration is present within the estimated model. The subsequent step is to estimate both the short-run and long-run coefficients of the ARDL model, contingent upon the confirmation of cointegration established in the first step (Pesaran et al., 2001).

5.0 Empirical Results

5.1 Preliminary Statistics

Table 1 presents the descriptive statistics of the variables under study (mean, standard deviation, minimum and maximum values, skewness, and kurtosis). All the variables are in natural logarithm form. Total debt has a high mean as compared to other variables. On standard deviation, private external debt has a higher value. The skewness data is fairly symmetrical since the values range in the recommended region (-0.5 to 0.5), except for inflation.

Table 1: Descriptive Statistics

Variables	N	Mean	SD	Min	Max	Skewness	Kurtosis
Inflation	84	1.78	0.47	1.10	2.96	0.68	2.79
Domestic debt	84	8.36	0.66	7.23	9.43	-0.27	1.83
Private external debt	84	7.53	0.97	5.87	8.97	-0.14	1.71
Public external debt	84	9.25	0.49	8.28	10.02	-0.05	1.80
Total debt stock	84	9.75	0.54	8.71	10.66	-0.12	2.08
Money supply	84	9.47	0.84	7.79	10.69	-0.48	2.02
Income growth	84	1.79	0.32	0.95	2.52	-0.40	2.08
Interest rate	84	2.76	0.06	2.61	2.90	-0.04	2.58
Real exchange rate	84	4.63	0.11	4.41	4.84	0.21	2.25

Note: All variables are in log form

Source: Own computations based on data extracted from BOT (2024).

We also performed the correlation analysis for the variables under study, and the results are presented in Table 2. According to the outcomes, inflation is positively correlated with the exchange rate but negatively correlated with other variables. Total debt, domestic debt, external debt, and public debt are strongly correlated with the inflation rate.

Table 2: Correlation Analysis

	INF	TD	DD	PD	PRD	M3	GY	IR	ER
INF	1								
TD	-0.71	1							
DD	-0.73	0.89	1						
PD	-0.64	0.97	0.75	1					
PRD	-0.44	0.82	0.50	0.91	1				
M3	-0.36	0.74	0.38	0.86	0.98	1			
GY	-0.06	-0.09	0.03	-0.14	-0.16	-0.17	1		
IR	-0.45	0.51	0.25	0.60	0.67	0.68	0.02	1	
ER	0.35	-0.64	-0.61	-0.61	-0.46	-0.44	0.09	-0.25	1

Where inf=inflation, TD=Total debt stock, DD=domestic debt, PD=public external debt, PRD=private external debt, m3= extended money supply, GY= income growth, LR= interest rate and ER=real exchange rate. All variables are in log form.

Source: Own computations based on data extracted from BOT (2024).

A prominent feature of ARDL models is that individual series can be integrated into order zero and/or one. However, it is crucial to ensure that the model does not contain any I(2) series for the calculated F-statistics to be reliable. To test for the integration properties of individual series, we employ the Augmented Dickey-Fuller (ADF) test for unit root (Dickey & Fuller, 1981). Table 3's ADF test results demonstrate that every variable—aside from the money supply and income growth—is non-stationary, or I(1), at any given level.

However, the ADF unit root test results are biased and unreliable when a series has a structural break. It has low power to reject the null hypothesis in the presence of a structural break. Therefore, we use the Zivot-Andrews (1992) unit root test to allow for one structural break in the series, which may appear in the intercept, trend, or both. Table 3 also presents the unit root test results by Zivot and Andrews (1992). Results show that total debt and income growth are stationary in levels, while other variables are stationary after the first difference. Therefore, we can reject the null hypothesis that the variables have a unit root with a structural break both in intercept and trend.

Table 3: Augmented Dickey-Fuller and Zivot-Andrews Unit Root Test Results

Variable	ADF Test statistic		Zivot-Andrews Test Statistic		Decision
	Level	1st Difference	Level	1st Difference	
Inflation	-1.648	-6.079 ***	-4.010	-5.827***	I(1)
Total debt	0.273	-3.521**	-4.873*		I(0)
Domestic debt	-1.098	-5.928 ***	-4.393	-11.830***	I(0)
Public external debt	0.159	-4.494 ***	-4.086	-8.576***	I(1)
Private external debt	-1.061	-9.976***	-3.443	-10.970***	I(1)
Money supply	- 4.233** *		-3.716	-4.830*	I(1)
Interest rate	-2.276	-6.307 ***	-4.436	-7.204***	I(1)
Real exchange rate	-2.031	-5.926***	-3.775	-8.671***	I(1)
Income growth	- 5.042** *		-7.307***		I(0)

Note: All variables are in natural logarithms forms, *, **, and *** means are significant at 10%, 5% and 1% levels, respectively

Source: Own computations based on data extracted from BOT (2024).

In addition, a cointegration test based on the ARDL bounds test approach proposed by Pesaran et al. (2001) was performed, and the results are presented in Table 4. Specifically, the calculated F-statistics and t-statistics are greater than the upper bound value at a 1% significance level. Therefore, we can reject the null hypothesis that no long-run relationship exists and conclude that long-run relationships exist among the variables under study.

Table 4: ARDL Bound Test of Cointegration Results

		10%		5%		1%	
	Model 1						
	Statistic	I (0)	I(1)	I (0)	I(1)	I (0)	I(1)
F	8.20	2.26	3.35	2.62	3.79	3.41	4.68
T	-5.67	-2.57	-3.86	-2.86	-4.19	-3.43	-4.79
	Model 2						
F	6.13	2.03	3.13	2.32	3.50	2.96	4.26
T	-5.58	-2.57	-4.23	-2.86	-4.57	-3.43	-5.19

Note: H0: no long run relationship. H1: There is a long run relationship

Note: reject Ho if F > critical value for I (1) regressors

Source: Own computations based on data extracted from BOT (2024).

5.2 Autoregressive Distributed Lag (ARDL) Estimated Results

5.2.1 Long Run Estimates

The long-run ARDL estimates are presented in Table 5. The coefficient of the national debt variable is negative and statistically significant at the 1% level. This implies that a rise in total domestic debt reduces inflationary pressure on the Tanzanian economy. Ngerebo (2014) obtained similar results in Nigeria.

However, the coefficient of private external debt is positive and statistically significant at a 5% level. This result suggests that a 1% increase in private external debt raises inflation levels in Tanzania by 0.61%. This finding is consistent with previous studies like Romero and Marin (2017), Aimola and Odhiambo (2021), and Mehmeti and Deda (2022) that found a positive effect of public debt on inflation. The argument for this result could also be based on a similar reason highlighted in the fiscal theory of price level determination. This supports the fiscal theory, which explains that rising private debt adds to household wealth and, therefore, to demand for goods and services, leading to higher inflation in the economy (Gordon & Leeper, 2002; Kwon et al., 2006).

The result shows that public external debt negatively and significantly affects inflation in Tanzania. That is, a rise in public external debt by 1% reduces inflation in the economy by 1.98%. This finding is consistent with Kannan and Singh (2009), who found a negative impact of debt on inflation in India. Likewise, Mwamkonko (2022) found that foreign financing negatively and significantly impacted Tanzanian general price levels. Therefore, this finding supports the Ricardian equivalence hypothesis that increasing government debt leads to decreased wealth, resulting in lower interest rates, output, and price levels. Therefore, government borrowing from external sources considerably restrains inflationary pressure in Tanzania. This suggests that external debt was meant for investments in productive activities that increase total national output and hence reduce the inflationary pressure in the economy.

Concerning the domestic debt, the results presented in Table 5 show that the domestic debt has a positive but statistically insignificant effect on inflation in Tanzania. This implies that domestic debt has a neutral impact on the inflation process in Tanzania. It is worth noting that inflation may not necessarily be caused by domestic debt alone. There could be several other factors that contribute to inflation. This supports the Ricardian theory, which assumes that fiscal policy does not create any wealth effects. Ahmad et al. (2012) and Muhammad et al. (2021) found positive and statistically significant effects of domestic debt on inflation in Pakistan and Nigeria, respectively. Therefore, this supports the fiscal theory, which postulates that government borrowing increases households' wealth, necessitating high demands for goods and services. As a result, it generates inflation pressure on the economy. The positive sign of domestic debt could be that government

domestic borrowing to finance its expenditure raises the money supply, which leads to increased demand for goods and services, resulting in price pressures.

The results also show that the coefficient of income growth is negative and statistically significant in the long run. This suggests that in Tanzania, economic growth reduces inflationary pressure on the economy. This finding is in line with the study by Aimola and Odhiambo (2021), which advocates a negative relationship between economic growth and inflation in Ghana. Mehmeti and Deda (2022) also found similar results in Kosovo and North Macedonia.

An inverse relationship between interest rates and inflation in Tanzania is revealed in the long run. This implies that a percentage increase in the interest rate will lead to a decrease of 3.26% in the level of inflation in Tanzania. The motivation behind this view is that higher interest rates increase the cost of borrowing, lowering spending and putting inflationary pressure on prices (Cochrane, 2016; Matheson, 2019).

As we expected, the coefficient of money supply is positive and statistically significant in determining inflation in the long run. This result is in line with the findings of Durguti and Malaj (2022), Mehmeti and Deda (2022), and Afari et al. (2021). Thus, it supports the Friedman (1970) view that a high money supply would, in the long run, result in a high inflation rate. Therefore, a continuous increase in the Tanzanian economy's money supply will cause long-term inflationary pressure. So, policymakers should be concerned with bringing the broad money supply down as a monetary policy tool to control inflation.

Similarly, like Perpetua (2014), the coefficient of exchange rate is positive and statistically significant at the 5% level. This suggests that, over time, the exchange rate and inflation have a positive relationship. Therefore, an increase in the volatility of the exchange rate will lead to an increase in inflation in Tanzania.

Table 5: ARDL Long Run Estimated Results

Variables	Model 1	Model 2
Log of total debt	-0.836*** (0.141)	
Log of private external debt		0.609** (0.251)
Log of public external debt		-1.982*** (0.579)
Log of domestic debt		0.164 (0.234)
Log of interest rate	-2.587** (1.277)	-3.258*** (0.929)
Log of money supply	0.362***	0.877**

Variables	Model 1	Model 2
	(0.103)	(0.418)
Log of real exchange rate	1.686**	2.304**
	(0.755)	(1.142)
Log of GDP growth	-0.278*	-0.144
	(0.150)	(0.178)
Durbin-Watson d-statistic	1.690	1.892
Breusch-Godfrey LM test for autocorrelation	5.955*	0.616
Durbin's alternative test for autocorrelation	3.557*	0.372
LM test for autoregressive conditional heteroskedasticity	0.648	1.655
White's test for heteroskedasticity	80.00	80.00
Ramsey RESET test using powers of the fitted values	1.15	0.26
Observations	80	80
R-squared	0.628	0.699

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Own computations based on data extracted from BOT (2024).

5.2.2 Short-Run Estimates

The results of the short-run dynamics and their respective elasticities are shown in Table 6. First and foremost, the coefficients of the lagged ECM term are negative and significant at the 1% level of significance. Thus, it is suggested that there is a convergence rate of 41% and 48% per annum to restore the long-run equilibrium after a short-run shock.

The study finds that both one- and two-lag inflation values are positively significant in explaining inflation in Tanzania at the 5% and 10% significance levels. This suggests that Tanzanian inflation has a cumulative effect. The short-run outcome shows that Tanzania's total debt stock has a positive and significant impact on inflation at a 1% significant level. This is consistent with a similar result reported by Ngerebo (2014) in Nigeria. The estimated short-run coefficients of public external debt are positive and statistically significant at a 1% significance level. Contrary to long-run estimates, the short-run elasticities of domestic debt to inflation are negative and statistically significant at the 1% level. This means that in Tanzania, a one percent increase in domestic debt is linked to a 0.4% short-term decrease in inflation.

Other variables presented in Table 6 indicate that, as in the long run, the coefficients of economic growth are negative and statistically significant in the short run. This suggests that economic growth negatively influences inflation in Tanzania. This finding is consistent with that of Aimola and Odhiambo (2021) in Nigeria, which also suggests a negative relationship between economic growth and inflation in the short run. However, the study finds that interest rates have a positive and statistically significant impact on inflation in the short run. Similarly, the money supply has a positive and statistically significant effect on inflation in Tanzania. The exchange rate coefficients are negative and statistically significant in the short run.

Table 6: ARDL Short Run Estimated Results

Variables	Model 1	Model 2
Log of inflation, L1	0.162 (0.098)	0.259** (0.105)
Log of inflation-L2	0.189* (0.108)	0.203* (0.108)
Log of total debt-L2	0.916*** (0.260)	
Log of total debt-L3	1.134*** (0.275)	
Log of public external debt-D		1.088*** (0.247)
Log of public external debt-L3		0.975*** (0.284)
Log of domestic debt- D		-0.398*** (0.113)
Log of domestic debt- L		-0.307** (0.123)
Log of interest rate- D	1.636** (0.766)	1.568* (0.807)
Log of interest rate-L1	2.734*** (0.717)	3.129*** (0.715)
Log of interest rate- L2	1.165* (0.678)	1.725** (0.726)
Log of interest rate- L3		1.659** (0.758)
Log of money supply- L1	1.148* (0.649)	
Log of real exchange rate-D	-1.401*** (0.382)	-0.997** (0.405)
Log of real exchange rate-L3	-0.836** (0.390)	
Log of GDP growth- L1	-0.113** (0.051)	-0.161** (0.076)
Log of GDP growth- L2		-0.128* (0.071)
Log of GDP growth- L3		-0.116* (0.058)
Constant	2.495 (2.288)	9.498*** (2.964)
ECT	-0.412*** (0.073)	-0.481*** (0.086)
Observations	80	80
R-squared	0.628	0.699

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Own computations based on data extracted from BOT (2024).

5.2.3 Post Estimates Analysis

After estimating the ARDL models, sensitivity analysis was conducted to confirm the model specification. The results are presented in Table 5. The tests for heteroskedasticity (White's test, LM test for autoregressive conditional) showed that in both cases, we failed to reject the null hypothesis since the observed probability values are greater than the 5% significance level, concluding that the variance of the residuals in the models is constant. We also performed tests for autocorrelation (Durbin's alternative test, Breusch-Godfrey LM test) and concluded that there is no serial autocorrelation problem in the data used since the observed p-values exceed 0.05. The Ramsey RESET test was used to check whether the model has no omitted variables, and we concluded that the models used have no omitted variables bias. Therefore, the results of the tests indicated that the estimated model 2 is free of serial correlation, multicollinearity, and heteroscedasticity. Furthermore, the residuals follow a normal distribution, suggesting that the model fits the data and that the conclusions are trustworthy and appropriate for formulating policy recommendations.

The study also performed stability tests for the estimated ARDL model using the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. Figure 3 specifies the plots of CUSUM and CUSUMSQ for models 1 and 2, respectively. It shows that the CUSUM and CUSUMSQ statistics plots are within the 5% critical boundaries, confirming the accuracy of the model's long- and short-run parameters.

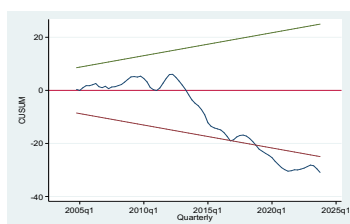


Figure 3(a): CUSUM for Model 1

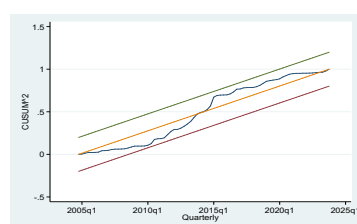


Figure 3(b): CUSUM Square for Model 1

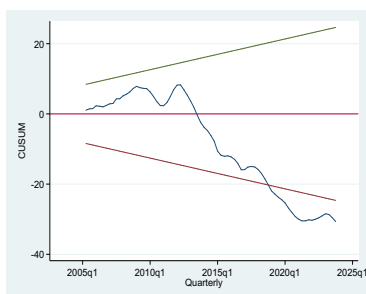


Figure 3 (c): CUSUM for Model 2

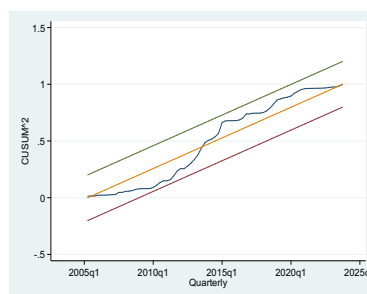


Figure 3(d): CUSUM Squared for Model 2

Source: Own Constructions based on data extracted from BOT (2024).

6.0 Conclusion

The aim of the study was to evaluate the impact of national debt on inflation in Tanzania. To do this, the researchers divided the national debt into two categories: domestic debt and external debt (public and private). They used quarterly data from 2003 to 2023 and applied the Autoregressive Distributed Lag (ARDL) approach to analyse the effect of disaggregated debt on inflation.

The findings revealed that the total debt stock has a negative and significant relationship with long-term inflationary pressure. However, in the short run, external debt has a positive and statistically significant influence on inflation in Tanzania. Although public external debt has a negative and significant impact on inflation, domestic and private external debt have a positive effect on inflation in the long run. Therefore, to control public debt-oriented inflation, the government should rely on external borrowing instead of domestic borrowing. They should also keep an eye on private external debt since it generates inflationary pressure on the economy.

In the short run, public external debt has a positive and significant effect on inflation, while domestic debt has a negative impact. Moreover, the Granger causality tests show that there is a one-way causal relationship between total debt stock and inflation, public external debt and inflation, and domestic debt and inflation.

Most of the other control variables have expected coefficients. The coefficient of economic growth is negative and statistically significant in both the short and long run. The variable interest rate has a negative and statistically significant impact on inflation in the long run but a positive and statistically significant effect in the short run. Furthermore, money supply and inflation are positively related in the short and long run. However, the interest rate is positively related to inflation in the long run but negatively related in the short run.

The study's policy implication is that the government of Tanzania must implement a national debt management strategy that effectively controls inflationary pressures in the economy. In addition, the government should take measures to improve the economy's overall output over the long term and reduce the inflationary impact of public debt resulting from increasing the fiscal deficit, unless there is a risk that the economy will fall into a debt inflation trap. The study also recommends measures to lower domestic debt, including broadening the tax base and implementing structural reforms to cut costs. To avoid unfavourable effects on the economy, it is crucial to manage and track debt levels properly. Total domestic debt stock should be held for extended periods and productive purposes. In contrast, total domestic debt should not be used for short-term purposes like funding recurrent projects because this will fuel inflation.

However, the study has some limitations, particularly in its focus on linear relationships, which overlooks the potential for nonlinear effects. Therefore, future research should explore the nonlinear impacts of debt on inflation and examine how these effects vary across different sectors. Gaining a better understanding of both the nonlinear and sector-specific impacts of debt on inflation could help develop more effective fiscal and monetary policies for managing inflation.

References

- Ahmad, M. J., Sheikh, M. R., & Tariq, K. (2012). Domestic Debt and Inflationary Effects: An Evidence from Pakistan. *International Journal of Humanities and Social Science*, 2(18), 256-263.
- Aimola, A. U., & Odhiambo, N. M. (2020). Public Debt and Inflation: A Review of International Literature. *Folia Oeconomica Stetinensia*, 20(1), 9-24.
- Aimola, A. U., & Odhiambo, N. M. (2021). Public Debt and Inflation: Empirical Evidence from Ghana. *Development Studies Research*, 8(1), 1-13.
- Aimola, A. U., & Odhiambo, N. M. (2021). Public Debt and Inflation Nexus in Nigeria: An ARDL Bound Test Approach. *Cogent Economics & Finance*, 9(1), 1921905.
- Aimola, A. U., & Odhiambo, N. M. (2022). External Debt, Domestic Debt and Inflation in Nigeria: A Multivariate Granger-Causality Test. *Econometric Research in Finance*, 7(2), 143-169.
- Akram, N. (2017). Role of Public Debt in Economic Growth of Sri Lanka: An ARDL Approach. *Pakistan Journal of Applied Economics*, 27(2), 189-212.
- Bank of Tanzania, (2011). Tanzania Mainland's 50 Years of Independence: A Review of the Role and Functions of Bank of Tanzania (1961- 2014).
- Bassetto, M. (2008). Fiscal Theory of the Price Level. *The New Palgrave Dictionary of Economics*, 1, 409-412.
- Bedada, T. D., Demissie, W. M., & Wolde, E. T. (2020). Determinants of Inflationary Experience in Ethiopia. *Journal of Economics and Financial Analysis*, 4(1), 15-54.
- Bilan, I. (2016). Overview of the Main Theories on the Economic Effects of Public Indebtedness. *EIRP Proceedings*, Vol 11 (2016).
- Cochrane, J. H. (2016). Do Higher Interest Rates Raise or Lower Inflation?. Unpublished paper, February, <https://faculty.chicagobooth.edu/john.cochrane/research/papers/finer.pdf>.
- Danlami, I. A., & Bin Hidihiir, M. H. (2018). Inflation in Sierra Leone: An Empirical Analysis of the Impact of Interest Rate on Price Level Changes. *Academic Journal of Economic Studies*, 4(4), 42-49.
- Deshappriya, N. P. R., (2012), "Debt and Fiscal Sustainability in Sri Lanka", *International Journal of Scientific and Research Publications*, Vol.2, Issue 3.

- Helmy, H. E. (2022). The external Debt-Inflation Nexus in Egypt. *Journal of Public Affairs*, 22, e2802.
- Iwedi, M. (2020). Granger Causality Analysis Between Domestic Debt and Inflation in Nigeria. *Journal of Development Economics and Finance*, 1(1), 135-49.
- Jordan, S., & Philips, A. Q. (2018). Dynamic Simulation and Testing for Single-Equation Cointegrating and Stationary Autoregressive Distributed Lag Models. *R Journal*, 10(2).
- Kayamo, S. E. (2021). Asymmetric Impact of Real Exchange Rate on Inflation in Ethiopia: A Non-Linear ARDL Approach. *Cogent economics & finance*, 9(1), 1986931.
- Krugman, P. (2009). How Did Economists Get it So Wrong? *New York Times*, 2nd September.
- Kwon, Gooheon, Lavern McFarlane, and Wayne Robinson (2009), "Public Debt, Money Supply, and Inflation: A Cross-Country Study," *IMF Staff Papers*, Vol. 56, No. 3, May, pp. 476-515, <<http://www.jstor.org/stable/40377808>>
- Leeper, E. M. (1991). Equilibria Under 'Active and 'Passive' Monetary and Fiscal Policies. *Journal of Monetary Economics*, 27(1), 129-147.
- Lim, Y. C., & Sek, S. K. (2015). An Examination on the Determinants of Inflation. *Journal of Economics, Business and Management*, 3(7), 678-682.
- Lopes da Veiga, J. A., Ferreira-Lopes, A., & Sequeira, T. N. (2016). Public Debt, Economic Growth and Inflation in African Economies. *South African Journal of Economics*, 84(2), 294-322.
- Mehmeti, I., & Deda, G. (2022). Econometric Evaluation of Public Debt on Inflation: Evidence from Kosovo and North Macedonia. *Journal of Liberty and International Affairs*, 8(3), 171-187.
- Matheson, T. (2019). Interest Rates and Inflation. Brazil: Boom, Bust, and the Road to Recovery, ed. A. Spilimbergo and K. Srinivasan, IMF, 255-265.
- Mhlaba, N., and Phiri, A., (2017), "Is Public Debt Harmful Towards Economic Growth? New Evidence from South Africa", MPRA paper No.83157, Nelson Mandela University.
- Mtui, J. M. (2024). Inflation Dynamics in Tanzania's Post-Reform Period. *Tanzania Journal of Development Studies*, 22(2), 133-152.
- Muhammad, N. I., Olaolu, D., Abu, A. S., & Umar, H. U. (2021). Effect of Public Debt on Inflation Rate in Nigeria. *Lafia Journal of Economics and Management Sciences*, 6(1), 171-186.
- Mohanty, M.S. (2012). Fiscal Policy, Public Debt and Monetary Policy in EMES: An Overview. Bank for International Settlements. BIS Papers No 67. Available at <https://www.bis.org/publ/bppdf/bispap67.pdf> [01 April, 2023].
- Mwamkonko, M. A. (2022). Budget Deficit Financing in Tanzania: Implications for Price Stabilization. *African Journal of Economic Review*, 10(4), 181-195.

- Ngerebo, T. A. (2014). Domestic Debt Burden, Debt Overhang and Inflationary Pressure in Nigeria. *Journal of Empirical Economics*, 3(3), 172-183.
- Nyonzo, F. S. (2021). The Impact of Private External Debt on Monetary Policy in Tanzania (2010-2020) (Unpublished Doctoral dissertation, The Open University of Tanzania).
- Perpetua, O. I. (2014). Impact of Exchange Rate Variation and Inflation on the Economic Growth of Nigeria: An Empirical Approach. *Research Journal of Finance and Accounting*, 5(22), 166-176.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of applied econometrics*, 16(3), 289-326.
- Saungweme, T. & Odhiambo, N.M. (2022). Does Public Debt Granger-Cause Inflation in Tanzania? A Multivariate Analysis," *Economia Internazionale / International Economics*, Camera di Commercio Industria Artigianato Agricoltura di Genova, 75(1), 75-100.
- Saungweme, T., & M Odhiambo, N. (2021). Public Debt and Inflation Dynamics: Empirical Evidence from Zimbabwe. *Croatian Review of Economic, Business and Social Statistics*, 7(2), 14-30.
- Saungweme, T., & Odhiambo, N. M. (2022). Does Public Debt Granger-Cause Inflation in Tanzania? A Multivariate Analysis. *International Economics/Economia Internazionale*, 75(1).
- Sharaf, M. F., & Shahan, A. M. (2023). Does External Debt Drive Inflation in Sudan? Evidence from Symmetric and Asymmetric ARDL approaches (No. 270641). ZBW-Leibniz Information Centre for Economics.
- Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. *Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications*, 281-314.
- Siddiqui, T. A., Iftikhar, K., & Naqvi, S. K. A. (2022). The Impact of Public debt on Inflation in Pakistan. *Competitive Social Science Research Journal*, 3(2), 392-402.
- Sihotang, C. A., Efendi, B., & Rangkutty, D. M. (2024). Analysis of The Influence of Money Supply, Interest Rates, and Exchange Rates on Inflation in Indonesia. *International Journal of Economics, Business and Accounting Research (IJEBAR)*, 8(2).
- Sims, C. A. (1994). A Simple Model for Study of the Determination of the Price Level and the Interaction of Monetary and Fiscal Policy. *Economic Theory*, 4, 381-399.
- Sumba, J. O., Ondiba, R. O., & Mugambi, P. J. (2023). Domestic Verses Foreign Borrowing: Does the Mode of Fiscal Deficit Financing Matter for Inflation in Sub-Saharan African Countries?. *International Journal of Applied Economics, Finance and Accounting*, 17(2), 294-304.

- Tchamda, C. (2017). The Fiscal Theory of the Price Level in Sub-Saharan Africa: A Structural Break Analysis. Thesis and Dissertations. 1139, South Dakota State University.
- Tolasa, S., Whakeshum, S. T., & Mulatu, N. T. (2022). Macroeconomic Determinants of Inflation in Ethiopia: ARDL Approach to Cointegration. *European Journal of Business Science and Technology*, 8(1), 96-120.
- Tsoufidis, L. (2007). Classical Economists and Public Debt. *International Review of Economics*, Vol. 54(1), 1-12.
- U Aimola, A., & M Odhiambo, N. (2022). Is the Effect of Public Debt on Inflation Symmetric or Asymmetric? Evidence from the Gambia. *Croatian Review of Economic, Business and Social Statistics*, 8(1), 41-57.
- URT (2000). Tanzania Development Vision 2025. Planning Commission. United Republic of Tanzania.
- Van Bon, N. (2015). The Effects of Public Debt on Inflation in Developing Economies of Asia: An Empirical Evidence based on Panel Differenced GMM Regression and PMG Estimation. *The Empirical Economics Letters* (2015), 14(4), 1-20.
- Van Bon, N. (2015). The Relationship Between Public Debt and Inflation in Developing Countries: Empirical Evidence Based on Difference Panel GMM. *Asian Journal of Empirical Research*, 5(9), 128-142.
- Woodford, M. (1994). Monetary Policy and Price Level Determinacy in a Cash-in-Advance Economy. *Economic theory*, 4(3), 345-380.
- Yusuf, A., & Mohd, S. (2023). Nonlinear Effects of Public Debt on Economic Growth in Nigeria. *SN Business & Economics*, 3(4), 88.