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## BUDGET DEFICIT AND INFLATION IN TANZANIA: ARDL BOUND TEST APPROACH

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### ABSTRACT

**Purpose** - The study aimed at analyzing the existence of the long run relationship between the government budget deficits and inflation in Tanzania.

**Methodology** - We used annual time series data for the budget deficit and inflation from 1970 to 2015 sourced from International Monetary Fund (IMF) database. Autoregressive Distributed Lag (ARDL) bound test approach Pesaran and Shin (2001) was used.

**Findings**- Our results revealed the positive relationship and existence of the long-run relationship between budget deficits and inflation. The coefficient of the speed of adjustment is significant at 5 percent; the whole system can get back to the equilibrium at the speed of adjustment of 72% towards a long run.

**Conclusion**- We suggest the government to adopt measures that would reduce the large budget deficit that has been growing over time. This would be one of the necessary conditions in reducing inflation over time and thereby the high economic growth witnessed can be sustainable.

**Keywords:** ARDL model, budget deficit, Inflation, long run, Tanzania

**JEL Codes:** M41, L10

### 1. INTRODUCTION

Budget deficits have been cited in literature to be a problem facing many developed as well as least developed countries over time. It is mentioned that in developing countries it is common to comprehend both high budget deficits as well as high inflation; however, the link between the two is not obvious. High budget deficits may results in high inflation if monetized (Hamburger and Zwick 1981: viera, 2000). According to monetarist, inflation is purely a monetary phenomenon. Sometimes it has worried economists that budget deficits may also lead to inflation too. Policymakers give greater attention in controlling inflation through applying appropriate policies due to its distortive nature to the economy that does not need to be overemphasized here. On the other hand, deficits are not preferred because they are purported to cause a crowding out in investments and exports (Rose and Hakes 1995). That was also supported by Akcay et al (1996) who commented on the two possible channels through which deficits lead to higher inflation. In the first place, he asserted that the government borrowing requirement increases the net credit demand and drive up interest rates eventually it results in crowding out private investment. Secondly, is when the private sector purchases the securities and then the central bank attempts to limit any interest rate increase. Under both or any of these circumstances, deficits lead to greater money base growth that can ultimately create inflationary pressure. Many studies have been conducted in different countries on the relationship between budget deficits and inflation but the results are inconclusive. Therefore we see a need to specifically study the relationship between the two variables in the context of Tanzanian economy.

Tanzania is one of the least developed countries, despite its recent high growth rates of 7 percent has at times faced high rates of inflation especially in the early 1990's as well as high budget deficits (Sumaila and Larya, 2001; also Solomon and Wet, 2004). Moreover, the high budget deficits have been a problem of Tanzania just like many other least developed countries for a long time. According to the bank of Tanzania (BoT, 2017) and IMF, the external debt stock comprising of both public and private sectors amounted to USD 19,239.9 million at the end of September 2017 from a USD 18,651.1 million compared with the same month one year before. It has been mentioned that in the past ten years from 2007 there has been a bit by bit accretion from about 20 percent of GDP to 34.2 percent of GDP in 2017. Albeit high rates of the debts due to deficits, it has been argued that the debt burden, as well as the country's risk of distress, is low. This study aims at investigating whether the proposition of positive effect of budget deficits on inflation can be verified in the particular case of Tanzania. The study implores to differ with an earlier study that was done in Tanzania by Solomon and de wet in 2004, in two aspects; first the methodology used is more modern ARDL method developed by Shin and Pesaran, secondly, the study used data set which are up to the recent period. The rest of the paper is organized as follows; the first part of the work addresses the introduction of the topic, objective and the background, the second part covers the literature review of the work, third part analyzes the data sources and econometrics methodology, while the final part covers the conclusion of the work.

## **2. LITERATURE REVIEW**

According to Snowdon and vane, (2005) argued that budget deficits very much matter in the growth theories of countries in the sense that they reduce national savings. The impact of savings reduction is ultimately lowering the growth of the country. They further assert that due to deficits, which leads to large debts results into a burden by diverting private wealth that otherwise would be used in productive investments in capital that would raise wages of the future generations. So, for that matter, budget deficits have been drawing the attention of the economists and policy makers due to the striking impacts that may arise as a result. Classical, Keynesian, and monetarist tried to explain the relationship between budget deficits and inflation. The perspective of the classical school of thought on inflation was based on the quantity theory of money. They believed money supply was the sole reason for the general price levels and it has no impact on the real side of the economy. The monetarists, on the other hand, perceived inflation to be a result of the money supply. It is further argued that if monetary policy is complaisant to the budget deficit, the money supply will for a long period of time be on the rise. Due to this deficit financing will cause aggregate demand to rise and resulting in output rising above the natural level of output (Serban, 2002).

According to Keynes when there is the high stock of debts the society does not perceive an increase in tax to be the way to reduce the accumulated debt stock, so inflation may be used to close that gap through debt repayment with higher interest rates. When the monetized way is used in financing the budget deficit it results in an increase in aggregate demand, however, doesn't increase the supply of goods (Keynes, 1971). Empirically, many researchers and economists have worked on the relationship between these two macroeconomic variables we intend to revise briefly some of their works here. According to Solomon and de Wet (2004), who studied the coexistence of a relatively high inflation rate and high fiscal deficits for a prolonged period from 1967 to 2001 for the economy of Tanzania they established a causal link that runs from the budget deficit to the inflation rate. They used cointegration analysis over the period of study. In their study they concluded, "due to monetization of the budget deficit, significant inflationary effects are found due to increases in the budget deficit". Similar to the methodology used by Solomon and de Wet, Agha and Khan (2006) investigate the long-run association between fiscal indicators and inflation in Pakistan economy using data from 1973 to 2003. Their findings were different from those obtained by the former, so it was not in favor of the relationship between deficit and inflation. Viera, (2000) post-war annual data investigates the inflationary effect of central government deficits in a sample of six European Union members, namely Belgium, France, Germany, Italy, Netherlands and the UK. He employed bounds testing ARDL approach, to examine the existence of a long-run relationship, and the LA-VAR causality analysis, to confirm the direction of causality. The results were not supportive of the aforementioned hypothesis that deficits in the EU countries were inflationary. The results of Viera conformed the results of Burdekin and Wohar (1990) who conducted a similar analysis earlier on the relationship between budget deficits and money growth in eight developed countries including Canada, France, Italy, Japan, Switzerland, United Kingdom, United States and West Germany, in the period 1960-1985 using quarterly data. All these studies had a similar conclusion that the independence of the central banks from governments in these countries would be a reason for the weak relationship between budget deficit and inflation. Many more papers have had similar conclusions in the developed countries especially. To mention a few, for example, Barnhart and Darrat (1988) who did their study for OECD countries. Similar results of no support were found in the study using data from 32 countries by Abizadeh and Yousefi (1998). There has been an argument that, this phenomenon is observed much in the developing countries and poor countries possibly because there is no or very little autonomy in the central banks and the relative governments.

Muhammad et al (2016) used ARDL bound test approach to find out the link between budget deficit (fiscal imbalances) and price inflation using annual time series data from 1973 to 2014 in Pakistan. In their findings, they discovered that there is an association between budget deficit and inflation. On the other hand, Lin and Chu (2013) used the dynamic panel quintile regression (DPQR) model under the autoregressive distributional lag (ARDL) specification, and after tested the causality between budget deficits and inflation for 91 countries between 1960 and 2006. Their results show that the fiscal deficit had a strong impact on inflation particularly in high-inflation periods, whereas during periods of low inflation weak impact was observed.

**3. DATA AND METHODOLOGY**

This study used annual time series data for the budget deficit and inflation that were both sourced from International Monetary Fund (IMF). These datasets covered the period from 1970 to 2015 making a series of 45 years; this period was selected because of data series accessibility to the country as least developed. Autoregressive Distributed Lag (ARDL) bound test approach of Pesaran and Shin (1999) and Pesaran et al (2001) was applied to analyze the long run relationship between budget deficit and inflation in Tanzania for the period under study. This methodology is appropriate for testing long-run relationship because, firstly, it can be used with a mixture of I(0) and I(1) data series. Secondly, it involves just a single equation set up, making it simple to apply and interpret. Thirdly, it is possible to assign a different lag length to different variables as they enter the model. Equation can be specified as;

$$\Delta Y_t = \beta_0 + C_0t + \sum_{i=1}^q \zeta_i \Delta Y_{t-i} + \sum_{j=0}^p w_j \Delta x_{t-j} + \gamma_1 Y_{t-1} + \gamma_2 x_{t-1} + \epsilon_t \dots\dots\dots(1)$$

Whereby  $\beta_0$ ,  $C_0$  is the coefficient that represents the drift and trend respectively,  $\epsilon_t$  is the error term of the model.  $\zeta_i$  And  $w_j$  corresponds to short run while,  $\gamma_j, j = 1,2$  corresponds to a long run relationship between the variables.  $Y_t$  is the dependent variable (budget deficit) and  $x_t$  represents the independent variable in the model (inflation), moreover,  $p$  and  $q$  represent lags.

**4. FINDINGS AND DISCUSSIONS**

**4.1 Unit Root Test**

We used Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests below in order to check and make sure that none of our series is I (2). The table below shows the results of ADF and PP tests.

**Table 1: Unit Roots Test at Level and First Difference**

Test Degree	ADF				PP			
	Level		First difference		Level		First difference	
Variable	t-stat	Prob	t-stat	Prob	t-stat	Prob	t-stat	Prob
bd	2.0937	0.2481	-9.9794	0.0000	2.2146	0.2041	-9.7338	0.0000
ifl	2.9618	1.0000	-4.8058	0.0021	6.8734	1.0000	-7.2875	0.0000

Note: Intercept and trend model with 5% significance level.

As the tests are presented, it shows that series was not stationary at level and we cannot reject the null hypothesis in favor of an alternative, hence integrated to first order.

**4.2. Lag Selection**

The ARDL approach lag selection is important because it determines the general picture of the model and results. To obtain the accurate optimal lag for the model, SIC and AIC criteria are suggested, however, SIC over AIC criteria provides a slightly better estimation to choose the model for small sample size Pesaran and Shin (1998). The optimal lag length can be determined through the common method of AIC (Akaike 1974) and the SIC Schwarz-Bayesian (Schwarz et al 1978). The equations below defines the criteria;

$$AIC = - 2\ln(LH) + 2k\dots\dots\dots(2)$$

$$SIC = - 2\ln(LH) + k\ln(n)\dots\dots\dots(3)$$

The variable n is the number of observations and k is the number of regression Parameters to be estimated. LH is the maximum likelihood of the model. It is believed that AIC criteria tend to overestimate the size of the lag to be included in

the model which is totally insignificant for small sample size, the larger the number of the lags it lowers the sample size included in the model. The idea does not guarantee the direct use of SIC criteria. But, for the purpose of obtaining accurate lags we use both AIC and SIC criteria to determine the number of lags to be used in the model, as the lowest AIC or SIC criteria the best the model. The table below shows the values of AIC and SIC criteria, and finally, AIC criteria were selected as a determinant of the model because it has the lower values.

**Table 2: Lag Selection Criterion**

Criterion	Akaike info criterion (AIC)	Schwarz criterion (SIC)
Lag 4	4.2689	4.7286
Lag 6	3.9881	4.6280

#### 4.3. F-Bounds Test and Error Correction Modelling

To examine if a long-run relationship exists, an F-test is performed which included budget deficit as the dependent variable while inflation applied as the independent variable. Hence to analyze if the coefficients for the two periods lagged variables (inflation and budget deficit) are jointly zero. As seen in the table below F-Bounds Test hypothesis involves both upper and lower bounds critical values. The computed F-statistic is 7.7118 is significant at 5%, and the lower and upper bounds for the F-test statistic at 10%, 5%, and 1% significance levels are [4.04, 4.78], [4.94, 5.73], and [6.84, 7.84] respectively, so, exceed the critical value tabulated in Pesaran et al. (2001). Hence we reject the null hypothesis that concludes there is an existence of a long run relationship between two variables. (Duasa 2007). (Budget deficit and Inflation in Tanzania), the coefficient of the speed of adjustment is significant by -0.729 and the probability value is 0.042 significant at 5%. This means that the whole system can get back to the equilibrium at the speed of adjustment of 72% towards a long run.

**Table 3: F-Bounds Test Hypothesis**

Test Statistic	Value	df	Probability
F-statistic	7.711.860	(2, 24)	0.0026
Chi-square	1.542.372	2	0.0004
Null Hypothesis: C (14)=C(15)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(14)		0.137012	0.034931
C(15)		0.053607	0.019068

#### 4.4. Serial Correlation Tests

Breusch-Godfrey test (Godfrey 1978) was used to test the serial correlation of the series if different lags of the residuals are correlated. The hypothesis of this test is set as follows;

H0:  $\rho = 0$ , No serial correlation in the model

H1:  $\rho \neq 0$ , There is serial correlation in the model

Here we reject the null hypothesis in favor of alternative hypothesis; hence series are stationary from the serial correlation as seen in the table below.

**Table 4: Breusch-Godfrey Serial Correlation LM Test**

F-statistic	0.681398	Prob. F(2,22)	0.5163
Obs*R-squared	2.274944	Prob. Chi-Square(2)	0.3206

#### Q-statistic test

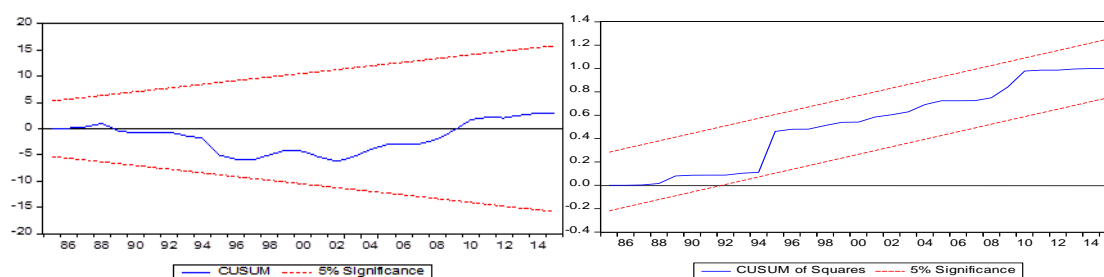
To verify the stationarity of the series, the Q-statistic test was applied to analyze the serial correction by observing the Probability values. All the P-value are greater and significant at 5%, this is evident that series are free from serial correlation.

**Table 5: Q-Statistic Probabilities Adjusted for 14 Dynamic Regressors**

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob*	
. *   .	. *   .	1	-0.119	-0.119	0.5953	0.440
. *   .	. *   .	2	-0.088	-0.104	0.9302	0.628
. *   .	. **   .	3	-0.181	-0.210	2.3863	0.496
.   .	. *   .	4	-0.060	-0.133	2.5488	0.636
. **   .	. **   .	5	-0.223	-0.324	4.8783	0.431
.   .	. **   .	6	-0.031	-0.244	4.9251	0.553
.   *   .	. *   .	7	0.077	-0.156	5.2189	0.633
.   **   .	.   .	8	0.249	0.055	8.4201	0.394
.   .	.   .	9	0.022	-0.033	8.4450	0.490

#### 4.5. Test for Stability

To analyze the long run and the short run relationship between budget deficit and inflation it is quite important to test for stability of the series. To assess the stability of the coefficients CUSUM and CUSUM of Squares tests are proposed by Brown et al. (1975) can be applied. The blue lines of both tests do not go beyond the limits of significance line at 5% that suggest that coefficients of the series are stable.



#### 5. CONCLUSION

The relationship between government budget deficits and inflation has been an issue of debate among economic policymakers in academic literature. Many kinds of literature as we have pointed out remain inconclusive and the empirical evidence has been different from one country to another depending on the regimes that the central banks are subordinated. This study aimed at studying if there exist a positive effect of the budget deficit to inflation in Tanzanian economy's context. The annual time series data from 1970 to 2015 were employed, also ARDL bound test approach was used. It was found that the computed F-statistic is 7.7118, so the study confirmed the existence of the long-run relationship between the government deficit and inflation. So we could not refute the positive impact of the budget deficit on inflation. Our results conformed to the results of Muhammad et al (2016) who did their study in Pakistan, also Lin and Chu (2013) who tested the association between the two variables in 91 developing countries. Contrary to similar studies conducted in the developed countries it can be said that in developing and least developed countries including Tanzania the central banks are not independent. The two variables inflation and budget deficit are significant that policy makers should pay attention for the country to realize sustainable growth. On the one hand if inflation is made stable it may lead to the overall increase of welfare of the community, lead to the decline in unemployment level that has been believed to be a tremendous problem, and finally accelerate the industrialization process. This goal of industrialization in the Tanzanian context has been given much weight with the current regime. On the other hand, budget deficit has a significant impact on inflation, so we think that even though authorities seem not to worry about the level of the budget deficit in the country, but reducing the large budget deficit would be one of the necessary conditions in reducing inflation overtime and thereby the high economic growth witnessed can be sustainable.

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