

The Effect of Public Debt on Private Investment in Tanzania

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Abstract

This study explores the effect of public debt on private investment in Tanzania. Secondary data for the period of 1970-2016 were collected from National Bureau of Statistics (Tanzania), Bank of Tanzania, World Bank, and scholarly journals. An Autoregressive Distributed Lag (ARDL) bound test to cointegration is used in this study. Results suggest a significant evidence of nonlinear long run and short run relationship between external debt and private investment. However, Granger causality test suggests that this relationship is rather a co-movement than causal. At 5% level of significance, there is no significant evidence of long run and short run relationship between domestic debt and debt service on one hand, and private investment on the other hand. However, the combined effect of domestic and external debt on private investment is statistically significant both in long run and short run. The study recommends the government to adopt strict policies on project implementations to ensure positive returns of borrowed funds and closely monitoring of public debt, particularly external debt on which private investment is more responsive than domestic debt and debt service, despite its sustainability at present.

Keywords: Public debt, ARDL, External debt, Domestic debt, Debt servicing, Investment, Tanzania

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1. Introduction

Public debt is a characteristic of all economies. It has an important influence on economic growth both in the short-run and long-run (Kumar & Woo 2015). Since 1980s, the impact of public debt on macroeconomic variables has been a matter of debate among scholars, (Herndon et al. 2014; B. C. M. Reinhart & Rogoff 2010; Krugman 1988). Public borrowing has generally been one of the important methods of financing budget deficit in both developing and developed countries which initially affect the allocation of resources in the economy and finally generate impact on macroeconomic activities like investment. Financing budget deficit through public borrowing entails the government to use both domestic and external debt instruments through intermediation by the banking system.

Government domestic borrowing is implemented with a view of avoiding inflation, external crisis or with a view of redistributing income. However, it can harm the economy at some levels because it reduces the credits and hence raising the interest rates which shrinks the financial capital that would be available for the private sector. Even in situations of interest rate control, there would be selective crediting leading to crowding out of private investment. If the economy is linked to the international capital markets, the public and the private sectors will have access into borrowing from external sources. The main sources of external borrowing for financing budget deficit include international financial institutions like World Bank, International Monetary Fund (IMF) and private overseas creditors. Governments borrow from abroad in order to finance public goods that increase welfare and promote long-term economic growth (Balago 2014). In the case of current account deficit caused by external disturbances, (Ezeabasili & Ph 2011) recommended that the government can borrow from external sources in order to store up the foreign reserves position and strengthen the foreign liquidity in the future. Due to lack of well established banking systems in Africa, internal resources to finance deficit have been insufficient (Agenor & Montiel 1996) necessitating countries to seek for external debts which, for many developing countries, presents macroeconomic challenges when they are beyond recommended Debt-to-GDP ratios. Although debt ratios may rise further beyond the indicative thresholds, governments have to choose options of renormalizing them to levels that are relative to nominal activities in the long-run, (Reinhart et al. 2015).

During early post independence period in Tanzania (Tanganyika by then), excessive government borrowing (see URT 2011) was intended to implement various ambitious national development projects including Development Plan for Tanganyika 1961/62 – 1963/64 and Tanganyika Five-Year Plan for Economic and Social Development 1964 – 1969. The early development plans mainly directed efforts at implementing educational policies, (Galawa 1990). The worsening of the public debt begun in 1970s corresponding to the shocks in prices of oil (1973-74 and 1978-79) accompanied with fall in commodity prices. This situation continued through the period of Structural Adjustment Programs (SAP) in 1980s where governments in Africa, including Tanzania, received foreign assistance to restructure their economies under directives of IMF and World Bank. The Debt-to-GDP ratio of Tanzania oscillated between low of 35.6% in 1970 to high of 164.9% in 1994, (URT 2011) as indicated in figure 1 below.

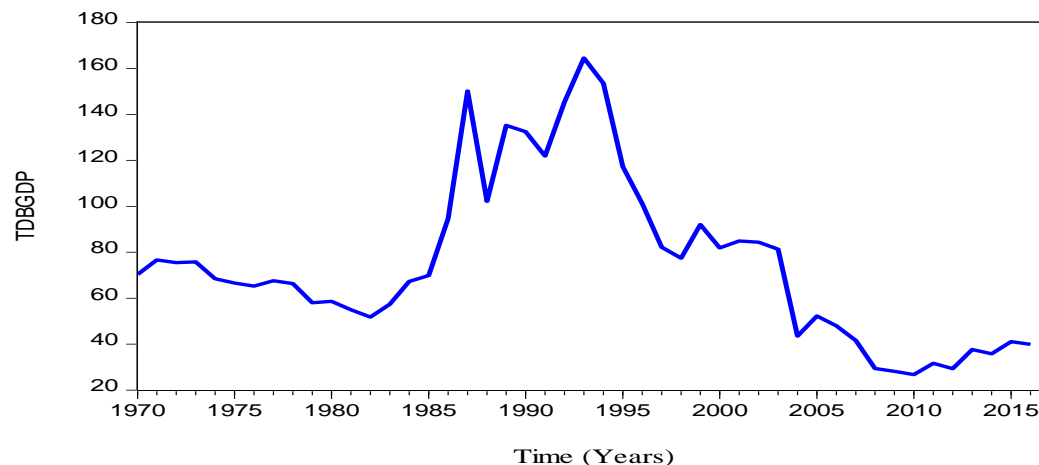


Figure 1: Trend of Public Debt-to-GDP Ratios in Tanzania (1970-2016)

Source: Author's compilation

After Economic Recovery Programs that were implemented in 1990s and due to debt cancellation of about US\$ 3 billion from creditors under HIPC and MDRI initiatives, the trend of Tanzania public debt was reduced to a public Debt-to-GDP ratio of about 29.9% in 2006 and it steadily started rising from 2008 as shown in figure 1.

A significant contribution of private investment in the economy of Tanzania traces its origin in Structural Adjustment Programs (SAP) and trade liberalization policies of 1980s. Since 1960s to mid-1980s, Tanzania implemented socialist economic policies with the government playing an extensive role in making economic decisions. Some of the economic policies that were implemented by the government before trade liberalization include; central control of investment planning with restrictive codes on private and foreign investment, administrative allocation of foreign exchange through licensing, price controls, regulated or controlled interest rates and credit rationing, (Moshi & Kilindo 1999).

The decree of Arusha Declaration in 1967 was another hostile environment on private sector that saw nationalizing all major means of production like land, factories and banks as well as imposing restrictions like the 1967 Party Leadership Code that prohibited government and party officials from owning rentable properties, doing private business and holding shares in enterprises. Such severe environment hampered the growth of private sector which saw 1970s and early 1980s with a declining trend in private investment.

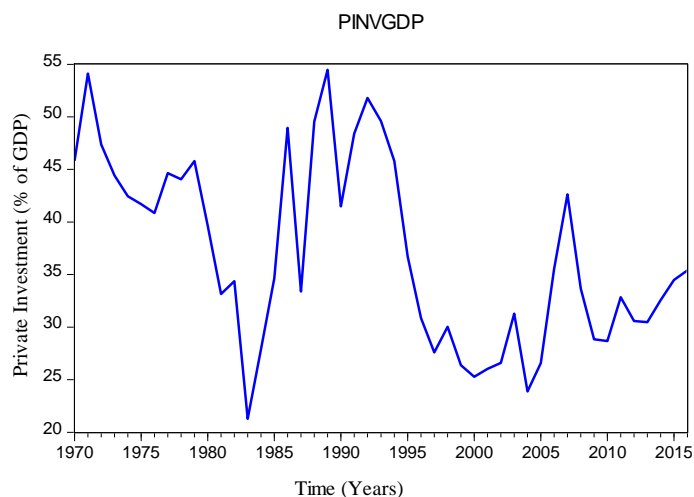


Figure 2: Trend of Private investment in Tanzania

Source: Author's EViews output

The introduction of Economic Recovery Programs (ERPs) in Africa and Tanzania in particular during 1980s was meant to deliberately and systematically remove regulatory controls in the economy. Implementation of these policies may have been a reason for improvement in private investment which rose from 22% in 1984 to about 43% in 1991, (see figure 2). The late 1990s and early 2000s were characterized by another sharp decline in private investment which may be attributed to the burden of external debts and later in mid 2000s private investment stabilized probably due to cancellation of debts from some of the creditors. Since 2006, both private investment and public debt have been on an increasing trend.

The good indicators of the ability of a country to repay its public debt are debt ratios like debt-to-GDP, debt-to-Export, debt-servicing-to-Export and debt-servicing-to-GDP all expressed in percentage form. As a rule of thumb, scholars like C. M. Reinhart & Rogoff (2010a); B. C. M. Reinhart & Rogoff (2010b) suggest that the public debt is sustainable and suitable to growth up to the debt burden threshold of 90 percent of GDP. However, country specific levels may be below or above this indicative debt burden threshold as presented by (Aristovnik et al. 2014) who found turning points of between 80% - 94% for old members and 53% - 54% for new members in the European Union. The indicative debt burden threshold in Tanzania is currently 56 percent with the present value of total debt-to-GDP of 36.8 percent that is well below the indicative threshold, (IMF 2016; URT 2016). Although these figures appear impressive, they do not provide evidence of the extent and the nature of influence on private investment in Tanzania.

Public debt has a twofold effect on the economy through private investment; first, it crowds-out private investment because by its very nature high public debt ratio represents a deadweight burden on the economy for which private investors would be skeptical of paying higher taxes in the future in order to service the debt. The resources used to repay debt as well represent an opportunity cost because they would be otherwise used to provide social services like schools, health and security. This is a negative effect of public debt on private investment. Second, public debt may crowd-in private investment (positive effect), because borrowed funds are meant for

financing deficit and hence they are necessarily directed to public investment. When the government invests the borrowed funds in strategic infrastructures like railways, roads, electricity, airports and water supply, the likelihood that private investment would be encouraged is high. The central question here is therefore whether the current level of public debt in Tanzania crowds-out or crowds-in private investment. Since crowd-out and crowd-in are the possible impacts of public debt, the checks and balance of the two must be ongoing in order to make sure that public debt benefits the economy and, in particular, the individuals. This is the kind of effects the current study intended to weigh up and shade light on debt-investment management in Tanzania.

The remainder of this study is organized as follows. Section 2 reviews the literature on the nexus between public debt and private investments. Section 3 presents the methodology. Section 4 presents and discusses the empirical results. Section 5 concludes and offers recommendations.

2.0 Literature Review

Various empirical studies have been conducted to study the effect of public debt on macroeconomic variables in general and private investment in particular. Numerous theories like Public Debt theory, Debt Overhang Theory, Crowding-out Theory, Dual-Gap Theory, Investment Theory and Public Debt Theory have been used to provide the benchmarks to guide the studies. While most of the literatures, including Apere (2014); Checherita & Rother (2010); Kasidi & Said (2013); Kumar & Woo (2015); Sichula (2012); Al-zeaud (2014); Moshi & Kilindo (1999); Herndon et al. (2014); C. M. Reinhart & Rogoff 2010; B. C. M. Reinhart & Rogoff 2010) and Aristovnik et al. (2014), have directed efforts on analysis of the effect of public debt on economic growth, a few have investigated the effect of public debt on private investment. With respect to methodology, most of these studies have analysed the effect of public debt on macroeconomic variables using OLS models that provides room for comparison with result of the ARDL model used in the current study.

2.1 Theoretical Framework

Many of the authors who have investigated about the relationship between debt ratios and macroeconomic variables have used various theories in supporting their studies. In this study, five theories are discussed, four about public debt and one about investment, in order to support the specific objectives as follows;

2.1.1 The Debt Overhang Theory

Debt overhang occurs if the external debt in a country exceeds a country's ability to repay given some future probability. The debt overhang theory was first coined by Myers (1977) in an attempt to explain the company's decision on borrowing. He verified that there is always a threshold at which a firm can borrow from capital markets even at a willingness of paying higher interest rates. Later on, other scholars like Krugman and Sachs likened the theory and applied the same concept to the debt situation of a country and its ability to meet debt servicing obligations and how debt relief would actually benefit the creditor receiving some payment, (Sichula 2012). Krugman and Sachs stated that overhang exists when the country's debt service burden is so heavy such that a large portion of the current output builds up to foreign lenders that discourage investment, (Sichula 2012). The higher the current debt service burdens the higher expected tax

on private investors that implies lower future private investment because the resources that would be otherwise available to investors are used for servicing debt. Disincentive to investment further hampers economic growth which virtually makes poor countries to be caught in the vicious circle of poverty. The Laffer curve, which is basically nonlinear and inverted U-shape, is a tool that is used to postulate the peak at which the debt overhang occurs.

2.1.2 The Dual-Gap Theory

The dual-gap theory postulates that investment is a function of saving, (Boboye & Ojo 2012). According to dual-gap theory, domestic saving is not sufficient to finance investment for economic development. To fill the gap external sources of capital for investment are sought to complement the deficit, (Presbitero & Panizza 2012). The central question is to assess whether or not such external debt contributes to improvement in private investment in debtor countries and at what thresholds. The identities of national income accounting provide the basis of dual-gap analysis by equating the components of income and expenditure approach as below;

$$Income = Consumption + Imports + Savings \quad (i)$$

$$Output = Consumption + Exports + Investments \quad (ii)$$

Since $Income = Output$, from (i) and (ii) it implies that;

$$Investment - Saving = Imports - Exports \quad (iii)$$

In theory, for identity (iii) to hold true it requires that;

$$Investment = Savings \text{ and } imports = exports \quad (iv)$$

If domestic saving fall short of targeted economic growth, then a saving-investment gap occurs. Likewise, if imports exceed the necessary level of exports it creates an export-import of origin exchange gap, (Balago 2014).

2.1.3 The Crowding Out Theory

By shifting tax to the next generations in the form of debt service, the current consumption is encouraged which reduces savings. This situation increases interest rates in the capital markets which in turn discourage private investment. Low level of investment further reduces government revenues and hence it impedes its ability to influence fiscal policies. Crowding out effect begins with inability of domestic creditors (mostly the government through central bank as a lender of last resort) to meet investors' needs because of higher external debt servicing because of liquidity constraints, (Broner et al. 2013). Current higher debt servicing implicates higher future taxes of which private investors escape it by being reluctant to invest.

2.1.4 The Investment Theory

The existence of an independent investment function in the economy was presented by Keynes in 1930s from which many investment theories have drawn, (Asante 2000); (Agidew 2014). In Keynesian analysis, the central feature of investment function is that although savings and

investment must be identical in theory, the decisions about the two variables are taken by different decision makers. It follows that, there is no reason why savings should always equal investments. The *flexible accelerator model* is a neoclassical theory favoured by Keynesian school of thoughts that can be used to evaluate the effect of macroeconomic variables on private investment, (Kilindo 2016). The basic notion of flexible accelerator model is that; the larger the gap between the existing capital stock and the desired capital stock, the greater the firm's rate of investment. The hypothesis is that firms seek to fill a fraction (δ) of the gap between the existing capital stock in the previous year (K_{-1}) and the desired capital stock (K^*). The net investment (I) function in this case is of the form;

$$I = \delta(K^* - K_{-1}) \quad (v)$$

Within the framework of the *flexible accelerator model* in (4) above; output, internal funds, cost of external financing and other variables can be included as determinants of K^* , (*ibid*). This allows for inclusion of public debt in the investment function which provides the basis of the model to be used in the current study.

2.1.5 The Public Debt Theory

Public borrowing has been a matter of serious concern among economists since 19th century, (Churchman 2001). The growth of public debt at a glance is a deficit issue. It emanates in the desire of a government to spend more than it can collect revenues by its will or due to circumstances like wars, floods and droughts. However, long run debt also fastens the growth of public debt through debt service. Adam Smith and David Ricardo can be singled out as two earlier critics of public borrowing. They maintained that public debt harmed the national capital stock because the true level of public expenditure is not revealed instead it encourages government expenditure that is largely harmful to the state's well being. Ricardo, in Ricardian Equivalence, further argued that both taxation and debt were a form of transfer payment and a burden to the current generation and the future generation respectively. Opponents of Ricardo in 1820s and afterward could not agree with him. For instance, Keynesians based on "the General Theory of Employment, Interest and Money" in 1936 believed that the absolute size of the debt does not constitute any burden upon society as a whole. However, post Keynesian theorists in 1950s and 1960s like J.M Buchanan and R.A. Musgrave reiterated that the real cost of the government expenditure that is financed through debt implies postponed taxes to be paid in the future because taxes are compulsory and involuntary hence burden to future generation. After Barro's re-statement of Ricardian Equivalence in 1970s, economists recognized that part of public debt is productive in the form of public investment which in turn influences private investment but part of it could be wasteful as claimed by classical economists, (Barro 1979). Since private investment nourishes in peaceful environment and well established infrastructures where the government spends (public investments) possibly through public debt, we expect correlation between public debt and private investment. The following are some of empirical studies related to public debt and its effects on some of macroeconomic variables.

2.2 Empirical Evidence

Various empirical studies have been conducted to study the effect of public debt on macroeconomic variables in general and private investment in particular. This section attempts a review of some of the past studies which were conducted both within the country and abroad whose topics were related to the current subject.

Apere (2014) studied the impact of public debt on private investment in Nigeria over the period of 1981-2012 by regressing private investment on external debt, domestic debt and private consumption expenditure by using an OLS nonlinear model. They found that domestic debt had a linear and positive impact on private investment, external debt had a U-shaped impact and private consumption expenditure had a negative impact, all variables were statistically significant at 1%.

Moshi & Kilindo (1999) conducted a study on the impact of government policy on macroeconomic variables for the period of 1970-1992 with a case study of private investment in Tanzania. They related private investment with growth of income (GDP), credit flow (CRD), public investment (PSI) and net foreign exchange (IMPC). Linear and nonlinear models were used from which all variables were found statistically significant at conventional levels (1% and 5%). They study concluded that there is a direct link between government policies and private investment. However, public debt was not included in their models which provide a gap for the current study to fill.

Another study by Checherita & Rother (2010) investigated the impact of high and growing government debt on economic growth in twelve Euro area countries over the period of 1970-2010. Using private investment as a channel through which economic growth receives change, they regressed private investment on public debt (including control variables) on an OLS model. Surprisingly, the results on various models were neither conclusive nor robust, the debt variables turning mostly insignificant. This result is against to the finding of Apere (2014) as discussed earlier. In addition to private investment, results on the relationship between public debt and public investment were broadly robust across various models with turning points ranging from 45% to 68% of GDP ratio.

In their study entitled “Impact of External Debt on Economic Growth: A Case Study of Tanzania” for the period of 1970-2010, Kasidi & Said (2013) found OLS that external debt has a positive effect with a positive coefficient of 0.369 and the debt service payment has a negative effect of about 28.5 on economic growth. The study suggested further research on the impact of external debt on foreign direct investment which is partly the subject matter of this study.

Herndon *et al.* (2014) studied the relationship between public debt and economic growth among 20 advanced economies by replicating two studies by Reinhart & Rogoff (2010a, 2010b) over the period of 63 years since 1946. Contrary to Reinhart and Rogoff’s broad contentions, both mean and median GDP growth when debts exceed 90% of GDP were not remarkably different from when public debt-to-GDP ratio was lower. Herndon’s study therefore refuted Reinhart and Rogoff’s study. Such a disagreement on the thresholds of debt ratios and considering that the relationship between debt and private investment was not dealt in the study, it propels interest to

further evaluate the effects of public debt on macroeconomic variables, including investment, using different locations like Tanzania.

Writing on “Public Debt and Growth”, Woo and Kumar (2015) examined the impact of high public debt on long-run economic growth using a large panel of countries over the period of four decades. To avoid inconsistency of estimates, they employed a variety of techniques like Pooled OLS, robust regression, between estimators (BE), fixed effects (FE) panel regression and system GMM (SGMM) dynamic panel regression. The result of the study indicates that there are adverse effects associated with high initial public debt on growth which translated themselves into slowdown in labour productivity growth mainly due to reduced investment. The current study assessed the direct relationship between public debt and private investment instead.

An investigation by Sichula (2012) from SADC countries in the study entitled “Debt Overhang and Economic Growth in HIPC Countries”, they utilized a combination of overhang model and financial model in order to measure the linear relationship of debt indicators on economic output, causality among variables was tested using Granger Causality Test. Results of the study reveal that debt service does not have any direct effect on private investment unless via some forms of macroeconomic variables like debt. The study concludes by saying debt overhang is still a paradox. Objective number (iii) in this study was set to investigate the relationship between debt service and private investment in case of Tanzania.

Aristovnik & Mencinger, Verbic (2014) in their study ‘The Impact of Growing of Public Debt on Economic Growth in the European Union’ collected panel data from 25 members of European Union covering the period of 1980-2010 for old members and 1995-2010 for new members. They used non-linear model (an inverted U-shape) to evaluate the threshold values at which debt ratios are detrimental. In order to account for the impact of Debt-to-GDP ratio on real growth rate of GDP, they employed panel estimation in which debt variable was augmented within a generalized economic model. Their findings indicate a Debt-to-GDP turning point between 80% - 94% for old members and 53% - 54% for new members. These results imply that not all countries have the same convergence point with regard to the debt overhang hypothesis. Their findings further point out that growth is affected by excessive external debt not directly through level of investment but through effectiveness of investment; a contrast of most empirical findings. Objective number (i) of this study investigated to see and compare results using data from Tanzania.

While most of empirical studies have established that debt variables have negative effect on economic growth as discussed in the previous literatures, the study by Presbitero & Panizza (2012) has different findings. In their study “Public Debt and Economic Growth: Is there a Causal Effect?; they didn’t find a turning point of Debt-to-GDP ratio and economic growth as expected suggesting lack of negative relationship between the two variables. Lack of the expected results does not, however, imply that countries should commit to indebtedness without thoughtful decisions because the advanced economies investigated may represent a sample of countries that are still operating below county-specific thresholds at which debt starts having a negative effect on growth.

Jilenga, Xu, & Gondje-Dacka (2016) studied the impact of external debt and foreign direct investment (FDI) on economic growth in Tanzania using ARDL model. They used time series data for the period of 1971-2011. They found that, in the long-run external debt is positively related to economic growth while FDI had a negative impact on economic growth. Furthermore, short-run analysis revealed no directional causality between the variables. Their study neither established the threshold at which Debt-to-GDP ratio and economic growth would be optimal nor did it attempt to investigate the relationship between external debt and private investment which is addressed in the subject matter in the current study.

Finally, Al-zeaud (2014) studied the relationship between public debt and economic growth in Jordan with data covering the period from 1991 through 2010. By employing augmented linear growth-debt models and using OLS methods they found that public debt have a significant effect on economic growth but investment-economic growth relationship was insignificant. Once again, their study is silent about the relationship between public debt and private investment which the current study was set to investigate in Tanzania.

Based on the empirical literatures reviewed, it is evident that public debt influences macroeconomic variables. However, two observations are clear from the reviewed literatures that (1) the majority of studies were not conducted in Tanzania and their focus was on the relationship between public debt and economic growth using OLS models; and (2) Only two studies among the works reviewed did attempt to evaluate the effect of public debt on investment one with focus on public investment and another on FDI or private investment and again they were not conducted in Tanzania. Unlike most of the previous studies, the current study intended to evaluate the effect of public debt on private investment which will simultaneously expand the scope of examining the effect of public debt on private investment and add to the body of knowledge using ARDL model with data from Tanzania.

3.0 Methodology

This study seeks to evaluate the effect of public debt on private investment in Tanzania. The study adapted the model of Apere (2014) and Checherita & Rother (2010). Apere (2014) studied the impact of public debt on private investment in Nigeria over the period 1981-2012 by regressing private investment on external debt, domestic debt and private consumption expenditure while Checherita & Rother (2010) investigated the impact of high and growing government debt on economic growth in twelve Euro area countries over the period of 1970-2010 by regressing private investment on public debt. The two studies used an OLS nonlinear model of order 2. For the purpose of this study, an ARDL non-linear model of order 4 was specified as it would yield more significant results and allow estimation of debt burden thresholds. The econometric model is of the form below;

$$y_t = \beta_0 + \beta_1 y_{t-1} + \dots + \beta_k y_{t-p} + \beta_k x_t + \beta_{k+1} x_{t-1} + \beta_k x_t^4 + \beta_{k+1} x_{t-1}^4 + \dots + \beta_{k+1} x_{t-q} + \beta_{k+1} x_{t-q}^4 + \varepsilon_t \quad (1)$$

The subscripts of the variables and error term represent the number for which each variable is lagged. The ARDL model estimates a total of $(p+1)^k$ regressions and choose the optimal number of lags for each variable where p is the number of lags and k is the number of variables. The

appropriate number of lags is selected based on a criterion such as Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC)

Borrowing from the flexible accelerator model as discussed in Asante (2000) and Agidew (2014), our model derivation began by assuming an investment function of the form

$$I = \delta(K^* - K_{-1}) \quad (2)$$

The hypothesis is that firms' investment (I) seeks to fill a fraction (δ) of the gap in the existing capital stock between the previous year (K_{-1}) and the desired capital stock (K^*). The basic notion of the model is that; the larger the gap between the existing capital stock and the desired capital stock, the greater the firm's rate of investment. Within the framework of the flexible accelerator model; output, internal funds, cost of external financing and other variables can be included as determinants of K^* , (*ibid*). This allows for inclusion of public debt (PD) and debt servicing (DS). The investment model can be rewritten as

$$I = \delta(PD, DS, -K_{-1}) \quad (3)$$

Since a non-linear investment model was used in the study, public debt (PD) was further decomposed into domestic debt (DB) and external debt (XD) and thereafter, debt-to-GDP ratios were expressed in linear and no-linear components following Apere (2014); Checherita & Rother (2010). More specifically, equation (1) is presented using the variables of the current study as follows;

$$PINVGDP = \beta_0 + \beta_1DBGDP + \beta_2DBGDP^4 + \beta_3XDGDP + \beta_4XDGDP^4 + \beta_5DSEXP + \beta_6DSEXP^4 + \beta_7PCERGDP + \beta_8DUMMY + \varepsilon_t \quad (4)$$

Where

PINVGDP = private investment (% of GDP)

DBGDP = Domestic debt (% of GDP)

XDGDP = External debt (% of GDP)

DSEXP = Debt service (% of total export)

PCERGDP = Private consumption expenditure (% of GDP)

ε_t = Error term

Private investment was obtained by a proxy of private capital formation as presented in national accounts while public debt was decomposed to domestic and external debt including debt service. The expected signs of β_2, β_4 and β_6 were positive in the short run and negative in the long run while with β_2, β_4 and β_6 either of the two signs positive or negative were expected in

both short run and long run. PCERGDP and DUMMY are exogenous with PCERGDP treated as a control to account for variables not included in the model while the dummy variable was intended to trace whether socialist policies (before 1986) and free market policies (after 1985) had a significant impact on private investment. The lagged form of equation (4) is presented as follows;

$$\begin{aligned} \Delta PINVGDP_t = & \beta_0 + \sum_{i=1}^k \varphi_i \Delta PINVGDP_{t-i} + \sum_{j=0}^l \beta_j \Delta DBGDP_{t-j} + \sum_{m=0}^n \gamma_m \Delta DBGDP_{t-m}^4 \\ & + \sum_{p=0}^o \tau_p \Delta XDGDP_{t-p} + \sum_{q=0}^r \gamma_q \Delta XDGDP_{t-q}^4 + \sum_{u=0}^s \omega_u \Delta DSEXP_{t-u} \\ & + \sum_{z=0}^w \mu_z \Delta DSEXP_{t-z}^4 + \delta_1 PINVGDP_{t-1} + \delta_2 DBGDP_{t-1} + \delta_3 DBGDP_{t-1}^4 \\ & + \delta_4 XDGDP_{t-1} + \delta_5 XDGDP_{t-1}^4 + \delta_6 DSEXP_{t-1} + \delta_7 DSEXP_{t-1}^4 + DUMMY + \mu_t \end{aligned} \quad (5)$$

In the above equation, Δ and μ_t are the first difference operator and white noise term respectively. The terms with the summation signs represent the error correction model while the second part with coefficients ($\delta_i; i = 1, 2, 3, \dots, 7$) represent the long run dynamics. The null hypothesis in equation (5) is that $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0$, which states that there is no co-integration among variables against the alternative hypothesis that there exist at least one co-integration. This is a bounds testing procedure based on the joint F-statistic or Wald statistic with upper bound critical values referred to as I(1) series and lower bound critical values as I(0) series. F-statistic values greater than the upper level of the band leads to rejection of null hypothesis indicating that there is co-integration. If the calculated F-statistic is below the critical value band, the null hypothesis can not be rejected and F-statistic falling between the bounds of critical value would be inconclusive as it does not tell the order of co-integration among the variables. In this case, ARDL approach can not be used and alternative co-integration techniques like Johansen co-integration are desirable, (Nkoro & Uko 2016). Finally, we decompose equation (5) into long run and short run as presented in the form of equations (6) and (7) respectively.

$$\begin{aligned}
 PINVGDP_t = & \alpha_1 + \sum_{i=1}^k \varphi_i PINVGDP_{t-i} + \sum_{j=0}^l \beta_j DBGDP_{t-j} + \sum_{m=0}^n \gamma_m DBGDP_{t-m}^2 \\
 & + \sum_{p=0}^o \tau_p XDGDP_{t-p} + \sum_{q=0}^r \partial_q XDGDP_{t-q}^2 + \sum_{u=0}^s \omega_u DSEXP_{t-u} + \\
 & \sum_{z=0}^w \mu_z DSEXP_{t-z}^2 + DUMMY + \varepsilon_{1t}
 \end{aligned}
 \tag{6}$$

$$\begin{aligned}
 \Delta PINVGDP_t = & \alpha_2 + \sum_{i=1}^k \varphi_i \Delta PINVGDP_{t-i} + \sum_{j=0}^l \beta_j \Delta DBGDP_{t-j} + \sum_{m=0}^n \gamma_m \Delta DBGDP_{t-m}^2 \\
 & + \sum_{p=0}^o \tau_p \Delta XDGDP_{t-p} + \sum_{q=0}^r \partial_q \Delta XDGDP_{t-q}^2 + \sum_{u=0}^s \omega_u \Delta DSEXP_{t-u} \\
 & + \sum_{z=0}^w \mu_z \Delta DSEXP_{t-z}^2 + \phi ECT_{t-1} + DUMMY + \varepsilon_{2t}
 \end{aligned}
 \tag{7}$$

If there exists a long run relationship, ϕ (in equation 7) is the coefficient of the error correction term that shows how fast the short run dynamics would adjust to retain long run equilibrium. It should be statistically significant and negative for the results to hold true.

The current study used data from various sources including Tanzania National Bureau of Statistics Reports, Bank of Tanzania Quarterly Reports, World Bank Websites, and published papers from scholarly journals. The most recent datasets for 47 years up to 2016 on public debt and private investment including private consumption expenditure were gathered. However, data on domestic debt from 1970 to 1998 and on debt servicing from 1970 to 1975 could not be obtained. Lack of data on domestic debt may be attributed to the fact that a well established financial market sector in Tanzania traces its beginning in 1990s implying that domestic borrowing has been a recent phenomenon. According to Martin (2011), financial sector reforms in 1990s were implemented due to the weaknesses experienced during the socialist era in which financial markets were controlled by the state.

Following Chen et al. (2003), neighborhood average imputation method was thought one of the effective techniques in dealing with missing values. The missing data problem was handled by two imputation procedures. Firstly, in case of domestic debt, all missing values were imputed by putting zero assuming that there has been limited domestic borrowing between 1970 and 1998 in Tanzania due to lack of well developed financial markets. Secondly, the neighborhood moving average imputation with six periods was used to obtain the missing values on debt servicing for

the period between 1970 and 1975. The same method was also used to replace outliers with values that were within acceptable range in each data series.

4.0 Results and Discussions

4.1 Unit Root Test

A data series is non-stationary if its variance is time variant. Most co-integration techniques begin with pre-testing of stationarity of data series in order to determine the appropriate co-integration technique to be used. However, for ARDL approach to co-integration this requirement is not mandate. However, for the sake of ascertaining whether data series are I(0), I(1) or both as a requirement for ARDL modeling, the pre-testing of the order of co-integration for each variable was undertaken using two tests, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) using Eviews with the results as shown in table 1 .

Table 1: Unit Root Test

Variable	Dickey-Fuller test statistic (with intercept and no trend)		Phillips-Perron test statistic (intercept and no trend)	
	I(0)	I(1)	I(0)	I(1)
Private Investment-to-GDP (PINVGDP)	-1.999	-3.491	-2.561	-8.192
	0.286	0.013*	0.108	0.000**
Domestic Debt-to-GDP (DBGDP)	-1.436	-4.753	-1.787	-9.786
	0.556	0.000**	0.382	0.000**
External Debt-to-GDP (XDGDB)	-1.070	-3.027	-1.169	-7.366
	0.719	0.040*	0.680	0.000**
Debt Service-to-Export (DSGEXP)	-1.319	-3.560	-1.253	-7.270
	0.613	0.011*	0.643	0.000**
Private Cons. Expend-to-GDP (PCERGDP)	-0.327	-5.645	-0.824	-9.109
	0.912	0.000**	0.803	0.000**

** Significant and Stationary at 1%

* Significant and Stationary at 5% and 10%

I(0) = Level

I(1) = First difference

Table 1 shows that all data series are non-stationary at level hence we fail to reject the null hypothesis that the data series is non-stationary at level.

After first differencing, all data series became stationary (see table 1 and figure 3), which implies that the null hypotheses at first difference were rejected in favour of the alternative hypotheses for all data series. The two tests in table 1 have all data series not stationary at level and all stationary at first difference consistent to observations by Arltova & Fedorova (2016).

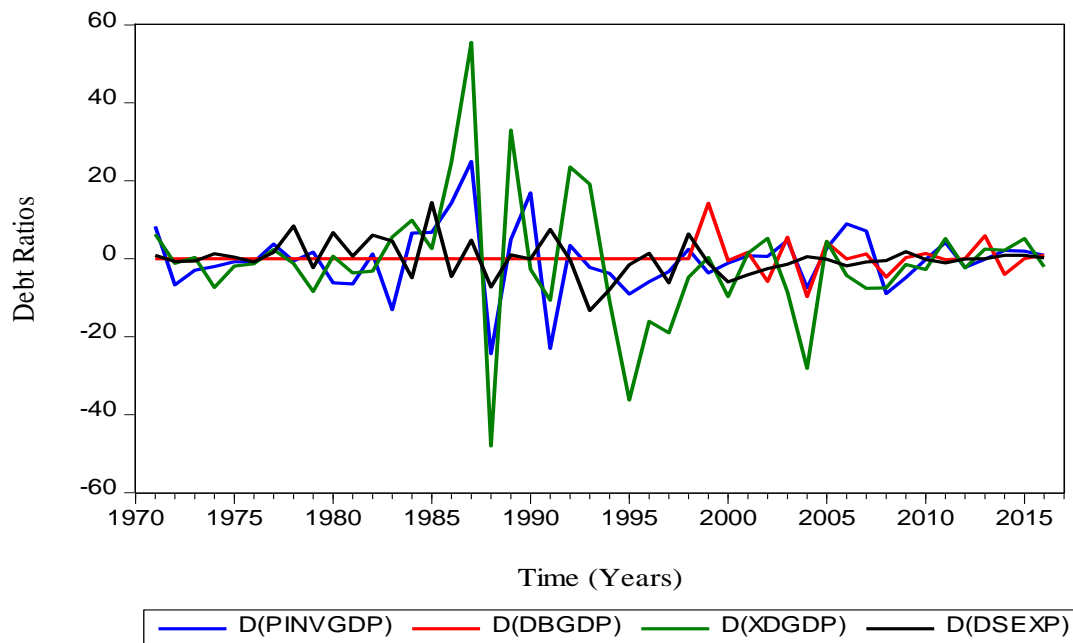


Figure 3: Stationarity of Data Series at first Difference

Since data series were both $I(0)$ and $I(1)$, ADRL modeling was found appropriate as it outweighs other techniques in dealing with such data series. According to Duasa (2007) and Narayan (2004), ARDL works better with small sample size where variables are all stationary at level, at first difference or a mixture of the two.

4.2 Bounds Test for Co-integration Analysis

After establishing stationarity of variables, equation (1) was estimated and the bound test carried out in order to examine the long run relationship among the variables. By choosing a maximum of two lags based on AIC, the model was built by generating results using EVIEWS as presented in table 2 to ascertain if there exists co-integration among variables.

Table 2: F-Statistic Bound Test for Co-integration relationship

				Bound Critical Values† (Restricted Intercept and no Trend)		Bound Critical Values† (Restricted Intercept and Trend)	
Test Statistic	Value	Lag	Significance level	I(0)	I(1)	I(0)	I(1)
F-Statistic	4.91	2					
			10%	1.99	2.94	2.33	3.25
			5%	2.27	3.28	2.63	3.62
			2.5%	2.55	3.61	2.9	3.94
			1%	2.88	3.99	3.27	4.39

† Pesaran 2004

I(0) = Lower Bound

I(1) = Upper Bound

The calculated F-statistic (4.91) in table 2 is higher than the upper bound critical value at 5% level of significance (3.28) for restricted intercept and no trend and (3.62) for unrestricted intercept and no trend models. This is a desirable condition for ARDL model to be estimated following Pesaran et al. (2001) and Narayan (2004) when using small samples of size between 30 up to 80 observations. At 5% level of significance we reject the null hypothesis which states that there is no co-integration, and therefore there exists a long run relationship among the variables.

4.3 Long Run Relationship among Variables

A total number of 1458 regressions were evaluated using EViews from which ARDL (1, 2, 1, 1, 2, 1, 0) model was selected based on Akaike Information Criterion (AIC) which had the minimum standard error.

Table 3: Long Run ARDL (1, 2, 1, 1, 2, 1, 0) Model Results

Regressor	Coefficient	Std. Error	p-value
Constant	22.733	1.237	0.282
DBGDP	2.531	-2.026	0.226
DBGDP4	-0.001	3.309*	0.0524
XDGP	0.825	-2.665**	0.003
XDGP4	-0.00000011	-0.671**	0.013
DSEXP	-0.227	-0.511	0.508
DSEXP4	-0.0000028	1.0968	0.613

Dependent Variable: PINVGDP

** = Significant at 5%

* = Significant at 10%

From table 3, it is evident that external debt is a key determinant of private investment in the long run with p-values of 0.003 and 0.013 for XDGDP and XDGDP4 respectively at 5% level significance. It implies that, a unit increase in external debt to GDP ratio in Tanzania is associated with approximately 0.825 percent increase of private investment to GDP in the long run. Domestic debt, external debt and debt service ratios have an inverted U-shape relationship with private investment exhibited by negative coefficients of the 4th order components and a positive linear relationship indicated by the positive coefficients of DBGDP, XDGDP and DSEXP. Regarding external debt, Apere (2014) found a U-shaped relationship between external debt and private investment which is not in line with findings of the current study in which the relationship between private investment and external debt is an inverted U-shape. The difference may be that Apere considered a short run relationship only in which external debt may have a stimulating effect on private investment. The inverted U-shape relationship between debt service ratio and private investment was expected (though not significant) based on the crowding-out theory in which higher debt service beyond some thresholds crowds-out private investment in the long run.

Domestic debt and debt service have an insignificant long run relationship with private investment. The null hypotheses that “domestic debt does not affect private investment in Tanzania” and “debt service does not affect private investment in Tanzania” are not rejected. This findings concurs with Apere (2014) who found an inverted U-shape relationship between domestic debt and private investment in which a 1 percent increase in domestic debt was associated with a decrease of about 0.000001 percent in private investment to GDP ratio. Results further indicate that the thresholds of domestic debt to GDP ratio and debt service to export ratio are 9.95 and 5.46 percents respectively. It implies that beyond 9.95 percent of domestic debt to GDP while other variables are constant, private investment starts to decline. In theory and on the basis of the present value of domestic debt of 9 percent of GDP (IMF 2015; URT 2016), the debt burden indicator is well below but very close to the threshold of 9.95 percent of GDP as determined in the current study. This implies that Tanzania is approaching to a moderate probability of debt distress with regard to domestic debt which may pose difficulties in debt-servicing. With regard to debt servicing, there is a discrepancy between results of IMF (2016) and that of the current study.

As of June 2016, debt service-to-Export ratio for IMF was 7.8 percent with a threshold of 20 percent while results of the current study suggest a debt-to-Export ratio of 3.8 percent with a threshold of 5.46 percent in Tanzania. The discrepancy may be a data issue. However, both results reveal that debt service-to-Export is well below thresholds and within country’s repayment capacity which implies that the resources currently allocated to service the national debt do not crowd out, but rather it does crowd in, investment. This situation, however, does not guarantee the country from not facing debt servicing problems in the future. In addition, since interest rates on domestic debt are generally high in low-income countries compared to market rates with short maturities, this may expose the country to significant roll-over risks in the near future. However, one should also take a caution of data issues than reality as most of the domestic debt values in the current were missing and hence imputed.

The combined effect of external and domestic debt, defined as public debt in the current study, have a significant negative inverted U-shape relationship with private investment. This result

was expected but it is contrary to what Checherita & Rother (2010) who surprisingly found no relationship between public debt and private investment. Moreover, results indicate that the threshold of public debt to GDP ratio in Tanzania is 55.66 percent. It implies that beyond 55.66 percent of public debt to GDP ratio, private investment would start declining. With respect to the debt burdens of 36.8 percent and 39.9 percent for IMF (2016) and the current study respectively which both are below indicative thresholds, the public debt distress for Tanzania is still moderate meaning that the debt stock is still manageable. However, the debt stock will be sustainable only if the country's debt repayment capacity will keep improving as debt service increases. This entails to continue with implementation of prudent policies on debt management.

4.4 Error Correction Model for Private Investment

To find the short run relationship between regressors and the dependent variable, the error correction model results was constructed as tabulated in table 4. The negative coefficient (-0.557) of the lagged error correction term (ECT(-1)) and high significance of its standard error 0.082 (0.000) altogether reveal the presence of short run relationship between external debt and private investment. The error correction coefficient (-0.557) implies that, the system converges towards long run equilibrium at a speed of 55.7%.

Table 4: Error Correction Model for Private Investment

Dependent Variable: D(PINVGDP) _t			
Regressor	Coefficient	Std. Error	p-value
Constant	12.662	4.439**	0.008
D(DBGDP)	-0.624	0.533	0.252
(DBGDP4)	-0.00002	0.000	0.866
D(DBGDP4(-1))	0.0001	0.000*	0.062
D(XDGDP)	0.698	0.118**	0.000
D(XDGDP(-1))	0.242	0.052**	0.000
D(XBGDP4)	0.000	0.000**	0.019
D(DSEXP)	0.243	0.168	0.161
PCERGDP	-0.166	0.040**	0.000
DUMMY	-0.580	1.770	0.746
ECM(-1)	-0.557	0.082**	0.000

** = Significant at 5% level

* = Significant at 10% level

The positive coefficient of external debt ratio in table 4 was expected because in the short run external debt stimulates private investment if the capital acquired by the government through borrowing is invested in basic infrastructures accordingly. Apere (2014) also found a positive relationship between external debt and private consistent to the findings of the current study. This result implies that a unit increase in external debt ratio increases private investment ratio by 0.689 and 0.242 percents in Tanzania contributed by lags 1 and 2 respectively. The positive short run relationship was expected because when borrowed public capital is invested, it stimulates

private investment before reaching a threshold beyond which it becomes a burden to the economy and tax payers in particular and hence causes private investment to decrease. In addition, private consumption expenditure is statistically significant and it affects private investment negatively. This was expected because final consumption is an opportunity cost for private investment and thus it would crowd it out. Finally, the standard error of the dummy variable is not statistically significant with a negative coefficient implying that the level of private investment as a percentage of GDP before and after 1985 is statistically the same in Tanzania. Private investment may have increased in terms of figures but proportionately it did not have significant changes.

4.5 Model Diagnostics

The model of the current study was checked for soundness using several diagnostic tests which were conducted using EVIEWS 9.5 student version software. The purpose was to ascertain if the model constructed was a good fit. The tests included bound test, normality test, heteroskedasticity test, serial correlation and stability test as follows;

4.5.1 F-Statistic Bound Test

At 5% level of significance, the F-bound test statistic (4.91) with bands of [2.27, 3.28] and [2.63, 3.62] for restricted intercept (no trend) and restricted intercept (with trend) respectively was consistent with existence of long run relationship, (Pesaran et al. 2001; Narayan 2004). This confirms existence of a long run relationship between private investment and atleast one of the regressors.

4.5.2 Normality Test

Normality of data was tested using residual plot and Jarque-Bera statistic. The null hypothesis is that ‘residuals of data series are normally distributed’. Results revealed that residuals were normally distributed as indicated by constant variance ($\varepsilon(\mu_t) = 0$) in figure 5 and the Jarque-Bera statistic of 5.32 (*sig.* 0.0699) is not significant at 5%.

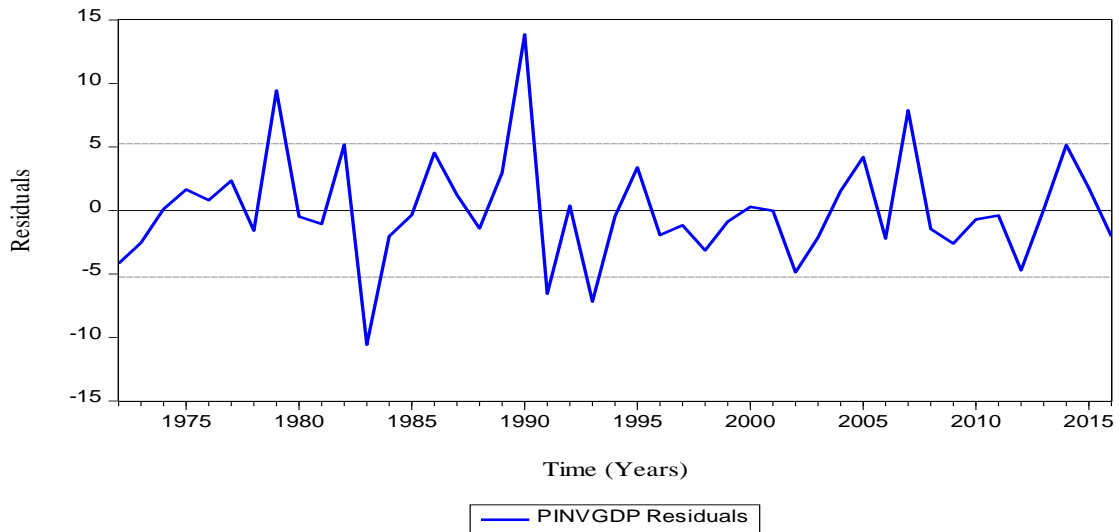


Figure 5: Plot of Residuals

Based on results on figure 5, the null hypothesis that states “data series are normally distributed” was not rejected; hence residuals of data series are normally distributed.

4.5.3 Heteroskedasticity Test

Heteroskedasticity exist if the error term is related to some variable (or set of variables). The Breusch-Pagan-Godfrey F-statistic (0.392) was highly insignificant (0.974), thus the null hypothesis that “there is no heteroskedasticity” in the data series was not rejected. This confirmed that data series were homoskedastic with constant variance.

4.5.4 Multicollinearity Test

Multicollinearity refers to co-movement of two or more regressors in which one variable can be perfectly explained by another. Variance Inflation Factor (VIF) is used to measure multicollinearity such that the value of VIF below 10 is desirable. In the current study, multicollinearity and outliers were detected in the data series. Multicollinearity was dealt by detecting outliers using the excel function that utilizes quartiles to determine the upper and lower bounds of values in each data series for which outliers are replaced by values obtained through neighborhood moving average imputation method. By this approach, all VIF for underlying variables were reduced below 10.

4.5.5 Serial Correlation

The Breusch-Godfrey LM Test was used to detect if the model suffers from serial correlation. The LM F-statistic (0.468) was statistically insignificant (0.631) at 5% level implying that the model was free from autocorrelation. Hence the null hypothesis of “no autocorrelation” was not rejected.

4.5.6 Model Stability

Concerning long run stability, the model revealed to be a stable system based on cumulative sum (CUSUM) of residuals. The null hypothesis of this test is that “The model is not stable”. According to Xiao & Phillips (2002), a model is stable if the plot reveals that the CUSUM of recursive residuals lie within the band of critical values. As indicated in figure 6, all CUSUM of recursive residuals are within the 5% band.

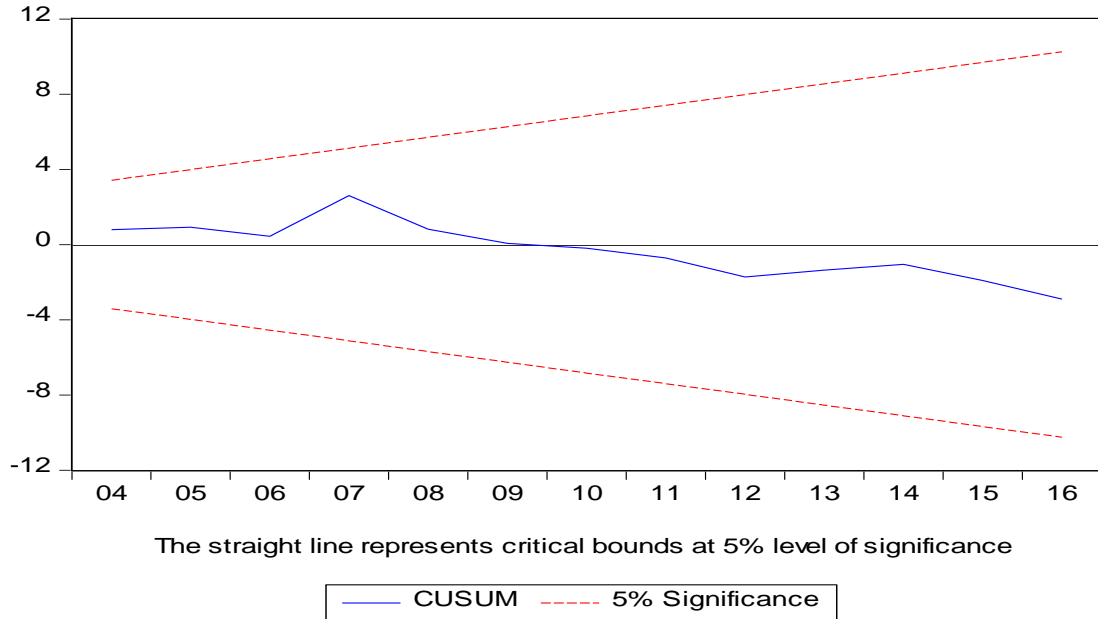


Figure 6: CUSUM of Residuals

With respect to results in figure 6, there is sufficient evidence to reject the null hypothesis and hence conclude that the model of the current study is stable.

4.5.7 Granger Causality Test

The F-statistic bound test in section 4.2 and models in sections 4.3 and 4.3 established that there exist both long run and short run relationship among regressors and private investment. These did not tell whether the relationship is a co-movement/causal and the direction was not specified. According to Granger (1969) causality approach, a dependent variable (Y) is caused by an independent variable (X) if Y can be predicted better by past values of Y and X than values of Y alone. The four possible results of the Granger causality test are:- (i) unidirectional causality running from independent to dependent variable; (ii) unidirectional causality running from dependent to independent variable; (iii) Feedback or bidirectional causality and (iv) no causality. Table 5 presents the Granger causality test results based on AIC two lags selection.

Table 5: Pairwise Granger Causality Tests

Pairwise Granger Causality Test

Date: 05/15/17 Time: 00:42

Sample: 1970 2016

Lags: 2

Null hypothesis	Observations	F-Statistic	Probability
XDGDP does not Granger cause PINVGDP	45	1.883	0.1654
PINVGDP does not Granger cause XDGDP		1.7648	0.1843
DBGDP does not Granger cause PINVGDP	45	0.6355	0.5349
PINVGDP does not Granger cause DBGDP		2.0753	0.3880
DSEXP does not Granger cause PINVGDP	45	1.5599	0.2227
PINVGDP does not Granger cause DSEXP		0.1108	0.8954
PCERGDP does not Granger cause PINVGDP	45	0.9053	0.4126
PINVGDP does not Granger cause PCERGDP		0.468	0.6296
DUMMY does not Granger cause PINVGDP	45	10.9404	0.0002
PINVGDP does not Granger cause DUMMY		0.7383	0.4843
DBGDP does not Granger Cause XDGDP	45	1.2919	0.2860
XDGDP does not Granger Cause DBGDP		0.2727	0.7627
DSEXP does not Granger cause XDGDP	45	12.5339	0.0001
XDGDP does not Granger cause DSEXP		2.6793	0.0809
PCERGDP does not Granger cause XDGDP	45	2.9458	0.0641
XDGDP does not Granger cause PCERGDP		1.4744	0.2411
DUMMY does not Granger cause XDGDP	45	11.7997	0.0001
XDGDP does not Granger cause DUMMY		0.01665	0.0984
DSEXP does not Granger cause DBGDP	45	0.42008	0.6599
DBGDP does not Granger cause DSEXP		2.46385	0.0979
PCERGDP does not Granger cause DBGDP	45	0.9251	0.4048
DBGDP does not Granger cause PCERGDP		4.2624	0.0210
DUMMY does not Granger cause DBGDP	45	1.0386	0.3633
DBGDP does not Granger cause DUMMY		0.0000	1.0000

Source: E-views output by author

** = Significant at 5% level

* = Significant at 10% level

The pairwise Granger causality results in table 5 show that the relationship among most of the variables is a co-movement and thus not a causal relationship. Though it was established that external debt and debt service have respectively a long run and short run relationship to private

investment, they do not cause a direct effect rather they show a co-movement because their p-values are neither significant at 5% nor at 10% with regard to the pairwise Granger causality test. This implies that all null hypotheses of regressors against private investment are accepted suggesting that any effect of debt ratios on private investment is not direct but must be through other channels.

However, some variables were found to have a unidirectional relationship. For example the relationship between dummy variable and private investment has a p-value of 0.0002 showing that the type of ideology/policies pursued by the government may influence private investment despite lack of substantial evidence at 5% on whether socialist and capitalist ideologies impacted on private investment differently in the current study.

5.0 Summary, Conclusions and Recommendations

5.1 Summary

This study evaluated the effect of public debt on private investment for Tanzania from 1970 to 2016. To determine the effect of public debt and private investment, a nonlinear model was used (i) to explore the long run relationship between public debt and private investment using ARDL bounds testing approach to co-integration and (ii) To determine the thresholds of debt ratios at which investment starts to decrease in Tanzania and (iii) to construct VEC model using Granger causality test technique to test the causal relationship between public debt ratios and private investment.

Results suggest that there is strong evidence about nonlinear long run and short run relationship between external debt and private investment in Tanzania. Unless external debt-to-GDP ratio reaches a threshold of 40.89 percent, an increase in external debt is associated with increase in private investment. Furthermore, Granger causality test (see table 7) confirmed that the relationship that exist between external debt-to-GDP ratio on private investment is rather a co-movement than causal. There is no significant evidence of long run and short run relationship between domestic debt and debt service on one hand and private investment on the other hand. However, the combined effect of domestic and external debt on private investment was found statistically significant in both long run and short with a threshold of public debt-to-GDP ratio at 55.66 percent. This finding is consistent with the Debt Sustainability Analysis report of November 2016 in which the threshold was reported to be 56 percent based on the Tanzania general budget for 2017/2018 presented on 8th June 2017 by the minister of finance.

5.2 Conclusions

The major conclusions that can be drawn from the current study is that; (i) the impact of external debt in Tanzania is both linear and nonlinear inverted U-shape contributing positively on private investment before reaching a threshold of 40.89 percent where private investment start to decline because external debt becomes a burden and contributes negatively. It does occur both inn long run and short run; (ii) With respect to private investment, the effects of domestic debt and debt service in Tanzania is trivial and not statistically significant with indicative thresholds at 9.95 percent and 5.46 percent respectively; and (iii) the joint effect of domestic and external (public) debt is statistically significant for both linear and nonlinear components. The threshold of public debt with regard to private investment is 55.66 percent beyond which it has negative influence. Thresholds in this study has been used to indicate the level at which domestic, external and

public debt in general, as a percentage of GDP, reaches a limit beyond which private investment starts to decline. Using ARDL approach to co-integration, the results provide strong evidence that external debt do play a role as an indicator in determining the long run behavior of private investment while domestic debt and debt service were found to be statistically insignificant. This may be due to the fact that external debt constitutes a significant proportion (more than 70% of total debt) of the public debt compared to domestic debt. According to the crowding out theory, public debt would be harmful if an increase in public debt leads to decrease in private investment. Since the debt burden indicators in the current study are still below indicative thresholds, public debt still crowds-in private investment in Tanzania meaning that there is still a room to use external debt in stimulating private investment.

5.3 Recommendations

Based on the findings of the current study, the following are the policy implications;

- (i) The nonlinear inverted U-shape relationship between public debt and private investment in Tanzania should be a serious concern because public debt has a positive effect on private investment up to a threshold of 55.66 percent beyond which, private investment would start to decline. This study recommends that the government should adopt strict policies on project implementations to ensure positive returns of borrowed funds and closely monitoring of public debt despite its sustainability. According to Debt Sustainability Analysis of November 2016, the public debt indicated a debt-to-GDP ratio of 34.2 percent. This entails close monitoring of government borrowing from both domestic and external sources.
- (ii) A debt overhang problem might be experienced in the future because in the long run external debt affects GDP negatively implying that future external debt might be used to service domestic debt if borrowing is not contained.
- (iii) Another policy implication that could be drawn from the current study is that investment in private sector with regard to Tanzania could be better managed by regulating external debt policies because it is more responsive to private investment than domestic debt and debt service.

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