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EXTERNAL DEBT SERVICING AND CAPITAL FORMATION IN GHANA: AN AUTOREGRESSIVE DISTRIBUTED LAG ANALYSIS

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Abstract:
This study empirically examines the effects of external debt servicing on capital formation in Ghana. Using data from 1980 to 2019, the study estimates the Autoregressive Distributed Lag (ARDL) model and finds that the effect of external debt servicing is negative both in the long and the short run due to the tax disincentive effect. This suggests that as a result of the potentially high debt servicing due to the high debt stock, any future investment may attract high marginal tax rates and would tend to reduce investment in the economy. The result further shows that external debt servicing affects private capital formation more than public capital formation. However, the effect of the external debt stock on private investment is negative in the long run but positive in the short run confirming the direct effect of the debt hypothesis' existence in Ghana suggesting that external debt discourages a long-term investment which is critical for economic growth. Additionally, there exists complementarity between public and private investments indicating that some public investments attract private ones into the country. Therefore, external debt service payment crowds out private investment through excessive interest charges, so government should determine a threshold of borrowing in order to minimize the high debt servicing.

JEL: E22, E31, E62, F31, G31, H63, P24

Keywords: external debt, capital formation, tax disincentive effect, ARDL, Ghana

1. Introduction

Economies of most developing countries are generally characterized by low growth rates due to their inherent nature of lower savings, which tend to prevent them from providing financial support for investment in both private and public sectors. Savings and

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investment are, therefore, two major macroeconomics variables that support and sustain economic growth (Hunt, 2007). Linked to this is also the fact that economic growth cannot be sustained and maintained unless the level and the structure of capital formation reach a certain threshold. However, domestic savings in these countries is not enough to sustain the expected capital formation that could engender the needed economic growth hence they resort to foreign borrowing (Chenery & Strout, 1966). It is therefore justified that the growth and development of the Ghanaian economy cannot be fully understood without giving attention to the contribution of external debt servicing on capital formation.

Capital formation is critical for the economic growth and development process of countries because it expands the capacity of the economy to produce more goods and services, creates more job opportunities and also enlarges the export capacity (Omodero, 2019). According to Hernandez-Cata (1988), for any meaningful economic growth to occur, capital formation as a percentage of GDP should be at least 27 percent. Savings facilitates capital formation by making available resources for the needed investment but developing economies are often confronted with inadequate capital formation arising from the vicious cycle of low productivity, low income and low savings (Adepoju *et al*., 2007). External debt promotes economic growth if the funds borrowed are invested in sustainable projects with a higher marginal return than the cost of the funds (Ayadi & Ayadi, 2008). However, it is said that a lack of information about the nature, structure and magnitude of the debt in addition to the inability to meet debt servicing requirements is deleterious to economic growth (Were, 2001).

However, most developing countries are borrowing without considering the consequences attached to them. Despite the fact that increases in gross external borrowing fill the savings gap the implication continued to be servicing sizeable volume of debt at non-concessional interest rates and future tax increases which could eventually drive away foreign investors and also reduce present and future savings to pay off the debt (Aliyu & Osman, 2013). Higher debt servicing can also have adverse effects on the composition of public spending by squeezing the pool of resources available for infrastructure and human capital development, with negative effects on economic growth (Sachs, 1989).

Ghana's external debt increased considerably after the implementation of the Structural Adjustment Program (SAP) in 1986 (Frimpong & Oteng-Abayie, 2006). For example, in 1970 the country's total external debt which was US$558,719,000 (26.4 percent of GNI) increased to US$3,734,252,000 (67.2 percent of GNI) in 1990. By the 2002 when the country joined HIPC countries, its total external debt was US$7,196,914,000 or 126.6 percent of GNI (Abdullahi-Hassan *et al.*, 2016). Despite the fact some of the country's debt was cancelled as a result of joining HIPC, Ghana's total external debt stood at US$23,315,992,115 as at 2017, representing 38.9 percent of GNI (WDI, 2018).

Like many developing countries, the external debt problem in Ghana started initially in the form of difficulty in servicing external loans. During the early 1980s, the country faced debt servicing challenges with foreign debt payments hitting as high as $577million which was equivalent to 114 percent of GDP in 1982 (Frimpong & Oteng,

2006). The country also spent around US$409.7 million on debt servicing in 1994, an amount was equivalent to 38 percent of export earnings and in 1995, an amount of US$635 million was spent on debt servicing, which was equivalent to about 40.2 per cent of total export earnings (Bank of Ghana, 2005). For the years under study (1980-2017), Ghana's debt service payments to export averaged 87.68 percent (World Bank, 2019). The external debt servicing challenges became pronounced because Ghana has on several times been in arrears of servicing its debt; or requested the Paris Club of bilateral creditors to reschedule its debt; or had to resort to borrowing from non-concessionary platforms of the IMF (Bank of Ghana, 2005).

Despite the rapid increase in the level of external debt, the country has experienced moderate growth in capital formation. Ghana's gross capital formation as a percentage of GDP stood at 3.75 percent in 1983 against the average of 34.9 percent in SSA. The value rose to 14.44 percent of GDP in 1990 which was still below the average of 24.22 percent in SSA. Between 1990 and 2000, gross capital formation to GDP rose by 9.56 percent reaching 24 percent of GDP in 2000. Though the value in 2000 was above the SSA average of 22.19 percent, it was still below the threshold of 27 percent to drive economic growth. The country recorded its highest gross capital formation of 30.1 percent of GDP in 2015 but this has since nosedived to 14.86 percent in 2018 below the SSA average of 20.51 percent (World Bank, 2019). This trend clearly offers a course for concern and hence needs empirical enquiry to ascertain the link between external debt servicing and capital formation in Ghana.

Additionally, the literature is replete with studies that sought to examine the effect of external debt stock on economic growth in Ghana (see Frimpong & Oteng-Abayi, 2006; Abdullahi-Hassan, *et al.,* 2016; and Matuka & Asafo, 2018). However, given the importance of capital formation in economic growth and the constraint that debt servicing imposes on it, studies are hard to find in this respect, particularly in Ghana which is currently experiencing high debt overhangs. Therefore, this study empirically examines how the government's external debt servicing affects capital formation, particularly, private and public capital within the Autoregressive Distributed Lag (ARDL) estimation framework from 1980 to 2017. The findings of this study would contribute to the unsettled debate about the exact relationship between external debt servicing and capital formation as some studies believe that there is a negative link between them (see Ndemange, 2018; Thilanka & Ranjith, 2018; Lidiema, 2017; Adamgbo & Igbasra, 2016; Abdullahi *et al.,* 2016, Clements *et al.,* 2003, Were, 2001). Other studies also support a positive relationship (Omodero, 2019; Nemlioglu & Mallick, 2020) while a few reports a neutral relationship (Austin, 2014; Adesola, 2009; Ali & Mshelia, 2007).

The rest of the study is organized as: section 2 reviews both theoretical and empirical literature which is followed by methodology and data description in section 3, while section 4 deals with the discussion of empirical results and finally, section 5 concludes the study and provides policy suggestions.

2. Literature Review

2.1 Theoretical Issues

The "dual gap" theory originally by Harrod-Domar (1946) which was later explained by Chenery and Strout (1966) has been the traditional inspiration for development economists in justifying the importance of external borrowing in closing the savings-investment gap in developing countries. The theory suggests that a certain level of borrowing by a developing economy is expected to achieve its economic growth target since the savings levels are inadequate to finance their investments.

Several hypotheses, on the other hand, have explained the adverse effects of external debt and its servicing requirement on developing countries' growth. These include the debt overhang hypothesis, the crowding-out hypothesis liquidity constraint hypothesis and the direct effect of the debt hypothesis among others. Krugman (1988) sees debt overhang as a situation in which the expected repayment of external debt falls short of the contractual value of the debt whiles Borensztein (1990) argues that debt overhang is a situation in which the debtor country benefits very little from the return to any additional investment because of the debt service obligations. So, debt overhang is where the accumulated debt serves as a tax on the future output which discourages productive investment plans by the private sector and adjustment efforts of governments. Therefore, the private investor sees debt overhang as a potential increase in taxation to repay the external debt, hence investment in the private sector tends to reduce.

On the crowding-out hypothesis, the external debt service burden on the government decreases public spending, including spending on social investments such as education and health which are central to economic growth (Senadza *et al.*, 2017). A high debt burden generally suggests that a significant percentage of government revenue or export earnings would be used to finance the debt, thereby crowding out public investment in the economy. This could then lead to a reduction in private investment since some private investments tend to complement public investment (Diaz-Alejandro, 1981; Serieux & Yiagadeesen, 2001).

The argument for the direct effect of debt hypothesis (DEDH) states that countries experiencing debt servicing challenges relative to their resources are likely to exhibit a relatively low productive investment mix. Thus, even if adverse debt servicing does not reduce saving and investment levels substantially, it could nonetheless, reduce output growth by directly decreasing productivity resulting from adverse changes in the investment mix (Fosu, 1996). The liquidity constraint hypothesis (LCH), suggests that a high debt burden affects economic growth through its impact on the balance of payments. This theory posits that countries with high debt burden tend to require sufficient foreign exchange inflows for debt servicing especially when the debtor country's currency is not traded on the international market. This may eventually necessitate devaluation/depreciation or import restrictions or both to encourage continued foreign exchange inflows, a situation which could result in imported inputs becoming very

expensive. It could also lead to a shortage of imported capital inputs, low investment and slower economic growth (Taylor, 1993).

2.2 Empirical Issues

Empirical findings on the debt servicing-capital formation relationship present mixed conclusions. For instance, in their quest to establish the relationship between multilateral lending and capital accumulation, Nemlioglu and Mallick (2020) use data for 175 countries spanning the period 1970 to 2017 and employ the GMM estimation technique. The findings reveal a positive impact of multilateral lending on capital accumulation. Similarly, Omodero (2019) used time-series data from 1996 to 2018 to assess the effect of external financing on public capital investment in Nigeria by employing the OLS method. The results show that external debt has a significant negative effect on capital investment while the effect of debt servicing cost on capital investment is positive and highly significant.

In their study, Thilanka and Ranjith (2018) investigate the effect of public debt on private investment in Sri Lanka from 1978 to 2015 by employing the Vector Error Correction Model (VECM). The findings reveal that public debt crowds out private investment considering the study period. On the relationship between government borrowing and private investment in Kenya, Lidiema (2018) empirically analyses the time-series dataset spanning the period 1975 to 2014 using the ARDL estimation technique. The findings reveal that domestic debt affects private investment adversely in the long run. A related study on Kenya by Ndemange (2018), examines the impact of external debt servicing on capital formation and economic growth for a time series dataset from 1984 to 2014. By employing the OLS technique, the results show that external debt servicing significantly and negatively affects capital formation. The result further reveals that debt servicing has a significant negative effect on economic growth through its impact on capital formation.

Abdullahi *et al.*, (2016) analyze the effect of external debt on capital formation in Nigeria using the ARDL method on a time series dataset from 1980 to 2013. The results revealed that external debt servicing has a positive effect on capital formation. A similar study by Adamgbo and Igbasra (2016) examine the effect of external debt on capital accumulation in Nigeria from the period 1981 to 2010 by using the Johansen cointegration estimation technique. The results report a negative relationship between external debt servicing and capital accumulation in Nigeria. Additionally, Adesola (2009) investigate the effect of debt servicing on economic growth in Nigeria from 1981 to 2004 using time series data. The result reveals that debt service payments to Paris Club Creditors and Promissory notes holders positively impacted GDP and gross fixed capital formation while debt service payment to London Club Creditors and Multilateral Creditors negatively retards growth and capital formation in Nigeria.

In view of the above, this adds to the extant literature by employing data from 1980 to 2017 on Ghana to examine the effects of external debt servicing on capital formation. This study departs from the existing ones by decomposing the capital

formation into private and public to ascertain how external debt servicing affects them respectively and the complementarity between them in Ghana.

3. Methodology and Data

3.1 The Empirical Model

The empirical model is based on the 2–gap model as explained by Chenery and Straut (1966) and formulated within the national income identity by Root (1978) reflects the rationale for foreign borrowing to augment internal savings for investment in the economy. This relationship is expressed as follows:

$$M_t - X_t = I_t - S_t \quad (1)$$

Where:
M_t denotes Imports at time, *t*;
X_t denotes Exports at time *t*;
I_t represents Investment at time *t*, and
S_t reflects Savings at time *t*.

Equation (1) implies that the foreign exchange gap is equal to the savings gap.

According to Sepheri and Akam-Lodhi (2005) total domestic savings is the sum of private savings and government savings, hence it can be represented as:

$$S_t = S_t^P + S_t^G \quad (2)$$

where:
S_t^P is domestic private savings, and
S_t^G is government savings.

Note that total domestic savings may be reduced by government debt service payments which are expressed as:

$$S_t^G = TR_t - DS_t \quad (3)$$

where:
DS_t is debt servicing in period *t*, and
TR_t is government total revenue in period *t*.

Therefore, Equation (3) indicates that total savings in the economy is a function of debt service payments, therefore can be expresses as:

$$S_t = f(DS_{t-1}) \text{ or } S_{t+1} = f(DS) \quad (4)$$

where:
DS_{t-1} is a one period lag of debt servicing, while

S_{t+1} is one period lead of debt servicing.

Since external debt servicing can affect aggregate capital formation through public or private capital formation channels or both, it is imperative to present analytical expression in the disaggregated forms as suggested by Kassu *et al.,* (2014). Hence three independent models are estimated, *viz* the gross capital formation model, the private capital formation model and the public capital formation model. These are subsequently presented.

3.1.1 Gross Capital Formation Model

The effect of debt and debt servicing on economic growth has been theorized to pass through its impact on the capital formation or investment (Tuffour, 2012). The effects of debt servicing on investment have been hypothesized to be negative and usually referred to as debt overhang and crowding-out effects respectively (Sachs, 1989; Krugman, 1988; Boreinsztein, 1990; Iyoha (1999), Anyanwu & Erhijakpor, 2005; Cholifihani, 2008; Abdullahi *et al.,* 2016). Based on these studies, the empirical model for the effect of external debt servicing on gross capital formation is expressed as:

$$lnCAP_t = \beta_0 + \beta_1 lnEDSt + \beta_2 lnTED_t + \beta_3 lnSAV_t + \beta_4 lnINT_t + \beta_5 lnEXP_t + \beta_6 GDPGR_t + \beta_7 lnPOP_t + \mu_t \quad (5)$$

where:
CAP is gross capital formation,
EDS is total external debt servicing,
TED is total external debt stock,
SAV is Gross national savings,
INTRATE is the real interest rate,
EXP is export,
POP is population,
GDPGR is GDP growth rate,
β_0 is the intercept,
β_1 - β_7 are the parameters to be determined, and
μ is an uncorrelated stochastic error term.

3.1.2 Private Capital Formation (Investment) Model

Private investment remains the cornerstone of renewed economic growth in developing countries and therefore countries wishing to put their economies on a faster and stable growth path need to put measures in place to accelerate the level of private investment growth (Ronge & Kimuyu, 1997). However, external debt and its servicing requirements are theorized to have a negative impact on the private capital formation (Investment) because investors tend to be scared of higher tax rates imposed on their investment for debt servicing obligations, which affects their profit levels (Iyoha, 1999; Were, 2001; Ndung'u, 2002; Thilanka & Ranjith, 2018; Lidiema, 2017). Following the aforementioned

studies, the empirical model for external debt servicing and private capital formation (Investment) is stated below:

$$lnPRI\_INV_t = \delta_0 + \delta_1 lnEDS_t + \delta_2 lnTED_t + \delta_3 lnSAV_t + \delta_4 lnINT_t + \delta_5 lnEXP_t + \delta_6 GDPGR_t + \delta_7 INFL_t + \varepsilon_t \quad (6)$$

where:
PRI_INV is private investment.
δ_1- δ_7 are the parameters to be determined, whilst
ε is also an uncorrelated stochastic error term.

3.1.3 Public Capital Formation (Investment) Model

The importance of public capital formation comes from its contribution to reducing unemployment and improving the infrastructure necessary for economic growth (Al-Dughme, 2019; Abdullahi, 2015; Abu-Ismail, 1999; Black & Lyuch, 1996). It also stimulates private investment and the development of the productive sectors of the economy (Al-Dughme, 2019). Servicing of external debt clearly affects the influence on public investment because the need to repay the principal and interest reduces the available export earnings meant for public investment in growth-enhancing projects (Tuffour, 2012). Following studies by Omodero (2019) and Picarelli *et al.,* (2019), the empirical model for the effect of external debt repayment on the public capital formation (Investment) is stated below:

$$lnPUB\_INV = \alpha_0 + \alpha_1 lnEDS_t + \alpha_2 lnTED_t + \alpha_3 lnSAV_t + \alpha_4 lnINT_t + \alpha_5 lnEXP_t + \alpha_6 lnPRI\_INV_t + \alpha_7 lnPOP + £_t \quad (7)$$

where:
PUB_INV is public capital formation (public investment),
α_0 is the intercept,
α_1 - α_7 are the coefficients to be determined with £ being the error term.

3.2 Data Sources and Variable description

The study employs **s**econdary data drawn from the World Bank (World Development Indicators) and IMF (World Economic Outlook, 2020) online datasets for the analysis and estimations. The period of study spans 1980-2019 which captures the long-term impact of the early 1980s debt crisis which called for the Structure Adjustment Programme of the IMF in 1983, the HIPC debt relief in the early 2000s by the World Bank and the effect of the 2008 global financial crisis as well as the acute electricity power crises from 2012 – 2015 in Ghana on external debt servicing and capital formation. Brief indicators of the variables and the expected signs are presented in Table 1.

Table 1: Variables and their expected signs

Variable	Indicator	Expected Sign
External debt servicing (EDS)	Total External debt servicing	Negative
Total external debt (TED)	Total external debt stock	Positive
Export (EXP)	Export (% of GDP)	Positive
Savings (SAV)	National Saving to GDP	Positive
Economic Growth (GDPGR)	GDP Growth Rate	Positive
Inflation (INFL)	Consumer Price Index	Negative
Interest Rate (INT)	Treasury Bill Rate	Negative
Population (POP)	Population growth rate	Negative
Private Investment	Credit to private sector	Positive

Source: Authors' compilation.

3.3 The Estimation Techniques

3.3.1 Stationarity Test

The stationarity test is preliminary to the analyses of macroeconomic series and also being imperative for proper modeling (Abdullahi *et al.*, 2016). Using data that are non-stationary may lead to spurious regression (Cholifihani, 2008). To establish the stationarity of variables or otherwise, the Augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) unit root tests are employed. The ADF model can be tested by the estimation of δ from the equation below:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + \Sigma i^k_{=1} \theta_i \Delta Y_{t-i} + \mu_t \quad (8)$$

where:
Δ = first difference operator;
Y = time series variable under test;
t = time;
k = appropriate lags selected;
θ = coefficients;
μ = white noise error term.

The null hypothesis, H_0: δ = 0 or ϱ= 1 (that is, the data is non-stationary or has a unit root) against the alternative hypothesis, H_1: δ < 0 or ϱ < 1 (that is, the data is stationary or has no unit root).

For the PP test, the generalized form of the equation is specified as:

$$Y_t = \lambda Y_{t-1} + \delta_0 + \varepsilon_t \quad (9)$$

where:
λ = coefficient,
ε = error term,

All other variables are as described above.

The PP just like the ADF, test the null hypothesis that there is a unit root (non-stationarity) against the alternative hypothesis that there is no unit root.

3.3.2 Cointegration Test

Once the levels of integration have been successfully determined, the likelihood of long-run relation between capital formation and the regressors is determined by using the ARDL bounds testing approach proposed by Pesaran & Shin (1999). The ARDL test has many advantages over other cointegration methods such as the Johansen co-integration, Vector Auto Regression (VAR). It uses a single reduced form equation, as against other co-integration methods which require a system of equations to establish a long-run relationship (Abdullahi *et al.*, 2016). The ARDL bound test is applicable irrespective of whether the series is I(0), I(1) or a mixture of both and it is suitable for small samples. The general ARDL Bounds testing model is shown below:

$$\Delta Q = \alpha_0 + \alpha_{1t} + \alpha_2 q_{t-1} + \alpha_3 X_{t-i} + \Sigma^n_{t=1}\alpha_4 \Delta q_{t-i} + \Sigma^n_{i=0}\alpha_i \Delta X_{t-I} + \varepsilon_t \quad (10)$$

where:
Q represents the dependent variables,
X represents the vector of regressors, and
t represents the time trend for the sample period.

Specifically, however, the three variables are expressed below:

a. The Gross Capital Formation Model

$$\Delta lnCAP_t = \alpha_0 + \Sigma^n_{i=1} b_i \Delta lnCAP_{t-i} + \Sigma^n_{i=0} c_i \Delta lnEDS_{t-i} + \Sigma^n_{i=0} d_i \Delta lnTED_{t-i} + \Sigma^n_{i=0} e_i \Delta lnSAV_{t-i} + \Sigma^n_{i=0} f_i \Delta lnINT_{t-i} + \Sigma^n_{i=0} g_i \Delta lnEXP_{t-i} + \Sigma^n_{i=0} h_i \Delta GDPGR_{t-i} + \Sigma^n_{i=0} j_i lnPOP_{t-i} + \psi_1 lnCAP_{t-1} + \psi_2 lnEDS_{t-1} + \psi_3 lnTEDt_{-1} + \psi_4 lnSAV_{t-1} + \psi_5 + lnINT_{t-1} + \psi_6 lnEXP_{t-1} + \psi_7 GDPGR_{t-1} + \psi_8 lnPOP_{t-1} + \psi_9 lnPRI\_INV_{t-1} + \varepsilon_t \quad (11)$$

b. The Public Investment Model

$$\Delta lnPUB\_INV = \alpha_0 + \Sigma^n_{i=1} b_i \Delta lnPUB\_INV_{t-I} + \Sigma^n_{i=0} c_i \Delta lnEDS_{t-I} + \Sigma^n_{i=0} d_i \Delta lnTED_{t-i} + \Sigma^n_{i=0} e_i \Delta lnSAV_{t-i} + \Sigma^n_{i=0} f_i \Delta lnINT_{t-i} + \Sigma^n_{i=0} g_i \Delta lnEXP_{t-i} + \Sigma^n_{i=1} h_i \Delta lnPRI\_INV_{t-i} + \Sigma^n_{i=0} i_i lnPOP_{t-i} + \psi_1 lnPRI\_INV_{t-I} + \psi_2 lnEDS_{t-1} + \psi_3 lnTED_{t-1} + \psi_4 lnSAV_{t-1} + \psi_5 lnINT_{t-1} + \psi_6 lnEXP_{t-1} + \psi_7 lnPOP_{t-1} + \psi_8 lnPRI\_INV_{t-I} + \varepsilon_t \quad (12)$$

c. The Private Investment Model

$$\Delta lnPR\_INV_t = \alpha_0 + \Sigma^n_{i=1} b_i \Delta lnPRI\_INV_{t-i} + \Sigma^n_{i=0} c_i \Delta lnEDS_{t-i} + \Sigma^n_{i=0} d_i \Delta lnTED_{t-i} + \Sigma^n_{i=0} e_i \Delta lnSAV_{t-i} + \Sigma^n_{i=0} f_i \Delta lnINT_{t-i} + \Sigma^n_{i=0} g_i \Delta lnEXP_{t-i} + \Sigma^n_{i=0} h_i \Delta GDPGR_{t-i} + \Sigma^n_{i=0} i_i INFL_{t-i} + \psi_1 lnPRI\_INV_{t-1} + \psi_2 lnEDS_{t-1} + \psi_3 lnTED_{t-1} + \psi_4 lnSAV_{t-1} + \psi_5 lnINT_{t-1} + \psi_6 lnEXP_{t-1} + \psi_7 GDPGR_{t-1} + \psi_8 INF_{t-1} + \varepsilon_t \quad (13)$$

where:
Δ = the difference operator,
b, c, d, e, f, g, h, i, and j are parameters of the short run dynamics.

All other variables are as described above.

The long-run relationship is established using the F-statistics to test the significance of the one lagged level variables. The joint significance of the model to be tested are:

H_0: $\psi_1 = \psi_2 = \ldots\ldots = \psi_8 = 0$ and H_1: $\psi_1 \neq \psi_2 \neq \ldots\ldots \neq \psi_8 \neq 0$.

The ARDL provides two extreme critical values which are the upper and lower bound critical values. The upper bound takes all variables to be $I(1)$ while the lower bound assumes them as $I(0)$. The bound test decision says that there is co-integration among the variables if the computed F-statistic is greater than the upper critical value. If the F-statistic falls between the lower and the upper critical values, then the test is inconclusive whilst there is no co-integration if the F-statistic is less than the lower critical value (Narayan, 2005). The long-run relationship among the variables would be examined using ARDL decision criteria by Pesaran and Shin (1999) and extended by Pesaran *et al*., (2001).

3.3.3 Error Correction Model (ECM)

After testing for the long-run equilibrium relationship that exists among the variables, the test for the short-run dynamic parameters using ECM is subsequently conducted. The ECM provides information about the speed of adjustment when there is a deviation from the long run equilibrium. The short-run dynamics help in establishing whether the impact of any external debt burden is permanent or temporary. An error correction model in its generalized form is formulated below:

$$\Delta Q = \delta_0 + \Sigma^{n}_{t=1}\delta_{1i}\Delta Q_{t-i} + \Sigma^{n}_{i=1}\delta_{2i}\Delta X_{t-i} + \ldots + \lambda ECM_{t-1} + \acute{\eta}_t \quad (14)$$

where:
λ represents speed of adjustment, and
ECM represents the residual that is estimated from the estimated co-integration models.

4. Results and Discussions

4.1 Descriptive Statistics

Table 2: Descriptive statistics of variables

Variable	Mean	Median	Minimum	Maximum	Std. Deviation
Cap. Form	17.83	18.33	3.68	29.81	7.78
Debt Serv.	16.78	11.48	2.20	54.20	13.47
TED	62.40	56.40	16.58	139.43	33.79
Savings	12.40	10.80	3.84	24.93	6.61
Inflation	27.48	18.64	7.13	122.87	25.29
GDP Growth	4.51	4.74	-6.92	14.05	3.69
Priv. Inv.	9.16	10.22	1.54	15.88	5.30
Export	241.22	103.12	31.58	828	266.99

Int. Rate	22.51	20.35	9.79	42.77	9.42

Source: Authors computation based on data from World Development Indicators, (2020).

The analysis of descriptive statistics enables us to determine whether variables are close to normal distribution Table 1 shows the descriptive statistics of all the variables in this study. The mean and the median must be equal for the variables to be normally distributed. For the variables in this study, only the GDP growth rate has the mean and median being almost equal at 4.51 and 4.74 respectively, an indication that most of the variables in the study are not normally distributed. For positively skewed data, the mean is typically higher than the median as can be seen in the case of external debt repayment to export, total external debt stock, savings, inflation as well as export of goods and services, and interest rate. For gross capital formation and private investment, the median is greater than the mean suggesting that they are negatively skewed. The maximum value was recorded for export at 828, followed by total external debt to export with 139.43 percent and inflation with 122.87 percent whilst GDP growth rate records the minimum of -6.92. This confirms the report by the Bank of Ghana (2005) that Ghana's economy recorded only modest growth with successive bouts of high inflation, the unsustainable balance of payments deficits and high debt levels.

4.2 Unit Root Test Results

Table 3: Unit root test at levels and first difference with constant

Variable	ADF Test Statistic		PP Test Statistic	
	Level	First Difference	Level	First Difference
lnCAP	-1.80	-5.09***	-1.75	-5.56***
lnEDS	-0.40	-6.30***	-0.40	-6.25***
lnTED	-1.45	-3.05**	-1.69	-3.01**
lnSAV	-2.28	-6.71***	-2.28	-6.72***
lnINT	-2.38	-6.03***	-2.30	-7.75***
lnEXP	0.63	-9.17***	0.43	-10.90***
GDPGR	-3.02**	-6.63***	-2.64*	-6.08***
INFL	-4.68***	-6.40***	-4.73***	-5.96***
LnPRI_INV	-2.00	-5.77***	-1.42	-11.08***
LnPUB_INV	-1.85	-5.16***	-1.78	-5.92***
LnPOP	-0.28	-4.36***	-1.56	-4.74***

Note: ***, **, * denote significance at 1%, 5% and 10% respectively.

The results of the stationarity test of the variables are presented in Table 3. It is evident from Table 2 that inflation (*INFL*) and GDP growth (*GDPGR*) rates are stationary at levels while the remaining variables are stationary at first difference hence the use of ARDL cointegration method is justified.

4.3 The Cointegration Results

Table 4: Pesaran bounds test of cointegration among the variables

Gross Capital Formation Model	F-statistic = 7.84	**Lower Bounds I(0)**	**Upper Bounds I(1)**
		1% (2.62)	(3.77)
	K = 7	5% (2.11)	(3.15)
Private Investment Model	F-statistic = 6.88	**Lower Bounds I(0)**	**Upper Bounds I(1)**
		1% (2.62)	(3.77)
	K = 7	5% (2.11)	(3.15)
Public Investment Model	F-statistic = 5.06	**Lower Bounds I(0)**	**Upper Bounds I(1)**
		1% (2.73)	(3.9)
	K = 7	5% (2.17)	(3.21)

Note: Critical values are obtained from Narayan (2005) and K is the number of explanatory variables in the models.

Table 4 indicates the results of the bound tests based on Pesaran *et al.,* (2001). The results of the test confirm the presence of cointegration in all the three models as the bounds test F-statistic exceed the upper critical value at all the significance levels.

4.3.1 Long Run Results for Gross Capital Formation Model

Table 5: Long run estimates based on ARDL (2, 2, 2, 2, 2, 2, 2, 0)

Variable	Coefficient	Standard Error	t-statistic	p-value
LEDS	-0.387**	0.177	-2.188	0.046
LTED	0.299**	0.268	1.116	0.021
GDPGR	0.036	0.026	1.385	0.188
LEXP	0.317**	0.158	2.006	0.025
LPOP	3.946**	2.056	1.920	0.016
LSAV	0.309**	0.147	2.099	0.044
LINT	0.788**	0.271	2.908	0.012
CONST	-3.778	1.657	-2.436	0.0288

Note: **, * denotes significance at the 5% and 10% levels respectively.

Table 5 presents the results of the long-run analysis of the effects of external debt servicing on gross capital formation in Ghana. The coefficient of external debt servicing is negative and statistically significant at 5 percent meaning a 1 percent increase in external debt servicing inhibits capital formation by 0.387 percent. The result confirms the assertion that external debt servicing discourages investment leading to the crowding-out effect on private investment through high-interest rates and this eventually leads to the imposition of higher taxes on the private sector for debt servicing since the foreign credit market may not be accessible. This means public investment debt financing can stifle private sector growth through debt servicing that would crowd out the investible resources that could be made available to the new private sector projects according to (Khan & Kumar, 1997). In addition, this finding is supported by Nwannabulke *et al*., (2016), Ndemange (2018) and Omodero (2019).

The result also indicates that the coefficient of the external debt stock has the expected sign which is positive and statistically significant at 5 percent level. Thus, a percentage increase in the external debt stock improves gross capital formation by 0.299 percent. This positive relationship is supported by the literature that external borrowing may impact positively on investment and growth up to a certain threshold level, beyond which it begins to have a negative effect as described by Cohen (1993) as the debt Laffer curve. The result corroborates the findings of Nemlioglu and Mallick (2020), Al-Dughme (2019) and Orjinta & Nwadialor (2016). The impact of GDP growth rate on gross capital formation is positive though not statistically significant and this finding is similar to that of Lidiema (2018) and Abdullahi-Hassan (2016). On the control variables, the result shows that the coefficients of export and population are positive and statistically significant at 5 percent while savings and real interest rate are significant at 5 percent levels and positive. This result is corroborated by Senadza *et al.,* (2017) that expansion in export leads to an enhancement in productivity due to technology transfers, and creates job opportunities which eventually improve economic growth. Hunt (2007) argued that higher savings lead a to a higher rate of capital formation by making available resources for investment in plants, equipment and infrastructure.

4.3.2 Short Run Results for Gross Capital Formation Model

Table 6: Short-run estimates of gross capital formation model, ARDL (2, 2, 2, 2, 2, 2, 2, 0)

Variable	Coefficient	Standard Error	t-statistic	p-value
$DlnCAP_{t-1}$	0.312***	0.113	2.761	0.001
DlnEDS	-0.109**	0.060	-1.808	0.012
$DlnEDS_{t-1}$	0.110**	0.056	-1.954	0.031
DlnTED	-0.114	0.114	-1.005	0.332
$DlnTED_{t-1}$	-0.175***	0.132	-1.326	0.001
DGDPGR	0.043***	0.001	6.465	0.000
$DGDPGR_{t-1}$	-0.017**	0.007	-2.560	0.023
DlnEXP	0.080	0.056	1.429	0.176
$DlnEXP_{t-1}$	0.108**	0.052	2.083	0.016
DlnPOP	0.587***	0.145	4.048	0.000
$DlnPOP_{t-1}$	-0.227***	0.064	-3.547	0.000
DlnSAV	0.051	0.053	0.964	0.351
$DlnSAV_{-1}$	-0.125***	0.038	-3.258	0.005
ECT_{t-1}	-0.834***	0.159	-5.245	0.000
Adjusted R^2 = 0.842; Prob. (F-Stats) = 0.000; F-Statistics = 36.763; D-W Statistic = 2.17				

Note: ***, **, * denotes significance at the 1%, 5% and 10% levels respectively.

From Table 6, the results indicate that the effect of external debt servicing on overall capital formation is negative similar to the long-run effect and this is due to the tax disincentive effect as a result of inaccessible foreign capital market to raise additional loans (Ayadi & Ayadi, 2008). However, the effect of the total external debt stock on capital formation is negative in the short-run but was positive in the long run. This means in the

short run there is crowding out of the private sector from the domestic credit market to boost production. However, in the long run, government investments in public goods tend to complement the private sector activities to enhance production. The error correction term (ECT) indicates the speed at which any disequilibrium in the model gets corrected within a year. Thus, in the short run, the variables can wander apart but will quickly converge to the long-run equilibrium (Abdullahi-Hassan *et al.*, 2016). The findings as evident from Table 5 reveal that the error correction term (ECT) of -0.834 is highly significant at 1 percent level, indicating that 83.4 percent of all disequilibria resulting from shocks in the short-run are restored the following year.

4.3.3. Long Run Estimates of External Debt Servicing on Private and Public Investment

Table 7: Estimates of long-run models of private and public investments

A: Private Investment Model, ARDL (1, 0, 2, 1, 1, 2, 2, 0) selected based on AIC				
Variable value	**Coefficient**	**Standard Error**	**t-statistic**	**p-value**
LEDS	-0.431***	0.170	-2.535	0.0004
LTED	-0.414**	0.345	-1.200	0.0221
GDPGR	0.238***	0.046	5.218	0.0000
LEXP	-0.386***	0.137	-2.818	0.0000
LPOP	0.299***	0.203	1.473	0.0000
LSAV	0.087***	0.043	2.023	0.0000
LINT	0.346**	0.186	1.859	0.0286
CONSTANT	8.054	2.046	3.935	0.2008
B: Public Investment Model, ARDL (2, 2, 2, 2, 1, 0, 2, 2) selected based on AIC				
LEDS	-0.241**	0.132	-1.829	0.0373
LTED	0.815***	0.274	2.976	0.0094
LEXP	0.063	0.152	0.417	0.6829
LPOP	4.964**	1.859	2.670	0.0175
LSAV	0.152**	0.082	1.815	0.0295
LINT	0.633**	0.261	2.427	0.0283
LPRI_INV	0.444***	0.122	3.651	0.0024
CONSTANT	-10.003	2.909	-3.439	0.0015

Note: ***, **, * denotes significance at the 1%, 5% and 10% levels respectively.

From Table 7, the effect of external debt servicing on both private and public investment is negative and statistically significant at 1 and 5 percent levels respectively. This implies a 1 percent increase in external debt servicing is expected to reduce private investment by 0.431 percent and public investment by 0.241 percent. The impact of debt servicing is higher on private investment than on public investment due to overly domestic interest rate charges and seemingly shut down of the foreign credit market hence the fear that tax rates will be increased in future for debt repayment (Levy & Chowdhurry, 1993). This finding corroborates the study by Were (2001) that debt servicing negatively affects private investment in Kenya and is consistent with the study of Mbanga & Sikod (2001). The results further indicate that private investment and public investments are

complementary (Diaz-Alejandro, 1981). That is, a 1 percent increase in private investment is expected to increase public investment by 0.444 percent, all other things being equal. The complementarity may be explained that as public investment goes into infrastructural projects such as schools, electricity power generation and distribution, roads and highways among others, it tends to increase the marginal productivity of private capital through cost reduction of private firms.

4.3.4 Short Run Estimates for Private and Public Investment

Table 8: Short run estimates for private and public investment models

A: Private Investment Model, ARDL (1, 0, 2, 1, 1, 2, 2, 0) selected based on AIC				
Variable	**Coefficient**	**Standard Error**	**t-statistic**	**p-value**
DlnEDS	0.484***	0.099	4.889	0.0001
$DlnEDS_{t-1}$	0.363**	0.128	2.847	0.0103
DGDPGR	0.088***	0.013	6.762	0.0000
DINFL	-0.251***	0.030	8.333	0.0000
DlnEXP	0.390***	0.058	6.705	0.0000
$DlnEXP_{t-1}$	-0.144**	0.051	-2.847	0.0103
DlnSAV	0.345***	0.049	7.012	0.0000
$DlnSAV_{t-1}$	-0.119**	0.042	-2.819	0.0110
ECT_{t-1}	-0.557***	0.059	-9.379	0.0000
Adjusted R2 = 0.758; DW-statistic = 1.99; F-Statistic = 82.052; Prob(F-Statistic) = 0.000				
B: Public Investment Model, ARDL (2, 2, 2, 2, 1, 0, 2, 2) selected based on AIC				
$LPUB\_INV_{t-1}$	0.413***	0.084	4.891	0.0002
$DlnEDS_{t-1}$	0.013***	0.056	5.397	0.0001
$DlnTED_{t-1}$	-0.628***	0.150	-4.172	0.0008
DlnEXP	0.137**	0.051	2.688	0.0168
DlnPOP	7.254***	0.921	7.876	0.0000
$DlnINT_{t-1}$	-0.170**	0.065	-2.604	0.0199
DlnPRI_INV	0.280***	0.084	3.342	0.0045
$DlnPRI\_INV_{t-1}$	0.286***	0.084	3.413	0.0039
ECT_{t-1}	-0.890***	0.106	-8.360	0.0000
Adjusted R^2 = 0.86; DW-statistic = 2.18; F-Statistic = 40.71; Prob(F-Statistic) = 0.000				

Note: ***, ** denotes significance at the 1% and 5% levels respectively.

Table 8 presents the results of short-run estimates of the effects of external debt servicing on private and public investment using the Error Correction Model. In the short run, as evident from the table, the effect of external debt servicing is positive for both private and public investment and statistically significant at 1 percent level. The positive impact of debt servicing in the short run is what Fosu (1996) termed the direct effect of the debt hypothesis (DEDH). Fosu (1996) argued that due to potential debt servicing challenges, short-term investments would be favoured (due to their relatively faster returns) over longer-term investments. The effect of the total debt stock is negative for public investment due to the fact that public investments take time to actualize due to the

bureaucracies involved in executing public projects (Harisson *et al.,* 2004). The complementarity of public and private investments is again established in the short run. This suggests that public investment can facilitate new capital formation to enhance economic growth through its impact on private sector economic activities as highlighted. The findings also show that the coefficient of the error correction term (ECT_{t-1}) for the private investment model is -0.557 and that of public investment model is -0.890 and are both highly statistically significant at 1 percent levels. This suggests that 55.7 percent of disequilibrium from shocks in the short-run from the private investment model and 89 percent of disequilibrium resulting from shocks in the short-run from the public investment model would be stabilized in the ensuing year.

4.3.5 Diagnostic Tests

The following diagnostic tests are undertaken by the study to ascertain the robustness of the estimated results as shown in Table 9. They include; Autocorrelation Test, Heteroscedasticity Test, Jarque-Bera Normality Test, Stability Test using CUSUM of Squares and the Ramsey Reset test for functionality. The study adopted the Breusch–Godfrey (BG) Test given that it avoids the pitfalls of the Durbin-Watson (DW) test. Also, the Breusch–Pagan–Godfrey (BPG) Test is carried out to examine the presence of heteroscedasticity instead of the Goldfeld–Quandt test due to its superiority. The results indicate that all three models are good and well-specified because of the absence of both serial correlation and heteroscedasticity. The models are free from autocorrelation at the 5 percent level indicating evidence of non-randomness as well as presence of homoscedastic since the null hypothesis of homoscedasticity cannot be rejected at the 5 percent significance level which suggests a level of consistency and makes it easier to model and work with the data in the regression analysis.

Table 9: Results of Diagnostic Tests

	F-statistic	**LM Statistics**
Gross Capital Formation		
1. Autocorrelation	2.02 (0.150)	5.99 (0.039)
2. Heteroscedasticity	1.784 (0.199)	26.21 (0.199)
3. Normality	3.786 (0.151)	Not applicable
4. Functional Form	1.105 (0.312)	Not applicable
Private Investment Mode		
1. Autocorrelation	0.021 (0.885)	0.036 (0.041)
2. Heteroscedasticity	0.783 (0.687)	14.30 (0.576)
3. Normality	1.204 (0.548)	Not applicable
4. Functional Form	0.089 (0.769)	Not applicable
Public Investment Model		
1. Autocorrelation	1.274 (0.277)	2.817 (0.013)
2. Heteroscedasticity	1.859 (0.112)	25.649 (0.178)
3. Normality	1.112 (0.574)	Not applicable
4. Functional Form	0.120 (0.733)	Not applicable

Note: P-values are in parenthesis.

All the models passed the normality test since the probability values are greater than 0.05 (5% significance level). Also, the Ramsey Reset test for functionality defines that the models have been well specified and functionally formed and fitted. Test for the stability of the models was also conducted using the CUSUM test as shown in Figures 1, 2 and 3. The straight lines in all the three figures represent critical bounds at 5 percent significance level.

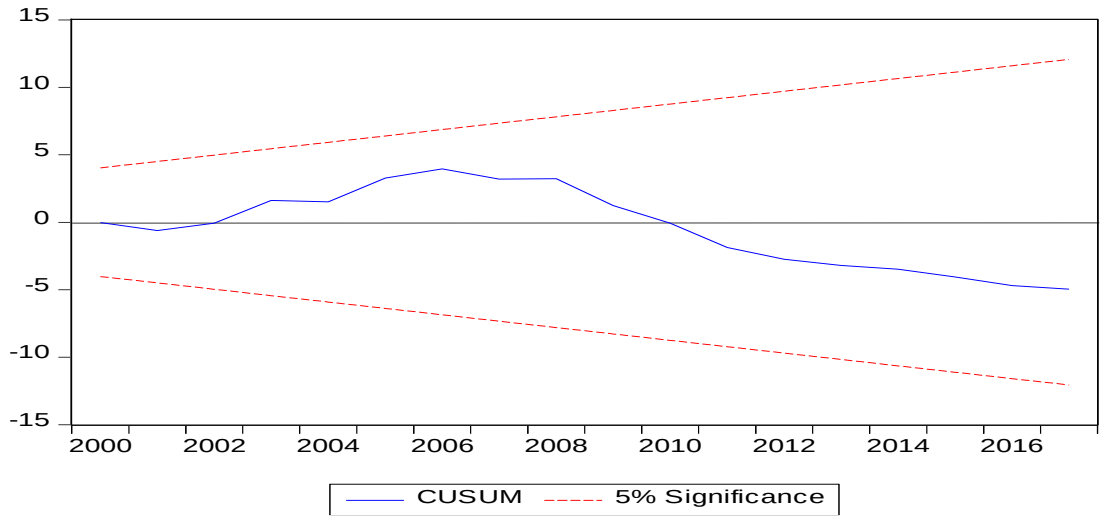

Figure 1: Plot of Cumulative Sum of Recursive Residuals for Gross Capital Formation

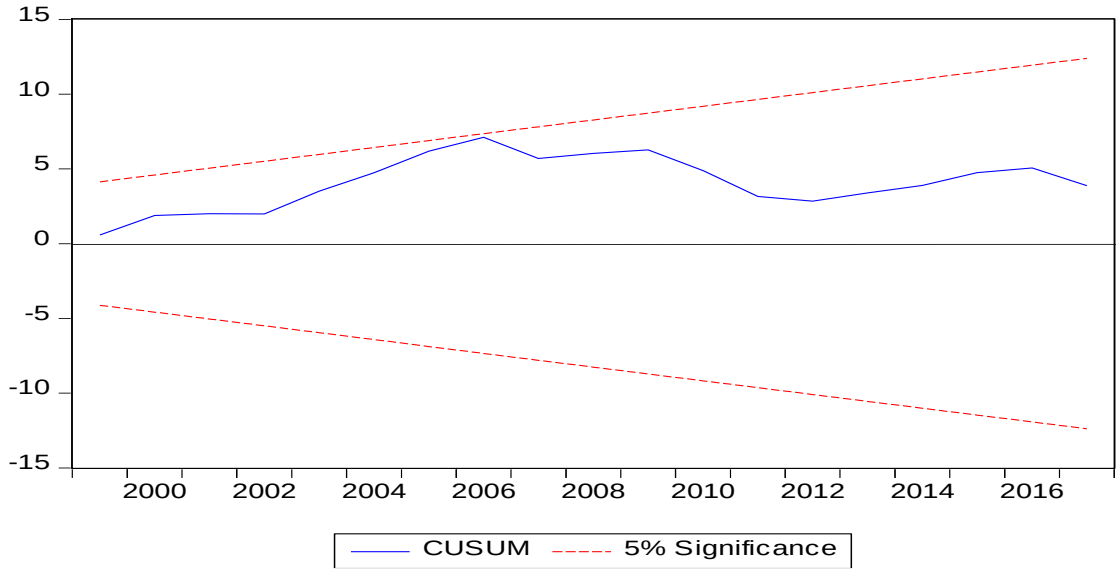

Figure 2: Plot of Cumulative Sum of Recursive Residuals for private investment model

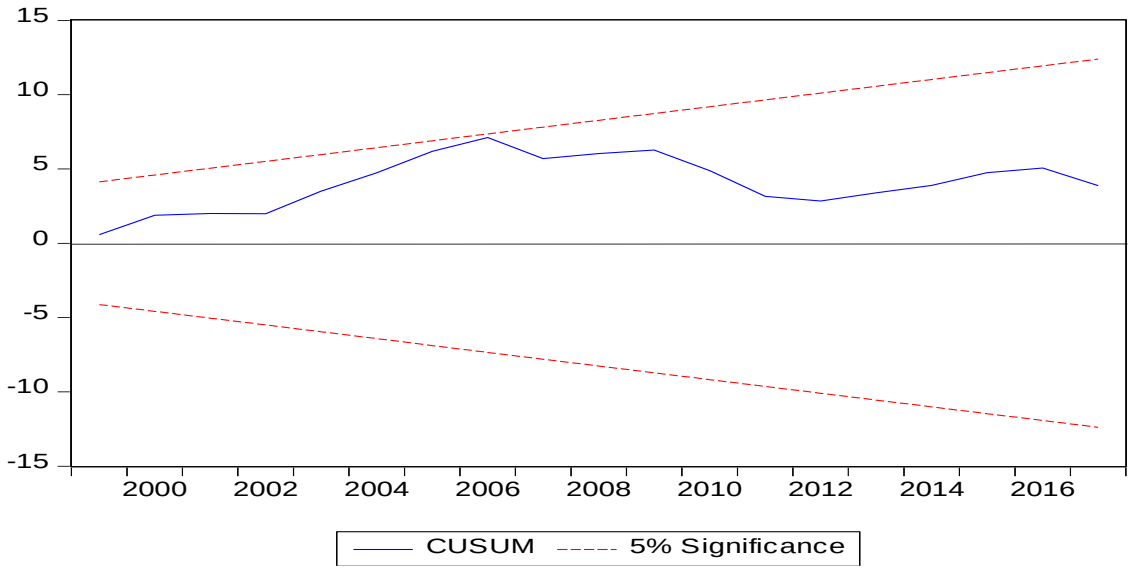

Figure 3: Plot of Cumulative Sum of Recursive Residuals for public investment model

5. Conclusion and Recommendation

Ghana has mostly relied on external funding to fill the financing gap resulting from the incessant dearth of domestic sources of finance. This external finance enables foreign capital inflows for long term investment and provides the needed capital to propel economic growth. However, servicing of this external finance by governments of developing countries has been identified to exert influence on capital formation in the domestic economies, albeit contentious. As a result, this study uses the ARDL bounds testing technique to examine the effects of external debt servicing on capital formation for the period 1980 to 2017. The findings suggest that external servicing inversely affects overall capital formation, but its effect on the disaggregated form reveals that private capital formation is more affected than public capital formation. This confirms the crowding-out effect of debt servicing on private investment through high-interest rates and taxes on the private sector in Ghana. The results further indicate that the total external debt stock positively impacts overall capital formation and public investment but has a negative effect on private investment due to the tax disincentive effect as private incomes are taxed to finance the debt thereby reducing the ability to accumulate capital for investment.

The private investment model shows that the influence of foreign loans, in the long run, leads to the crowding-out effect of private investment. The transmission mechanism of this process is that the high accumulation of external debts signals to investors of a possible increase in the marginal tax rate in the future for debt repayment and most investors are likely to move their investment elsewhere. Additionally, the government on its part tends to respond to such high debt stock and its servicing obligations by relying on domestic financial institutions for funds which results in high-interest rates. So, it can be stated that external debt servicing affects domestic private investment

through interest rates and tax distortions. The findings also reveal that public investments tend to complement private investments as government investment in the provision of public goods creates the bases for vibrant private sector activities.

For purposes of the policy, the study recommends that external borrowing should be controlled to levels that would impact the economy positively, hence the critical threshold should be determined and strictly applied. More importantly, the external loans should be contracted to investment in self-sustaining projects that would generate enough returns for debt serving with no adverse effect on capital formation. For enhanced revenue, the government should diversify the domestic revenue generation sources by broadening the tax net to cover the informal sector and blocking the revenue leakages in the country so as to reduce the over-reliance on foreign loans.

Conflict of Interest Statement

The authors declare no conflicts of interest with any organization or entity in financial or non-financial terms for writing this article.

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