Intertemporal Government Budget Constraint: Debts and Economic Growth in Ethiopia, 1990–2018

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Abstract

This paper uses the intertemporal government budget constraint model, linear logarithmic functions (for better regression results), annual time series data and the generalized least squares technique to examine the effects of external debt and external debt servicing on economic growth in Ethiopia between 1990 and 2018. Alemayahu and Zerfu (1998) confirm that the level of debt in Ethiopia is beyond the capacity of the country to service it.

This problem then begs the following major research questions: Does external debt or its servicing crowd out investment in Ethiopia? What have been the effects and estimates of (i) external debt and (ii) external debt servicing on economic growth in Ethiopia? The major hypotheses are: (a): External debt does not enhance economic growth. (b) External debt servicing depresses economic growth.

Data were collected from the World Bank and United Nations. The major findings of the paper are: (1) That increases in external debt enhanced economic growth in Ethiopia within the sample period, *ceteris paribus*; and (2) That external debt servicing had negative effect on economic growth in Ethiopia.

The paper also suggests maintaining reasonable levels of external debt by the government of Ethiopia to enhance economic growth, and avoiding excessive borrowing that might create difficulties in debt servicing (i.e. debt overhang). As a result of its findings, one future research topic this paper would proposes is: "Determination of the Sustainable Debt Levels for Enhancing Rapid Economic Growth in Ethiopia."

Keywords: intertemporal government budget constraint, external debt, debt servicing, and economic growth.

JEL classification: F34, O4, O47

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1. Introduction

Many macroeconomic analysts and policy makers argue that fiscal deficit does not enhance economic growth and can affect future economic growth by crowding out private investment expenditure. Concern about public debts has led some governments to embrace fiscal restraints in order to reduce levels of outstanding debt (Elliott and Kearney, 1988), although economic theory suggests that reasonable levels of borrowing by a developing country are likely to enhance its economic growth through capital accumulation and productivity growth (Ayele and Kalluraya, 2017).

In order to solve external debt problems, Shabbir and Yasin (2015) suggest that developing countries need to mobilize their own resources and minimize dependence on external borrowing as much as possible. External debts are typically contracted to finance the public investment needs required to enhance the economic growth of a country, but debt servicing can easily crowd out investments in the agricultural and service sectors, causing a reduction in the size of the manufacturing sector.

The result is that large debt repayments impose constraints on economic growth by draining away the limited resources that could have been spent on domestic development needs. Indeed, the external debt for Ethiopia is expected to increase significantly in the near future due to the need to secure finance from external sources to undertake infrastructure projects (Mohanty, 2017). Although nominal debt outstanding has increased dramatically, the deflated series data have tended to be low in recent years (Elliott and Kearney, 1988**).**

Research studies on the influence of external debt on economic growth have, however, shown mixed results. For instance, among similar empirical results, Jonse (2002) found that external debt has no direct effect on economic growth in Ethiopia, while Mohanty (2017) decided that external debt contributed positively to economic growth in Ethiopia.

Given this dichotomy of views, this study has employed the intertemporal budget constraint model and empirical data to examine the influence of external debt on economic growth in Ethiopia from 1990 to 2018.

2. Literature Review

Fiscal deficit is a common problem for the majority of developing countries. According to the World Bank (2017)**,** fiscal deficits have been increasing in most emerging and developing economies worldwide. The majority of these economies have strengthened their policies and accumulated significant savings over the past two decades, but they have still failed to resolve their fiscal or economic problems.

In emerging countries, fiscal deficits on average continuously rose from about 1% of GDP back in 2007 up to around 5% of GDP in 2016 (Kose et al., 2017). Nevertheless, although fiscal deficits have been continuously increasing in emerging countries worldwide, the effect on economic growth generally in developing countries still lacks sufficient empirical evidence (Tung, 2018).

Consideration of the issue is compounded by contradictory conclusions from available research results. For example, Cebula (1995), Ghura (1995), Biza et al. (2015) and Arjomand et al. (2016) find that there is evidence that shows the negative effects of fiscal deficit on economic growth. However, Ahmad (2013) and other researchers have found that fiscal deficit can have a positive effect on economic growth while Rahaman, (2012); Velnampy and Achchuthan, (2013); Tung, (2018) see the effects on economic growth as relatively insignificant.

Tung (2018) examines the effect of fiscal deficit on economic growth in Vietnam where the Vietnamese government has been facing large fiscal deficits for many years. He employs the Error Correction model on the quarterly data for 2003–2016; and his empirical results indicate that fiscal deficit during the sample period had harmful effects on economic growth in both short and long run. He also confirms that a fiscal deficit can hurt not only the gross output but also private investments, foreign direct investments, and net exports.

Navaratnam and Mayandy (2016) employ cointegration analysis, error correction modelling and Granger causality test under a Vector Autoregression (VAR) framework to examine the effect of fiscal deficit on economic growth in several selected South Asian countries, Bangladesh, India, Nepal, Pakistan and Sri Lanka, using time series annual data over the period 1980 to 2014. Their results confirm that during the sample period fiscal deficit had a negative effect on economic growth in these countries though there is the exception of Nepal, where the fiscal deficit had a positive effect on economic growth.

Rana and Wahid (2017), conducting a time–series analysis using data covering the period 1981 to 2011, while using ordinary least squares estimation, vector error correction model, and granger causality tests, found that the government budget deficit had a statistically significant negative impact on economic growth in Bangladesh. Kurantin (2017) using data for the period 1994 to 2014 finds that the budget deficit had adverse effects on economic growth in Ghana during the sample period. Huynh (2007) analysed data on Vietnam for the period 1990 to 2006 finding the budget deficit had a negative effect on the country's GDP growth rate.

One of the greatest problems facing economic growth in many Sub–Saharan African countries, including Ethiopia, is certainly very high indebtedness, indebtedness beyond repayment capacity. The external debt problem has been becoming more acute because the size of the debt relative to the size of the economy is so huge that it causes capital flight, as well as discouraging private investment; and debt servicing payments take up a significant proportion of annual export earnings. In other words, meeting debt servicing obligations significantly drains the resources that could otherwise have been used for financing basic services needed for the welfare of the citizens (Ajayi, 1991, p.1; Maruta, 2013, p.5).

Foreign borrowing may be beneficial for low income countries in need of inducing substantial investment, and attaining rapid economic growth. However, these countries soon face difficulties in both servicing their debt obligation as scheduled, and attaining a rapid economic growth. Frequent large debt repayment means the external debt stock continues to grow and reduces future output growth potential.

External debt repayments drain the available resources needed for the sustenance of economic growth of a country like Ethiopia (Pattillo et al. 2004, p.5).

Ethiopia as a result of its huge debt service obligations, has benefited very little from the marginal rates of return generated from any additional investments that new external loans provide. Debt servicing has drained the foreign currency reserves required for the import of capital goods and machinery for further investment and economic growth (Maruta, 2013, p.6). The Ethiopian economy is characterized by: low human development index (0.47%), relatively low life expectancy (66.2 years), low road density (12 km. of road per 100 sq. km.), and reasonable capital investment as a percent of GDP e.g. 34% in 2017 (World Bank, 2017).

The country requires huge investments to overcome the lack of development demonstrated by these figures. Financing the necessary major investments through domestic resource mobilization is exceptionally difficult for the government because the country's financial system is underdeveloped and characterized by: low population to financial service coverage, only 136 bank accounts per 1000 adults in 2018, bank credit to private sector as percent of GDP (only 18% in 2018), and low branch branches per 100,000 people (2.93 in 2018). The country's tax system is also underdeveloped, having a low tax to GDP ratio (7.5% in 2018) and reasonable savings to GDP ratio of only 33%.

With no other source of funding, the government has had no other option apart from external borrowing to finance major investments. The result is that the country's external debt has been increasing steadily and servicing huge debts has had adverse effects on the domestic economy (World Bank, 2019).

However, Maruta (2013) examining the effect of external debt on economic growth in Ethiopia using data covering the period 2000–2010, found external debt did not affect economic growth and that debt service payments had a positive influence on gross domestic product. According to Ayele and Kalluraya (2017) low–income countries like Ethiopia frequently keep on taking debts because they are in the phase of development and need extreme support in this regard.

Clements et al. (2003) suggested that foreign borrowing has a positive impact on investment and economic growth of a country if only up to a threshold level after which external debt service would adversely affect economic growth as most of the funds would be remitted for the repayment of debt rather than used as investments. More generally, economic theory suggests that reasonable levels of borrowing by a developing country are likely to enhance economic growth as Ayele and Kalluraya, (2017) indicate for Ethiopia.

However, Alemayahu and Zerfu (1998) confirm that the level of debt in Ethiopia is beyond the capacity of the country to service it. Ethiopia, in fact, faces debt problems arising from repayment because servicing debts costs more than the amounts borrowed.

The indications and uncertainties in the literature provided motivation of the need to conduct a country specific study to investigate the effect of public debt on economic growth in Ethiopia from 1990 to 2016 not least because, although it remains an agrarian economy with more than 30 percent of its population classified as poor, it is endowed with abundant natural resources which should be able to create favorable conditions for rapid economic growth.

3. Theoretical Framework

3.1 Intertemporal budget constraints

There are two approaches to the study of intertemporal budget constraint (IBC). One technique analyses the budget constraint mathematically; the other technique examines the IBC econometrically (Landolfo, 2008). The theoretical framework for subsequent empirical analysis consists of the following fiscal deficit arithmetic:

$$B_t = B_{t-1} + r_t B_{t-1} + G_{t-1} - T_{t-1}. \tag{2.1}$$

Where B_t is public debt at the beginning of the fiscal year t, B_{t-1} is public debt at the beginning of the fiscal year $t-1$, r_t is the real interest rate at the beginning of year t, $r_t B_{t-1}$ are interest payments at the beginning of the fiscal year t, G_{t-1} is the government expenditure net of interest during the fiscal year $t-1$, and T_t are tax revenues net of transfers during the fiscal year $t-1$.

Rewriting Equation 2.1 provides Equation 2.2., which is the exact opposite of the theoretical framework of what this study represents, whereby $-(T_{t-1} - G_{t-1})$ technically represents government deficit and new government borrowing is given by $(B_t - B_{t-1})$ during the fiscal year t.

$$-(T_{t-1} - G_{t-1}) = (B_t - B_{t-1}) - r_t B_{t-1}. \tag{2.2}$$

Thus, in the theoretical framework of the study for this paper, budget constraint is given by

$$(T_{t-1} - G_{t-1}) = (B_t - B_{t-1}) - r_t B_{t-1}. \tag{2.3}$$

Equation 2.3 is an intertemporal budget constraint that can be derived by supposing that government can collect tax revenues and spend its incomes in two fiscal periods, denoted by subscripts $t-1$ and t. In each period government can collect taxes (T) and choose how much to spend (G) as well as purchase bonds (B) and pay for the bonds at a constant interest rate (r) (Obstfeld and Rogoff, 1996, pp.76–78; Doppelhofer, 2009).

The budget constraint arising from the tax revenues and government spending for the two periods, therefore, becomes:

$$T_{t-1} = G_{t-1} + B_{t-1}. \tag{2.4}$$

$$T_t + B_{t-1}(1 + r_t) = G_t + B_t. \tag{2.5}$$

Hence, Equations 2.4 and 2.5 for the two periods can be combined and rewritten as an intertemporal budget constraint given by

$$T_{t-1} + \frac{T_t}{1+r_t} = G_{t-1} + \frac{G_t}{1+r_t} + \frac{B_t}{1+r_t}. \tag{2.6}$$

Consequently, manipulation of either Equation 2.5 or Equation 2.6 provides Equation 2.3. This indicates the intertemporal budget constraint consists of tax revenue, government spending, government deficits, government savings and debts. It implies the effects of the intertemporal budget on economic growth is the same as the effects of tax revenue, government spending, government deficits, government savings and debts on economic growth.

To examine the effects of government deficits on real income and consequently economic growth, it is appropriate to begin with some national income accounting identities. Thus, real GDP (Y_t) is composed of consumption (C_{nt}), savings (S_t), and taxes (T_t).

$$Y_t = C_{nt} + S_t + T_t. \tag{2.7}$$

Therefore, real income (Y_t) increases in line with either household consumption (C_{nt}), investment spending (I_t), government spending (G_t), or the level of foreign exports (X_t), minus import (M_t).

$$Y_t = C_{nt} + I_t + G_t + X_t - M_t. \tag{2.8}$$

Equating Equations 2.7 to 2.8 gives:

$$-(G_t - T_t) = (X_t - M_t) + (S_t - I_t). \tag{2.9}$$

Equation 2.9 implies that the government budget deficit equals the trade surplus plus the excess of investment over savings (Bernheim, 1988).

Equation 2.8, the equation must be rewritten in logarithm form as follows:

$$Y_t = C_{nt}^{\beta_1} I_t^{\beta_2} G_t^{\beta_3} X_t^{\beta_4} M_t^{-\beta_5}. \tag{2.10}$$

Or $\log(Y_t) = \beta_1 \log(C_{nt}) + \beta_2 \log(I_t) + \beta_3 \log(G_t) + \beta_4 \log(X_t) - \beta_5 \log(M_t).$ (2.11)

Next, suppose that government deficit is defined as $\log(G_t/T_t)$ then

$$\log(G_t/T_{nt}) = \log(G_t) - \log(T_t). \tag{2.12}$$

Thus, substituting Equation 2.12 in Equation 2.11 provides

$$\log Y_t = \beta_1 \log C_{nt} + \beta_2 \log I_t + \beta_3 \frac{G_t}{T_t} + \beta_6 \log T_t + \beta_4 \log C_{nt} - \beta_5 \log M_t + u_t. \tag{2.13}$$

From Equation 2.13 it can be discerned that government deficit and tax revenues have positive effects on real income and consequently economic growth.

3.2 Government borrowing choices and constraints

Consumption choices made over time are called intertemporal choices (Varian, 2010) pp.182–184). Assume that government can choose how much spending to incur in each of two time periods. We denote the amount of government spending in each period by (G_{t-1}, G_t) and suppose that the amount of expenditure is at constant prices. The amount of money the government will have as tax revenue in each period is denoted by (T_{t-1}, T_t).

The Government Intertemporal Budget Constraint 1 (Ricardian Equivalence)

Government spending (i.e. purchases) is its consumption, while tax revenue is its income. Government saving is defined as part of national income that is saved. Government saving (S_g) is tax revenue (T) minus government expenditure (G) and is given by

$$S_g = T - G. \tag{3.1}$$

Meanwhile, government deficit $(G - T)$, is defined as government saving preceded by a minus $(-S_g)$ (Krugman, Obstfeld and Melitz, 2012, p.304; Blanchard and Johnson, 2013, pp.496–497) and is given by

$$GD = -(T - G). \tag{3.2}$$

The paper analyses the welfare effects of timing in lump–sum taxation in the presence of government expenditure.

In this dynastic model, government has the authority to levy taxes on consumers and sequentially spends (G) the taxes it collects. The sequence of both debts (D) and taxes (T) overtime satisfies a budget constraint (B) at every time t and is given by

$$G_t + GB_{t-1} = r_t GB_{t-1} + T_t. \tag{3.3}$$

Or $$T_t - G_t = GB_{t-1} - r_t GB_{t-1}. \tag{3.4}$$

Or $$GB_t = GB_{t-1} - r_t GB_{t-1}. \tag{3.5}$$

Or $$\Delta D_t = \Delta D_{t-1} - r_t . \Delta D_{t-1}. \tag{3.6}$$

Thus $$D_t = D_{t-1} - r_t . D_{t-1}. \tag{3.7}$$

Also let $$GB_{t-1} = \omega D_{t-1}. \tag{3.8}$$

Hence, substitution of Equations (3.8) in Equation (3.4) gives Equation (3.9)

Or $$T_t - G_t = wD_{t-1} - wr_t D_{t-1}. \tag{3.9}$$

The Ricardian Equivalence requires that sources and uses of funds must equalize in every period. Thus, government borrows funds to finance expenditures (G_t) to repay debts (GB_{t-1}) i.e. bonds that are issued at time $t-1$ that must be settled at time, t.

Therefore, the sources of funds are lump–sum taxes (T_t) and new government borrowing (GB_t) and r_t is the interest on the bonds (Krusell, 2004, p.166).

The Government Intertemporal Budget Constraint 2 (Intertemporal Choices)

Here the government is assumed to be borrowing at interest rate r_t. If government decides to be a borrower, its first period consumption (G_{t-1}) is greater than its first period income (T_{t-1}). Thus, the government is a borrower if $G_t > T_t$, and the interest that government has to pay is $r_t(T_{t-1} - G_{t-1})$.

Meanwhile, government also has to pay back the amount that it has borrowed $r_t(T_{t-1} - G_{t-1})$ (Varian, 2010, pp.182 – 184). Therefore, the budget constraint is given by

$$G_t = T_t - (T_{t-1} - G_{t-1}) - r_t(T_{t-1} - G_{t-1}). \qquad (3.10)$$

Rearranging Equation 10 provides

$$T_{t-1} - G_{t-1} = (T_t - G_t) - r_t(T_{t-1} - G_{t-1}). \qquad (3.11)$$

3.3 Regression Analyses

Relevant regression econometric analyses were performed after making sure that time series data for each of the variables were stable. Some of the variables were made stable by dividing each of them by an appropriate numeraire. For each of the 24 regression results the coefficient of determination was very high, mainly due to the application of the national income model and variables from the national income model when running each of the respective regressions.

The t –tests showed that the coefficients of elasticity of each of the variables in the respective regression results was greater than the corresponding critical t value from the $t -$ distribution table. So, each of the variables in the regression results had significant influence on the respective independent variables. The F –statistic for each of the regression results indicates that the independent variables for each of the respective regressions had a joint effect on each of the respective independent variables. It implies that each of the respective $F -$ statistics appearing in the respective regression results was greater than the corresponding critical F value from the $F -$ table.

The DW test indicated that each of the 24 regressions was free from serial correlation, and finally, that the test for heteroskedasticity, the H_T –statistic for each of the 24 regressions was less than the critical t value from the $t -$ table, showing that each of the 24 regressions reported was free from heteroskedasticity.

Various western international organizations have criticized higher government spending but the government of Ethiopia continued to implement its fundamental principle of government intervention and investment for high social return. And it is clear, this bold policy has generated sustained economic growth and social transformation.

High government spending and pro–poor resource allocation decreased absolute poverty from 44 percent in 2000 to 26 percent in 2014 (Teshome, 2015). Economic growth during the 1992 to 2016 was generated by household consumption (0.79%), investment spending (0.23%), government spending (0.12%), exports (0.11%) and imports (-0.241%) following a 1% increase in each of the given variables as shown in Regression Model 1.

Regression Model 1

Dependent Variable: $(d(\log(Y_t)))/d(\log(S_t)))/d(d((d(Y_t))^2))$

Variable	Coefficient	t-statistic
$(d(\log(Cn_t)))/d(\log(S_t)))/d(d((d(Y_t))^2))$	0.788	29.22
$(d(\log(I_t)))/d(\log(S_t)))/d(d(d((Y_t))^2))$	0.228	18.70
$(d(\log(G_t)))/d(\log(S_t)))/d(d((d(Y_t))^2))$	0.116	20.13
$(d(\log(X_t)))/d(\log(S_t)))/d(d((d(Y_t))^2))$	0.105	5.42
$(d(\log(M_t)))/d(\log(S_t)))/d(d((d(Y_t))^2))$	-0.244	-15.13

$R^2 = 0.9988$ $DW = 1.93$ $F = 4296$ $H_T = 0.033$

Included observations $= 1993 - 2018$ Sample (adjusted) $= 26$

Similarly, Regression Model 2 shows that economic growth in Ethiopia during the sample period was caused by an increase in disposable income (0.61%) and tax revenues (0.15%) as a result of 1 percent increase in each of the respective variables.

Regression Model 2

Dependent Variable: $(d(\log(Y_t)))/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$(d(\log(Yd_t)))/d(d(Y_t^2))$	0.609	15.35
$(d(\log(T_t)))/d(d(Y_t^2))$	0.145	18.05

$R^2 = 0.9779$ $DW = 1.92$ $F = 1109$ $H_T = 0.057$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

Regression Model 3 indicates that the increase in tax revenue had a positive and significant effect on economic growth during the sample period because a 1 percent increase in economic growth is associated with 0.93%, 0.30%, 0.03%, 0.15% and -0.09% increases respectively in household consumption, investment spending, exports and imports, *ceteris paribus*. According to Gabato (2017), the positive effect on economic growth rate can be influenced by taxation if economic growth is indirectly driven by tax revenues, especially when taxes are used to finance investments in public goods, particularly goods generating positive externalities (infrastructure, education and public health).

Regression Model 3

Dependent Variable: $(d(\log(Y_t)))/d(d(X_t))/d(d((d(Y_t))^2))$

Variable	Coefficient	t-statistic
$(d(\log(C_{nt})))/d(d(X_t))/d(d((d(Y_t))^2))$	0.931	43.82
$(d(\log(I_t)))/d(d(X_t))/d(d((d(Y_t))^2))$	0.297	35.55
$(d(\log(T_t)))/d(d(X_t))/d(d((d(Y_t))^2))$	0.025	5.60
$(d(\log(X_t)))/d(d(X_t))/d(d((d(Y_t))^2))$	0.152	8.51
$(d(\log(M_t)))/d(d(X_t))/d(d((d(Y_t))^2))$	-0.087	-7.74

$R^2 = 0.9988$ $DW = 1.93$ $F = 4296$ $H_T = 0.033$

Included observations $= 1993 - 2018$ Sample (adjusted) $= 26$

From Regression Model 4 it can be clearly seen that there is almost a one-to-one relationship between disposable household income growth and economic growth. During the sample period, the contribution of increased household disposable income (0.97%) to economic growth, following a 1% rise in household disposable income, was much more than the contributions from the growth in government spending (0.15%), exports (0.17%) and exports (-0.22%), following a 1% rise in each of the independent variables.

Regression Model 4

Dependent Variable: $(d(\log(Y_t)))/d(S_t)/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$(d(\log(Y_{dt})))/d(S_t)/d(d(Y_t^2))$	0.969	27.32
$(d(\log(G_t)))/d(S_t)/d(d(Y_t^2))$	0.152	37.75
$(d(\log(X_t)))/d(S_t)/d(d(Y_t^2))$	0.167	4.39
$(d(\log(M_t)))/d(S_t)/d(d(Y_t^2))$	-0.216	-10.35

$R^2 = 0.9976$ $DW = 1.97$ $F = 3137$ $H_T = 0.430$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

From Regression Model 5 it can be confirmed that an increase in tax revenue has the potential of generating economic growth. This result shows that a 1% increase in household consumption, gross savings and tax revenue during the sample period might have caused economic growth to increase by 0.68%, 0.17% and 0.02% respectively, *ceteris paribus*.

Some researchers have found a positive relationship between tax revenues and economic growth. For instance, Sekou (2015) and Babatunde et al. (2017) find significant and positive correlations between tax collection and economic growth in Mali and Africa respectively.

Similarly, Chigbu et al. (2012), Ogbonna and Appah (2012) and Ihenyen, and Ebipanipre (2014) find that that tax reform is positively and significantly related to economic growth in Nigeria. They conclude that tax reforms would improve the government revenue capacity to undertake socially desirable expenditure to translate to economic growth in real output and per capita basis.

Regression Model 5

Dependent Variable: $(\boldsymbol{d}(\log(Y_t)))/d(log(X_t))/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$(\boldsymbol{d}(\log(C_{nt})))/d(log(X_t))/d(d(Y_t^2))$	0.678	93.75
$(\boldsymbol{d}(\log(S_t)))/d(log((X_t))/d(d(Y_t^2))$	0.171	76.52
$(\boldsymbol{d}(\log(T_t)))/d(log(X_t))/d(d(Y_t^2))$	0.024	10.26

$R^2 = 0.9998 \quad DW = 1.89 \quad F = 48153 \quad H_T = 0.085$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

Regression Model 6 provides results that can be used for testing the significance of the respective variable coefficients. The results show that tax revenues and government deficits both have a positive influence on economic growth.

Thus, a 1% growth in government deficit, investment spending, tax revenues, household disposable income, exports or imports was responsible for respective rises of 0.12%, 0.23%, 0.10%, 0.83%, 0.10% or -0.27% in economic growth.

Regression Model 6

Dependent Variable: $(\boldsymbol{d}(\log(Y_t)))/d(log(S_t))/d(d((d(Y_t))^2))$

Variable	Coefficient	t-statistic
$(\boldsymbol{d}(\log(C_{nt})))/d(log(S_t))/d(d((d(Y_t))^2))$	0.839	26.13
$(\boldsymbol{d}(\log(I_t)))/d(log(S_t))/d(d((d(Y_t))^2))$	0.231	20.85
$(\boldsymbol{d}(\log(G_t/T_t)))/d(log(S_t))/d(d((d(Y_t))^2))$	0.123	20.91
$(\boldsymbol{d}(\log(T_{nt})))/d(log(S_t))/d(d((d(Y_t))^2))$	0.098	10.48
$(\boldsymbol{d}(\log(X_t)))/d(log((S_t))/d(d((d(Y_t))^2))$	0.096	5.16
$(\boldsymbol{d}(\log(M_t)))/d(log(S_t))/d(d((d(Y_t))^2))$	-0.272	-14.56

$R^2 = 0.99999 \quad DW = 2.17 \quad F = 363912 \quad H_T = 0.001$

Included observations $= 1993 - 2018$ Sample (adjusted) $= 26$

Regression Model 7 indicates that government deficit, export surplus and tax revenue have weaker potential to influence real income through household disposable income since the sum of income elasticity of these three variables is approximately more than those of household income elasticity given in Regression Models 6 and 8, *ceteris paribus*.

Regression Model 7

Dependent Variable: $\boldsymbol{\log(Y_t)}/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$\boldsymbol{\log(G_{nt}/I_t)}/d(d(Y_t^2))$	1.263	6.95
$\boldsymbol{\log(X_t/M_t)}/d(d(Y_t^2))$	-1.906	-11.00
$\boldsymbol{\log(T_t)}/d(d(Y_t^2))$	1.262	175.62

$R^2 = 0.99999 \quad DW = 1.89 \quad F = 985344 \quad H_T = 0.228$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

While Regression Model 6 accepts the hypothesis that government deficit has a positive influence on economic growth, Regression Model 8 tests and confirms the hypothesis that in the case of Ethiopia, the government deficit had a positive influence on economic during the sample period. During the sample period, a 1% increase in growth of household disposable income, government deficit, balance of payment surplus or tax revenues was accompanied by 0.91%, 0.18%, 0.19% or 0.15% rises respectively in economic growth, *ceteris paribus*.

Regression Model 8

Dependent Variable: $(d(\log(Y_t)))/d(d(log(Y)))/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$(d(\log(Y_{dt})))/d(d(log(Y)))/d(d(Y_t^2))$	0.915	20.74
$(d(\log(G_t/T_t)))/d(d(log(Y)))/d(d(Y_t^2))$	0.179	6.35
$(d(\log(T_t)))/d(d(log(Y)))/d(d(Y_t^2))$	0.148	19.60
$(d(\log(X_t/M_t)))/d(d(log(Y)))/d(d(Y_t^2))$	0.188	2.87

$R^2 = 0.991$ $DW = 2.25$ $F = 807$ $H_T = 0.186$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

By contrast, Regression Model 9 tests and accepts the hypothesis that, in the case of Ethiopia, in regard to both government savings and the balance of payments deficit, the government deficit had the potential of having a negative impact on economic growth during the sample period.

Regression Model 9 shows that during the sample period a 1% increase in growth of household disposable income, investment spending, government savings, exports, imports, or tax revenues was associated with 0.84%, 0.23, -0.12%, 0.10, 0.27 or 0.10% rises respectively in economic growth, *ceteris paribus*.

Regression Model 9

Dependent Variable: $(d(\log(Y_t)))/d(log(S))/d(d((d(Y_t))^2))$

Variable	Coefficient	t-statistic
$(d(\log(C_{nt})))/d(log(S))/d(d((d(Y_t))^2))$	0.839	26.14
$(d(\log(I_t)))/d(log(S))/d(d((d(Y_t))^2))$	0.231	20.85
$(d(\log(T_t/G_t)))/d(log(S))/d(d((d(Y_t))^2))$	-0.123	-20.91
$(d(\log(T_t)))/d(log(S))/d(d((d(Y_t))^2))$	0.098	10.48
$(d(\log(X_t)))/d(log(S))/d(d((d(Y_t))^2))$	0.094	5.16
$(d(\log(M_t)))/d(log(S))/d(d((d(Y_t))^2))$	-0.273	-4.56

$R^2 = 0.99999$ $DW = 2.17$ $F = 363912$ $H_T = 0.001$

Included observations $= 1993 - 2018$ Sample (adjusted) $= 26$

Regression Model 10 implies that an increase in gross saving enhances economic growth (Blanchard and Johnson, 2013, p.97). Thus, during the sample period a 1% increase in household consumption, gross saving, or tax revenue in Ethiopia is associated with 0.71%, 0.22, or 0.10% rise respectively in economic growth, *ceteris paribus*.

Regression Model 10

Dependent Variable: $\log(Y_t)/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$\log(C_{nt})/d(d(Y_t^2))$	0.712	82.14
$\log(S_t)/d(d(Y_t^2))$	0.228	36.11
$\log(T_t)/d(d(Y_t^2))$	0.101	19.11

$R^2 = 1.0000 \quad DW = 1.72 \quad F = 3.61 \times 10^8 \quad H_T = 0.960$

Included observations $= 1992 - 2018 \qquad$ Sample (adjusted) $= 27$

In 1995, the share of total government debt to GDP ratio in Ethiopia increased by up to 150 percent. The major cause of this huge rise in debt was high government borrowing from external sources to implement the post-war social and economic reform program, the Structural Adjustment Program (SAP). By 2000, however, the total debt to GDP ratio had declined to 77 percent, and fell to only 23 percent in 2014 (Teshome, 2015).

Melese (2005) by using structural macroeconomic, Co integration and Error Correction Models as well as the Ordinary Least Squares (OLS) method, with data covering the period 1970 to 2002, found a significant and positive relationship between external debt and economic growth in Ethiopia (Mohanty, 2017). Regression Model 11 indicates that in Ethiopia, during the period 1992 to 2016, external debt had a significant and positive effect on economic growth, though in the sample period, external debt servicing had a significant and negative effect. The evidence provided by Regression Model 11 indicates that a 1% increase in household consumption, government spending, external debt, or external debt servicing during the sample period was responsible for 0.57%, 0.20%, 0.05% or -0.04% increases respectively in economic growth in Ethiopia, *ceteris paribus*.

Regression Model 11

Dependent Variable: $(d(\log(Y_t)))/d(d((G_t)))/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$(d(\log(C_{nt})))/d(d((G_t)))/d(d(Y_t^2))$	0.574	6.48
$(d(\log(G_t)))/d(d((G_t)))/d(d(Y_t^2))$	0.198	6.48
$(d(\log(ED_t)))/d(d((G_t)))/d(d(Y_t^2))$	0.052	3.83
$(d(\log(EDS_t)))/d(d((G_t)))/d(d(Y_t^2))$	-0.041	-3.42

$R^2 = 0.98 \quad DW = 1.85 \quad F = 375 \quad H_T = 0.033$

Included observations $= 1992 - 2018 \qquad$ Sample (adjusted) $= 27$

Regression Model 12 indicates that government spending could have affected economic growth through the household disposable income channel because a 1% increase in tax revenues is accompanied with 0.93%, a 0.97% rise in economic growth following a 1% increase in household income as given in Regression Model 4.

Regression Models 11, 12, and 13 indicate that in Ethiopia, during the sample period, growth in external debt had a significant and positive effect on economic growth; whereas external debt servicing had a significant and negative effect on economic growth.

Regression Model 12

Dependent Variable: $\log(Y_t)/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$\log(G_t)/d(d(Y_t^2))$	0.934	33.35
$\log(ED_t)/d(d(Y_t^2))$	0.711	7.83
$\log(EDS_t)/d(d(Y_t^2))$	-0.650	-4.82

$R^2 = 0.99999$ $DW = 2.02$ $F = 935672$ $H_T = 0.216$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

In addition, Regression Models 13, 5, 6 and 9 indicate that it is through disposable income, that household consumption could have influenced economic growth because in these four equations the coefficients of income elasticity of both household disposable income and household consumption are the nearly same nearly, i.e. 0.78, 0.68, 0.84, and 0.84 respectively.

Regression Model 13

Dependent Variable: $\log(Y_t/G_t)/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$\log(Y_{dt}/G_t)/d(d(Y_t^2))$	0.789	20.95
$\log(ED_t/G_t)/d(d(Y_t^2))$	0.173	7.02
$\log(EDS_t/G_t)/d(d(Y_t^2))$	-0.116	-4.82

$R^2 = 0.99995$ $DW = 1.73$ $F = 249349$ $H_T = 0.095$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

Theoretical intertemporal government budget constraint models which have failed to conform to empirical tests have been proposed by Antwi et al. (2013), Ayadi and Ayadi (2008), Barro (1979), Bianconi (2000), Blanchard et al. (2000, pp.437–439), Claeys, (2008), Curtasu (2011), Das (2016), Domar (1944), Landolfo (200I), Rode (2012, pp.151–152). However, these theoretical models do not entirely conform to the results in Regression Models 14 and 15 because the theoretical models proposed by these scholars are characterized as: $G = T - ED + EDS$; and in logarithm form the theoretical government budget deficit models proposed by them is wrongly characterized as: $\log(G/T) = -\log(ED) + \log(EDS)$. In this paper, the linear intertemporal government budget deficit model is characterized by $T = G + ED - EDS$ and this characterization conforms to the empirical findings as depicted in Equation 5.14.

Regression Model 14

Dependent Variable: $(\log(T_t)/d(d(X_t))/d(d(T_t^2))$

Variable	Coefficient	t-statistic
$(\log(G_t)/d(d(X_t)))/d(d(T_t^2))$	0.765	10.30
$(\log(ED_t)/d(d(X_t)))/d(d(T_t^2))$	0.466	7.91
$(\log(EDS_t)/d(d(X_t)))/d(d(T_t^2))$	-0.391	-4.21

$R^2 = 0.99999$ $DW = 1.97$ $F = 1249805$ $H_T = 0.072$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

In this present paper, the logarithm form reveals that the intertemporal government budget deficit is characterized by $log(T/G) = \log(ED) - \log(EDS)$ and this characterization conforms to the empirical findings depicted in Regression Model 15.

Regression Model 15

Dependent Variable: $(\log(T_t)/d(d(X_t))/d(d(T_t^2))$

Variable	Coefficient	t-statistic
$(\log(ED_t)/d(d(X_t)))/d(d(T_t^2))$	0.417	6.27
$(\log(EDS_t)/d(d(X_t)))/d(d(T_t^2))$	-0.585	-7.10

$R^2 = 0.997 \quad DW = 2.25 \quad F = 8356 \quad H_T = 0.389$

Included observations $= 1992 - 2018 \qquad$ Sample (adjusted) $= 27$

In other words, an increase in demand for external borrowing has positive consequences on real government spending; and it is the increase in demand for real government spending that has positive consequences on tax revenues at any given point in time. So, external debt servicing can clearly reduce demand for real government spending on goods and services and end up reducing demand for tax revenues at any given point in time.

Adopting the budget deficit model suggested by the scholars mentioned above gives results that are misleading, because it implies that reducing external borrowing leads to an increase in government spending, and also that an increase in external debt servicing leads to reduction in government spending. This is shown by Regression Model 16.

Regression Model 16

Dependent Variable: $(\log(G_t)/d(d(Y_t/P_t))/d(d(G_t^2))$

Variable	Coefficient	t-statistic
$(\log(T_t)/d(d(Y_t/P_t))/d(d(G_t^2))$	0.857	10.93
$(\log(ED_t)/d(d(Y_t/P_t))/d(d(G_t^2))$	-0.870	-14.66
$(\log(EDS_t)/d(d(Y_t/P_t))/d(d(G_t^2))$	1.278	9.33

$R^2 = 0.99999 \quad DW = 1.90 \quad F = 1548756 \quad H_T = 0.086$

Included observations $= 1992 - 2018 \qquad$ Sample (adjusted) $= 27$

Adopting the budget deficit model suggested is also misleading as it implies that reducing external borrowing leads to an increase in government deficit financing, and an increase in external debt financing leads to a reduction in government deficit financing. This is made clear in Regression Model 17.

Regression Model 17

Dependent Variable: $(\log(G_t/T_t)/d(log(Y_{dt})))/d(d((G_t/T_t)^2))$

Variable	Coefficient	t-statistic
$(\log(ED_t)/d(log(Y_{dt})))/d(d((G_t/T_t)^2))$	-0.132	-5.20
$(\log(EDS_t)/d(log(Y_{dt})))/d(d((G_t/T_t)^2))$	0.213	7.28

$R^2 = 0.996 \quad DW = 2.23 \quad F = 7056 \quad H_T = 0.157$

Included observations $= 1992 - 2018 \qquad$ Sample (adjusted) $= 27$

Regression Models 18 and 19 indicate that a 1% increase in population growth tends to raise tax revenues by as much it can raise government spending i.e. 1.13% and 1.11% respectively.

Regression Model 18

Dependent Variable: $(\log(T_t)/d(T_t))/d(d(T_t^2))$

Variable	Coefficient	t-statistic
$(\log(G_t/T_t)/d(T_t))/d(d(T_t^2))$	-0.572	-12.16
$(\log(P_t)/d(T_t))/d(d(T_t^2))$	1.133	269.31

$R^2 = 1.0000$ $DW = 1.92$ $F = 99933545$ $H_T = 0.011$
Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

So, equations 5.18 and 5.19 show that the government deficit in Ethiopia during the sample period affected tax revenues by as much as it affected government spending.

Regression Model 19

Dependent Variable: $(\log(G_t)/d(d(S_t)))/d(d(G_t^2))$

Variable	Coefficient	t-statistic
$(\log(G_t/T_t)/d(d(S_t)))/d(d(G_t^2))$	0.450	2.80
$(\log(P_t)/d(d(S_t)))/d(d(G_t^2))$	1.111	79.63

$R^2 = 0.99996$ $DW = 2.14$ $F = 607343$ $H_T = 0.728$
Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

Regression Model 20 indicates that in the long run tax revenue collection is positively influenced by an increase in government spending (0.95%), investment spending (1.72%) and exports (1.33%), but is negatively affected by gross savings (-1.664%) and imports (-2.40%).

Regression Model 20

Dependent Variable: $(d(\log(T_t))/d(\log(Y_t)))/d(d((d(T_t))^2))$

Variable	Coefficient	t-statistic
$(d(\log(G_t))/d(\log(Y_t)))/d(d((d(T_t))^2))$	0.957	12.22
$(d(\log(I_t))/d(\log(Y_t)))/d(d((d(T_t))^2))$	1.717	11.08
$(d(\log(S_t))/d(\log(Y_t)))/d(d((d(T_t))^2))$	-1.663	-12.28
$(d(\log(X_t))/d(\log(Y_t)))/d(d((d(T_t))^2))$	1.334	19.03
$(d(\log(M_t))/d(\log(Y_t)))/d(d((d(T_t))^2))$	-2.400	-17.16

$R^2 = 0.9697$ $DW = 1.92$ $F = 168$ $H_T = 0.159$
Included observations $= 1993 - 2018$ Sample (adjusted) $= 26$

Regression Model 21 implies that in Ethiopia during the sample period growth in exports rather than growth in government spending had greater influence on economic growth. It underlines that an export growth strategy would be a better alternative for stimulation of economic growth and also shows that, as revealed by the coefficients of imports and exports on taxes, other things equal, imports and exports always tend to be at equilibrium.

Regression Model 21

Dependent Variable: $(\log(T_t)/d(S_t/P_t))/d(d(T_t^2))$

Variable	Coefficient	t-statistic
$(\log(G_t)/d(S_t/P_t))/d(d(T_t^2))$	0.908	3.65
$(\log(X_t)/d(S_t/P_t))/d(d(T_t^2))$	2.843	5.59
$(\log(M_t)/d(S_t/P_t))/d(d(T_t^2))$	-2.869	-4.64

$R^2 = 0.999999$ $DW = 1.75$ $F = 13125049$ $H_T = 0.016$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

Regression Models 22 and 23 indicate that in Ethiopia during the sample period economic growth and growth in household disposable income were equally affected by growth in investment spending. It can also be deduced from Regression Models 22 and 23, that disposable income was influenced more than household disposable income, by household consumption, most likely due to the influence of taxes on real income.

Regression Model 22 implies that growth in both household consumption and investment spending could have influenced economic growth though household disposable income since the addition of coefficients 0.587, 0.095 and 0.131 almost equals 0.81 i.e. the value of the coefficient of elasticity of disposable income on gross domestic product (0.79) as given in Regression Model 13.

From Regression Models 22 and 23, it is clear that while the increase in the growth of tax revenues during the sample period had positive consequences on overall economic growth, it had negative consequences on household disposable income.

Regression Model 22

Dependent Variable: $(\log(Y_t)/d(d(\log(X_t))))/d(d(Y_t^2))$

Variable	Coefficient	t-statistic
$(\log(C_{nt})/d(d(\log(X_t))))/d(d(Y_t^2))$	0.587	9.27
$(\log(I_t)/d(d(\log(X_t))))/d(d(Y_t^2))$	0.095	7.55
$(\log(T_t)/d(d(\log(X_t))))/d(d(Y_t^2))$	0.131	22.54

$R^2 = 0.999$ $DW = 2.10$ $F = 12789$ $H_T = 0.026$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

Regression Model 24 shows that external debt enhanced economic growth faster than the rate at which external debt financing depressed it, although Alemayahu and Zerfu (1998) have confirmed that the level of debt in Ethiopia was beyond the capacity of the country to service it. Empirical results reveal that external debt servicing had a negative effect on economic growth as indicated by the negative correlation between external debt servicing and investment spending in Ethiopia during the 1992 to 2018 period.

Regression Model 23

Dependent Variable: $(\mathbf{d}(\log(Y_{dt}))\,/d(d(Y_t)))/d(d(Y_{dt}^2))$

Variable	Coefficient	t-statistic
$(d(\log(C_{nt}))\,/d(d(Y_t)))/d(d(Y_{dt}^2))$	0.856	180.50
$(d(\log(I_t))/d(d(Y_t)))/d(d(Y_{dt}^2))$	0.097	37.41
$(d(\log(T_{t-1})))/d(d(Y_t)))/d(d(Y_{dt}^2))$	0.027	6.04

$R^2 = 0.9998 \quad DW = 2.20 \quad F = 48815 \quad H_T = 0.809$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

However, external debt in Ethiopia had positive and significant effects on investment, indicating that a 1% increase in external debt in the case of Ethiopia contributed 0.74% increase to the level of investment as depicted by Regression Model 24. It also contributed -0.42% increase to the level of investment in the country during the given period *ceteris paribus*. Hence, external debt servicing crowded out investment in Ethiopia.

Regression Model 24

Dependent Variable: $(\log(I_t)\,/d(d(\log(S_t))))/d(d(I_t^2))$

Variable	Coefficient	t-statistic
$(\log(G_t)\,/d(d(\log(S_t))))/d(d(I_t^2))$	0.569	6.61
$(\log(ED_t)\,/d(d(\log(S_t))))/d(d(I_t^2))$	0.741	69.92
$(\log(EDS_t)\,/d(d(\log(S_t))))/d(d(I_t^2))$	-0.421	-4.09

$R^2 = 1.0000 \quad DW = 1.93 \quad F = 73923796 \quad H_T = 0.002$

Included observations $= 1992 - 2018$ Sample (adjusted) $= 27$

4. Conclusions

Higher government spending and pro–poor resource allocation reduced absolute poverty in Ethiopia during the 1990 to 2018 period. Empirical evidence in this study indicates that increases in tax revenue, government revenue and the government deficit had positive and significant effects on economic growth during this period.

The empirical evidence in this study also shows that some other variables had positive and significant effects on economic growth in Ethiopia during the sample period. These included: household disposable income, investment spending, household consumption, private savings, and the potentials for balance of payments and external debt. However, the study also showed a number of variables had negative and significant effects on economic growth: levels of import, government savings, the balance of payments deficit, the savings investment ratio and external debt financing.

Theoretical intertemporal government budget constraint models which have failed to conform to empirical tests have been proposed by a number of scholars: Antwi et al. (2013), Ayadi and Ayadi (2008), Barro (1979), Bianconi (2000), Blanchard et al. (2000), pp.437–439), Claeys, (2008), Curtasu (2011), Das (2016), Domar (1944), Landolfo (2008), Rode (2012, pp.151–152). Adopting the intertemporal budget deficit model suggested by these scholars is therefore misleading.

It implies that reducing external borrowing leads to an increase in government deficit financing; that an increase in external debt financing leads to a reduction in government deficit financing; that reducing external debts leads to an increase in government spending; and that an increase in external debt financing leads to a reduction in government spending.

This study found that an increase in demand for external borrowing has positive consequences on real government spending, and that an increase in demand for real government spending has positive consequences on tax revenues at any given point in time. t is clear that external debt financing reduces demand for real government spending on goods and services and consequently always reduces demand for increased tax revenues.

It is also clear that in Ethiopia, during the sample period, growth in exports rather than growth in government spending had the greater influence on economic growth. The conclusion must be that an export growth strategy rather than increased external borrowing is the better alternative to stimulate economic growth in Ethiopia.

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