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Relationship between Economic Growth and Debt: An Empirical Analysis for Sub-Saharan Africa

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Abstract. In this study, we examine the connection between economic growth and debt, with the question in mind -"Is debt a burden and bad for economic growth? Employing several sophisticated statistical approaches to investigate the problem and to assess the impact of debt on economic growth in 48 countries of Sub-Saharan Africa from 1995 to 2012, we find evidence of Granger causality between debt and economic growth in 8 out of the 48 sub-Saharan countries during the period of study and validate for the existence of "Debt Laffer Curve." We also study the relationship between debt and economic growth rate in Granger causality and Dynamic Arellano-Bond panel data estimation frameworks, and find evidence of a negative correlation between the two variables (Debt and GDP) and confirm the findings by testing several versions of the models.Political decision and economic policy are intertwined and need to be examined carefully when implemented for economic growth and our findings lend credence to the politically unpopular austerity measures (constraints on government spending financed by borrowing). There is a limit to the economic growth rate that the government financed expenditure can bring. If the burden of debt is too high then there is a negative impact of debt on the economic growth.
Keywords. Economic Growth, Debt, Laffer curve and Investments.
JEL. E20, E60, E24.

1. Introduction

The usefulness of debt to promote economic development is easy to establish with the help of traditional theories of economic development. Both the balanced and unbalanced theories of economic growth support this idea. These theories point out that the foreign debt can be an important source of capital that can be invested in the important sectors of the economy. The developing countries do not have the means to undertake massive investment projects because they are at the early stages of economic development, and do not have enough savings. Loans (Debt) can be utilized for investment in the infrastructures and then pave the way for further investment. Therefore, the "bottleneck" on investment can be eliminated with the help of debt.

In many least developed countries (LDC) financial institutions and markets (banks, investment companies and money market) and capital markets (stock and bond markets) are not fully developed, especially in Sub-Saharan Africa[i]. As a

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result, these countries suffer from theconstant shortage of investable funds. Critics argue that if there were a way to invest in the critical sectors of the economy by taking a loan from somewhere, then that would mitigate the shortage of funds for the economy. Such loans would open up flow of funds to other sectors opening the way for growth of the entire economy. If, for example, the government takes debt and builds a sea-port, then that will encourage investors to open their business, and they will start investing in their project. To undertake these kinds of projects, a country needs funds and where can such an investment-fund be found? Such an investment-fund can come with foreign debt, loan and grant. The argument for foreign debt to finance projects also has political and non-economic dimensions. Some experts believe that debt can often be used to establish control and influence of one country on the other country, but this study does not touch on those non-economic spheres. Over the years, experts have studied the impact of debt on economic growth from time to time and their effort has raised the question. "Is there something called "too much debt"? Is the debt actually having a negative impact on economic growth rather than encouraging it? In the current paper, we analyze the relationship between economic growth and debt with the help of several models, a recent data-set for 48 Sub-Saharan countries for the period 1995-2012, and with several advanced estimation techniques (Granger causality and Arellano-Bond panel data). Previous literature shows clear support for the existence of "Debt Laffer Curve".[ii]In prelude to our study, we find evidence in support of a negative impact of debt on annual growth rate of Gross Domestic Product (GDP).

Following the Introduction in Section 1, the paper is organized as follows: Section2 presentsthe literature review followed by section3 which presents thedata source and the empirical methodology. Section 4 discusses the findings, while section 5 concludes the paper.

2. Literature Review

We review the literatures that have dealt with economic growth and debt here in this section. Herndon, Ash and Pollin (2014), replicate Reinhart and Rogoff (2010a and 2010b) studies and find coding errors, selective exclusion of available data, and unconventional weighting of summary statistics lead to serious errors that inaccurately represent the relationship between public debt and GDP growth among 20 advanced economies in the post-war period. They find that when properly calculated, the average real GDP growth rate for countries carrying a public-debt-to-GDP ratio of over 90 percent is 2.2 percent, not -0.1 percent as published in Reinhart and Rogoff. That is, contrary to Reinhart and Rogoff, average GDP growth at public debt/GDP ratios over 90 percent is not dramatically different than when debt/GDP ratios are lower. They also show how the relationship between public debt and GDP growth varies significantly by period and country[iii]. Fincke and Greiner (2013) empirically study the relation between public debt and economic growth. They analyze how the public debt to GDP ratio at a certain point in time is correlated with the GDP growth rate in the following period, where one consider a one-year time span, a three-year' time interval and a five-years interval. Using panel data comprising seven developed countries from 1970-2012, they estimate a pooled regression model and a random effects model. They find strong evidence for a significantly negative relation between debt and growth[iv]. Baum, Westphal, and Rother (2013) paper, investigate the relationship between public debt and economic growth. Their empirical results suggest that the short-run impact of debt on GDP growth is positive and highly statistically significant, but decreases to around zero and lose significance beyond public debt-

to-GDP ratios of around 67%. The result is robust throughout most of their speculations, in a dynamic and non-dynamic threshold models alike. For high debt-to-GDP ratios (above 95%), additional debt has a negative impact on economic activity. Furthermore, they show that the long-term interest rate is subject to increased pressure when the public debt-to-GDP ratio is above 70%, broadly supporting the above findings. Reinhartet al. (2012) examined the growth and interest rates associated with prolonged periods of exceptionally high public debt, defined as episodes where public debt to GDP ratio exceeded 90 percent for at least five years. Authors found evidence that debt/GDP levels above 90 percent are associated with an average annual growth rate of 1.2 percent lower than in the period with debt below 90 percent debt; the average annual levels are 2.3 percent during the periods of exceptionally high debt versus 3.4 percent otherwise[v]. Égert (2013) utilized the Reinhart-Rogoff dataset to a formal econometric testing to see whether public debt has a negative non-linear effect on growth if public debt exceeds 90% of GDP. Using nonlinear threshold models, the authors show that the relationship between debt and growth is very sensitive to modeling choices. Authors repeat the test after they determine the threshold of 90 percent of GDP endogenously on the procedure proposed by Hansen (1999). They find similar results. Tasos (2012) paper investigates the relationship between economic growth and government debt for one of the biggest economies in the world, the economy of China. The analysis is based on data over the period 1984 to 2011. The results reveal that there are structural breaks in the economy of China but no Granger causality between the variables. Saad (2012) empirically investigates the relationship between economic growth, exports and external debt of Lebanon through an econometric analysis over the period 1970-2010 with the inclusion of a fourth macroeconomic variable that is the exchange rate. Exports were introduced in the models to test the export-led growth hypothesis for Lebanon. The results show that both short run and long run relationships exist among these variables. Moreover, the finding suggests, i) bidirectional Granger causality between GDP and external debt servicing, ii) unidirectional Granger causality that runs from external debt to exports, iii) unidirectional causality running from exports to economic growth, and iv) unidirectional causality running from exchange rate to economic growth. Hayati and Rahman (2012) used an array of advanced econometric frameworks in their research like VectorError Correction Model (VECM), Vector Auto-Regression (VAR) model, and co-integration (CI) tests. They test the impact of economic debt on economic growth. They used quarterly data from the first quarter of 2001 to the fourth quarter of 2011. They used both external and domestic debt but did not find any significant effect on economic growth either in short-run or in long run. Herndon et.al. (2014) in their paper examine the Reinhart & Rogof (2010) [vi] and Reinhart(2010) [vii] claim that the average real GDP growth rate for countries carrying a public-debt-to-GDP ratio of over 90 percent face reduced growth rate of GDP. They review evidence (they correct the data for spread-sheet errors, omission of available data, weighting, and transcription) and find that it is actually 2.2 percent, not -0.1 percent as published in the Reinhart & Rogof (2010) and Reinhart (2010). The authors conclude that the austerity programs in Europe and the United States that are based on the Reinhart & Rogof (2010) and Reinhart (2010) should be reviewed. Cecchetti, Mohanty, & Zampolli (2011) examined the relationship between debt and economic growth by using a new dataset that included the level of government, non-financial corporate and household debt in 18 OECD countries from 1980 to 2010. The authors follow Islam (1995) and others in estimating panel data regressions with country specific fixed effects (as well as time-specific fixed effects). The authors' result supports the view that, beyond a certain level, debt is a drag on growth. For government

debt, the threshold is around 85% of GDP. According to the authors "debt is a two-edge sword" and "over-borrowing leads to bankruptcy and financial ruin. Bivens & Irons (2010) is the continuation of the larger research on debt and growth across countries and time has yielded many valuable insights. Their paper has shown that there is no compelling reason to believe the most frequently cited claim from GITD that gross debt of about 90% will necessarily lead to slower economic growth. Abbas, Belhocine, and ElGanainy (2010) describe the compilation of the first truly comprehensive database on gross government debt-to-GDP ratios, covering nearly the entire IMF membership (174 countries) and spanning for an exceptionally long period (1880-2009). The paper deliberates the evolution of debt-to-GDP ratios across country groups for several decades, episodes of debt spikes and reversals. Finally, the authors find a pattern of negative correlation between debt and growth. Irons (2010) examines the movement of interest rate on short run and long run U.S. Treasuries, from July, 2007 to March, 2010) and Real Interest Rates on "Treasury's inflation protected securities" (TIPS) from January 2003 to March 2010. He finds these rates to be lower than the pre-recession rates of 2007, which suggests that the investors did not lose confidence in the U.S. economy. The mounting national debt in the U.S. is expected to increase (debt ratio was expected to reach 70 % of GDP in 2011). At some point, the author feels that we may see an increase: if the economy recovers more quickly than expected, a slight increase in rates (especially on the short-end) may result as they return to more "normal" levels. Bivens (2010) pointed out that there is no fear that the deficit to pursue anti-recessionary policies during 2010 will result in an increased interest rest (government borrowing may crowd out private investment and cause an increase in the interest rate in the loan market). The author argued that, in a recession, there are idle resources in the economy and so there is no competition between the public and private sectors. Thus, there is no need for interest rates to shoot up. The author points out to the "accelerator effect" related with a stimulus package leads to an expansion of GDP encourages investment (the so-called "crowding out effect"). Ferreira & Candida (2009) applied the Edril & Yetkiner (2009) methodology on data from OECD for 20 countries between 1988 and 2001 to study the relationship between public debt and economic growth. They concluded that there is clear Granger causality and that it is always bi-directional. The important findings of this study are that the relationship is a two-way relationship. The relationship is different across different countries, which indicates that different characteristics of different countries play an important role. Manasse & Roubini (2009) utilized the new statistical approach (Binary Recursive Tree), and a full dataset includes annual information on 47 economies with market access from 1970 to 2002. The authors find that not all crises are equal: they differ depending on whether the government faced insolvency, illiquidity or various macroeconomic weaknesses and risks. They argue that unconditional thresholds, for example for debt-output ratios, are of little value per se for assessing the probability of default. Abbas & Chrintensen (2007) develops a new public domestic debt database covering 93 low-income countries and emerging markets from 1975-2004 to estimate the growth impact of domestic debt. Authors find evidence that moderate levels of non-inflationary domestic debt overall exerts a positive impact on economic growth. The use of the Granger-causality regressions suggests the support for several channels of impact: improved monetary policy; broader financial market development; strengthened domestic institutions' accountability; and enhanced private savings and financial intermediation. There is little evidence that, above a ratio of 35-% percent of bank deposits, domestic debt begins to undermine growth. Imbs & Ranciere (2005) show some evidences that are supportive of a debt Laffer curve. The authors find evidence that there is a negative relation between debt and growth at high levels of

indebtedness. Authors find evidence that debt overhang occurs when the face value of debt reaches 55 to 60 percent of GDP or 200 percent of exports, or when the present value of debt reaches 35 to 40 percent of GDP or 140 percent of exports. And Pattillo, Poirson & Ricci (2002) examined the non-linear relationship between external debt on economic growth in 93 developing countries over the period 1969 to 1998 with a wide array of estimation techniques (OLS, instrumental variables, fixed effects, and system GMM) and found that doubling the debt ratio would reduce annual per capital growth rate between half and a full percentage point. They examined a hold of other variables as controls in their model to identify the channel through which debt might affect economic growth. Given the data-set, and the time-period covered, the empirical evidence is indeed very strong.

Wamboye & Tochkov (2014) examined the impact of external debt on labor productivity growth and convergence across SSA economies over the period 1970–2010. The results from parametric and non-parametric models indicate the presence of debt-overhang effects, regardless of model and sample specification. Debt reduction through the Heavily Indebted Poor Countries and Multilateral Debt Relief initiatives has helped these countries to achieve better economic growth but was not large enough in offsetting the debt-overhang effects. This supports "the debt overhang" and "the crowding out" hypothesis. Moreover, excessive levels of external debt were responsible for divergence in output per worker over the early 1990s, which reversed over the 2000s. The authors concluded that the reduction in debt through the debt relief initiatives seems to have been insufficient in helping heavily indebted countries in SSA catch up with the labor productivity levels of the best-performing economies in the region.

3. Data and Model

All the variables[viii] were downloaded for 48 countries[ix] of Sub-Saharan Africa for the period 1995 to 2012 comes from World Development Indicators (WDI) data's from "The World Bank". We generate a panel data set of 48 countries where each country has 16 years' of observations. The primary World Bank collection of development indicators are compiled from officially-recognized international sources. It presents the most current and accurate global development data available, and includes national, regional and global estimates. Even though Global Development Finance (GDF) is no longer listed in the WDI database name and bulk download file names, all external debt and financial flows data continue to be included in WD[x]I. In this study, we use the following equation adopted from Schclarek (2004) to examine the relationship between debt and economic growth.

$$Y_{i,t} = \propto X_{i,t} + \gamma D_{i,t} + \eta_i + \lambda_i + \epsilon_{i,t} \qquad (i)$$

Y is the dependent variable (annual growth rate of GDP), X is the set of explanatory variables, D is the set of debt variables, η_i is an unobserved country-specific effect, λ_i is an unobserved time-specific effect, $\epsilon_{i,t}$ is an error term, and the subscripts *i* represent country and *t* represent time period, respectively. We use both fixed and random effect models to estimate the regression.

We also run the model adopted from Pattillo (2002) as given below

$$Y_{i,t} = \alpha_{i,t} + \beta X_{i,t} + \gamma D_{i,t} + \delta D_{i,t}^2 + \varepsilon_{i,t} \qquad (ii)$$

According to this specification a "debt Laffer curve" exists if coefficient of debt is positive and coefficient of debt squared is negative. Most regressions in this study show such result and support a "debt Laffer Curve". We estimate the

Arellano-Bond panel data estimation framework and are interested in estimating the parameters of models of the form

$$Y_{i,t} = \gamma Y_{it-1} + \beta X_{it} + u_i + \epsilon_{it} \qquad (iii)$$

for i = {1, . . . ,N} and t = {1, . . . ,T} using datasets with large N and fixed T. By construction, $Y_{i,t}$ is correlated with the unobserved individual-level effectu_i. Here $Y_{i,t}$ is the annual GDP growth rate variable. $Y_{i,t-1}$ is the lag of the annual GDP growth rate variable. The set of variables $X_{i,t}$ include the control variables including the debt indicator variable.

4. Eprical Result

The summary statistics of the key variables are presented in Table 1a. A look at the dependent variable (the annual growth rate of GDP) shows the mean of 4.96 percent and a standard deviation of 7.67 percent. The debt related independent variable (total debt stock as % of GNI) had a mean of 3.52 percent and a standard deviation of 7.53 percent. Other variables included in the regressions are: Trade as % of GDP (76.21 mean and 37.64 standard deviation), Money and Quasi-Money M2 as % of GDP (31.49 and 23.83), Gross Fixed Capital Formation as % of GDP (20.03% and 11.04%), and Foreign Direct Investment Net Inflow (% of GDP) (5.15 and 11.05). Table 1b reports the names of the 48 countries under study.

Table 1. Panel a: *Summary Statistics*

Variable	Obs.	Mean	Std. Dev.
Foreign Direct Investment Net Inflow	817	5.15	11.05
GDP Constant 2005 US	822	13700000000.	38100000000.
GDP Growth Annual	825	4.96	7.67
GDP Per Capita Constant 2005 US	822	1532.51	2563.81
Gross Capital Formation as % of GDP	753	20.69	11.33
Gross Fixed Capital Formation as % of GDP	754	20.03	11.04
Money and Quasi-Money M2 as % of GDP	786	31.49	23.83
Trade as % of GDP	804	76.21	37.64
Real Interest Rate (%)	545	10.83	20.31
Real Effective Exchange Rate Index (2005=100)	304	115.84	69.92
Official Exchange Rate (LCU= 1 $)	819	679.79	1808.76
External Debt Stocks as % of GNI	784	93.55	125.80
Total Debt Service as % of GNI	784	3.52	7.53

Panel b: *Countries*

Angola	Cote d'Ivoire	Madagascar	Seychelles
Benin	Equatorial Guinea	Malawi	Sierra Leone
Botswana	Eritrea	Mali	Somalia
Burkina Faso	Ethiopia	Mauritania	South Africa
Burundi	Gabon	Mauritius	South Sudan
Cameroon	Gambia, The	Mozambique	Sudan
Cape Verde	Ghana	Namibia	Swaziland
Central African Republic	Guinea	Niger	Tanzania

Chad	Guinea-Bissau	Nigeria	Togo
Comoros	Kenya	Rwanda	Uganda
Congo, Dem. Rep.	Lesotho	Sao Tome and Principe	Zambia
Congo, Rep.	Liberia	Senegal	Zimbabwe

Table 2 presents the sets of correlations between different variables. We find that the correlation between the two key variables (the annual growth rate of GDP and total debt stock as % of GNI) is -0.04, which implies that when the debt variable increases, the GDP growth rate variable decreases. This shows that there is negative correlation between the two variables. To test for causality we conduct the regression analysis in the next section.

Table 2. *Correlation Coefficient*

	a	b	c	d	e	f	g	h	i
Foreign Direct Investment Net Inflow (% of GDP)	1.00								
GDP Constant 2005 US	-0.10	1.00							
GDP Growth Annual	-0.02	0.01	1.00						
GDP Per Capita Constant 2005 US	0.39	-0.13	0.11	1.00					
Trade as % of GDP	0.36	-0.13	-0.01	0.42	1.00				
Money and Quasi-Money M2 as % of GDP	-0.01	0.36	-0.11	0.24	0.17	1.00			
Real Effective Exchange Rate Index (2005=100)	-0.07	-0.08	-0.13	-0.12	-0.09	0.02	1.00		
Official Exchange Rate (LCU= 1 $)	-0.05	-0.18	0.03	-0.06	-0.34	-0.34	0.01	1.00	
External Debt Stocks as % of GNI	0.27	-0.15	-0.04	-0.14	0.06	-0.24	0.00	-0.03	1.00

Notes: **a**- Foreign Direct Investment Net Inflow (% of GDP); **b**- GDP Constant 2005 US; **c**- GDP Growth Annual; **d**- GDP Per Capita Constant 2005 US; **e**- Trade as % of GDP; **f**- Money and Quasi-Money M2 as % of GDP; **g**- Real Effective Exchange Rate Index (2005=100); **h**- Official Exchange Rate (LCU= 1 $); **i**- External Debt Stocks as % of GNI.

Table 3 presents a simple (base). In a panel a, we present the estimation results for the fixed effect model, and in panel b, we present the estimation results for the random effect model. We applied the fixed effects at the country level. The debt variable is inversely associated with the annual growth rate of Gross Domestic Product (GDP). This is evidence in support of the negative impact of debt on economic growth as in the "crowding out effect of debt."

Table 3. *Regression Results: Simple Model*
Panel a: *Fixed Effect Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	-0.02	0.00	-7.93	0.00
Foreign Direct Investment Net Inflow (% of GDP)	-0.22	0.03	-7.50	0.00
Gross Fixed Capital Formation as % of GDP	0.21	0.03	6.49	0.00
Money and Quasi-Money M2 as % of GDP	-0.12	0.02	-5.49	0.00
Trade as % of GDP	0.00	0.01	0.05	0.96
Constant	6.50	1.13	5.74	0.00

Panel b: *Random Effect Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	-0.01	0.00	-4.27	0.00
Foreign Direct Investment Net Inflow (% of GDP)	-0.13	0.03	-4.63	0.00
Gross Fixed Capital Formation as % of GDP	0.16	0.03	5.55	0.00
Money and Quasi-Money M2 as % of GDP	-0.06	0.01	-4.80	0.00
Trade as % of GDP	0.00	0.01	0.28	0.78
Constant	4.48	0.86	5.20	0.00

In Table 4, we present the estimation results based on an extended model. In the panel, we, present the estimation results for the fixed effect model and in panel b, we present results for the random effect model. Again, we find that the debt variable is negatively associated with the annual growth rate of Gross Domestic Product (GDP).We also discuss the result of the test on "the debt Laffer curve." We also run the model adopted from Patella (2002). According to this specification," the debt Laffer curve" exists if the coefficient of the debt variable is positive and the coefficient of debt squared is negative. In the fixed effect model, we find that the coefficient of the debt variable is insignificant and positive, but the coefficient of the debt-square variable is significant and negative. However, in a random variable model, we find evidence supporting "the debt Laffer curve." We run the Houseman test to select the best model and reject the null that the difference in coefficient is not systematic, which supports the results of the fixed effect model. Next, we perform the Granger causality test between external debt stock as a percent of GNI and annual GDP growth rate. The program module of Granger causality of panel data was designed by Christopher F. Baum of Boston College. We take each of the countries at a time and run the test with the time series of that country. In this dataset, we have 48 countries from Sub-Saharan Africa with 16 observations for each country. We use two lags. The null hypothesis is stated as external debt stock as a percent of GNI does not Granger-cause annual GDP growth rate. We found evidence of granger causality between the two variables in eight out of the forty-eightcountries included in the sample including Congo, Rep., Central African Republic, Ethiopia, Ghana, Lesotho, Sao Tome and Principle, Zambia, Zimbabwe.In the next step, we estimate a model similar to the one in Table 4, but in a dynamic framework created by Arellano-Bond panel data estimation. We again find that the debt variable is negatively and significantly related with the annual growth of GDP variable. We use the e-stat Sargan to get the Sargan test of the null hypothesis that model and over-identifying conditions are correct specified. In this case, we reject the null hypothesis.

Table 4. *Regression Results: Expanded Model*
Panel a: *Fixed Effect Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	-0.02	0.00	-6.87	0.00
Foreign Direct Investment Net Inflow (% of GDP)	-0.24	0.03	-7.23	0.00
Gross Fixed Capital Formation as %	0.19	0.04	4.73	0.00

of GDP				
Money and Quasi-Money M2 as % of GDP	-0.12	0.03	-4.40	0.00
Trade as % of GDP	-0.01	0.02	-0.39	0.70
Real Interest Rate (%)	0.00	0.01	0.18	0.86
Official Exchange Rate (LCU= 1$)	0.00	0.00	1.32	0.19
Constant	7.22	1.57	4.58	0.00

Panel b: *Random Effect Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	0.00	0.00	-2.09	0.04
Foreign Direct Investment Net Inflow (% of GDP)	-0.10	0.03	-3.25	0.00
Gross Fixed Capital Formation as % of GDP	0.13	0.03	3.91	0.00
Money and Quasi-Money M2 as % of GDP	-0.06	0.02	-3.56	0.00
Trade as % of GDP	0.00	0.01	-0.31	0.76
Real Interest Rate (%)	-0.02	0.01	-1.32	0.19
Official Exchange Rate (LCU= 1$)	0.00	0.00	-0.45	0.65
Constant	5.44	1.11	4.89	0.00

In table 5, we present the result for square of the debt variable is negative and significant at the 1 percent level in both the random effect (panel a) and the fixed effect (panel b). Based on the result of Panel a and b, of table 5, we conduct a "Hausman Test." The result supports the fixed effect model. This is evidence in support of "the debt-Laffer curve" , which implies that as a country takes more and more debt, initially this debt will have a positive effect on output but later on (beyond a certain threshold level) this will have a negative effect. Such a "debt-Laffer" curve was supported by the Reinhart & Rogof (2010a and 2010b) and their followers.

Table 5: *Test of Laffer curve*
Panel a: *Random Effect Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	0.0090	0.01	1.70	0.09
External Debt Stocks as % of GNI – square	-0.0001	0.00	-2.92	0.00
Official Exchange Rate (LCU= 1$)	-0.0001	0.00	-0.17	0.86
Real Interest Rate (%)	-0.0167	0.01	-1.28	0.20
Trade as % of GDP	-0.0012	0.01	-0.12	0.90
Money and Quasi-Money M2 as % of GDP	-0.0505	0.02	-2.74	0.01
Gross Fixed Capital Formation as % of GDP	0.1188	0.03	3.45	0.00
Foreign Direct Investment Net Inflow (% of GDP)	-0.0824	0.03	-2.51	0.01
_Constant	4.1539	1.20	3.47	0.00

Panel b: *Fixed Effect Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	-0.0031	0.01	-0.50	0.62
External Debt Stocks as % of GNI – square	-0.0001	0.00	-2.71	0.01
Official Exchange Rate (LCU= 1$)	0.0020	0.00	2.01	0.05
Real Interest Rate (%)	0.0024	0.01	0.18	0.86
Trade as % of GDP	-0.0050	0.02	-0.29	0.78
Money and Quasi-Money M2 as % of GDP	-0.1109	0.03	-4.16	0.00
Gross Fixed Capital Formation as % of GDP	0.1610	0.04	3.95	0.00
Foreign Direct Investment Net Inflow (% of GDP)	-0.2026	0.03	-5.84	0.00
_Constant	5.9505	1.63	3.65	0.00

Weconduct the Arellano-Bond procedure for no auto-correlation in first-difference of errors for order one and two in Table 6 (panel a). Next, we repeat the Arellano-Bond procedure but with two-step and no-constant in Table 6 (panel b). We find a similar result for the debt variable and the annual growth rate of GDP. Again we do the Arellano-Bond test for zero autocorrelations in the first-differenced errors and find zero results.

Table 6: *Arellano-Bond procedure*

Panel a: *Simple model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	0.049	0.05	0.97	0.33
External Debt Stocks as % of GNI - L1	-0.017	0.00	-5.79	0.00
Gross Fixed Capital Formation as % of GDP	0.011	0.06	0.18	0.86
Money and Quasi-Money M2 as % of GDP	-0.123	0.04	-3.12	0.00
Trade as % of GDP	-0.039	0.02	-1.62	0.11
Real Interest Rate (%)	0.044	0.02	2.37	0.02
Official Exchange Rate (LCU= 1$)	0.000	0.00	0.25	0.80

Panel b: *Two Step Model*

Variables	Coefficient	Standard Deviation	t-statistics	p-value
External Debt Stocks as % of GNI	0.018	0.02	1.21	0.23
External Debt Stocks as % of GNI - L1	-0.018	0.00	-37.26	0.00
Gross Fixed Capital Formation as % of GDP	0.021	0.01	1.94	0.05
Money and Quasi-Money M2 as % of GDP	-0.081	0.03	-2.36	0.02
Trade as % of GDP	-0.038	0.00	-10.56	0.00
Real Interest Rate (%)	0.051	0.01	6.72	0.00
Official Exchange Rate (LCU= 1$)	0.001	0.00	1.25	0.21

In Table 7, we present evidence from two models, namely, the fixed effect and the random effect model. This table presents evidence that the Total Debt Service as % of GNI variable is inversely associated with the GDP Per Capita Constant US $ for 2005 [xi]. The coefficients of the debt variable are negative and significant the 5 % level in both the fixed and random effect models. The F-test of each of the models is significant, implying that the models are statistically significant. Thus we get strong evidence that if the debt variable is higher, then the Per Capital GDP will be lower, implying that there is need for great care before the government borrows money[xii].

Table 7: *Robustness Check with GDP Per Capita Constant 2005 US as the dependent variable*

GDP Per Capita Constant 2005 US	Coefficient	Standard Deviation	t-test	P>|t|
Panel A: Fixed Effect				
Money and Quasi-Money M2 as % of GDP	10.95	1.17	9.33	0.00
Trade as % of GDP	-0.82	0.75	-1.09	0.27
Foreign Direct Investment Net Inflow (% of GDP)	-5.53	1.62	-3.41	0.00
Gross Capital Formation as % of GDP	2.99	1.73	1.72	0.08
Total Debt Service as % of GNI	-3	1.32	-2.27	0.02
Constant	831.56	57.83	14.38	0.00
Panel B: Random Effect				
Money and Quasi-Money M2 as % of GDP	11.1	1.17	9.42	0.00
Trade as % of GDP	-0.61	0.76	-0.8	0.42
Foreign Direct Investment Net Inflow (% of GDP)	-5.76	1.63	-3.52	0.00
Gross Capital Formation as % of GDP	3.02	1.75	1.72	0.08
Total Debt Service as % of GNI	-3.06	1.34	-2.29	0.02
Constant	782.28	207.11	3.78	0.00

5. Conclusion

In this study, we examine the relationship between national debt and the annual growth rate of GDP with the help of several advanced econometric tools, using both the fixed and random effects model on a panel data of 48countries. From the panel data fixed and random effect models, we find evidence of adverse impact of debt on growth rate from all the models. The relevant coefficient is negative and statistically significant. We test with several versions but get the same conclusion. We find support for "crowding out" hypothesis. When the government borrows fund from the private sector and take public expenditure projects, they are diverting a part of the investment funds of the private sector. Thus the private sector has less to invest, which may result in lesser economic growth. In the next step, the authors examine the "debt Laffer curve"-hypothesis with a framework suggested by Pattillo et al (2002). Two panel data methods (fixed and random variables) to conduct this part of the test and find clear support for the hypothesis. Therefore, we conclude that "too much debt is bad for the growth of GDP." The government can borrow and invest, which will stimulate the economy. However, if the burden of debt is too high, it can then impede economic growth. In order to compare the findings of the fixed and random effects models, we also conduct the Houseman text, and find support for the fixed effect model. In order to confirm their findings, we next

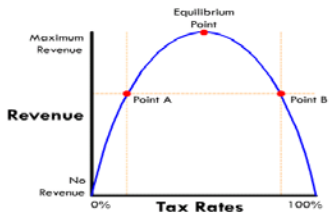
employ the “the Granger causality” tests and find that national debt has significant effect in only 8 out of the 48 countries. Next, we examine the relationship between economic growth and debt with the help of models based on the Arellano-Bond procedure framework and find negative and significant impact of debt on economic growth and even with several versions of the Arellano-Bond framework, we get the same results. Again using GDP Per Capita Constant 2005 US as alternate dependent variable, we find similar result for the fixed and random effect models i.e. find evidence that the debt variable is inversely associated with the new dependent variable, implying that there is need for great care before the government borrows money.

Political decision and economic policy are intertwined and need to be examined carefully when implemented for economic growth and our findings lendcredence to the politically unpopular austerity measures (constraints on government spending financed by borrowing).There is a limit to the economic growth rate that the government financed expenditure can bring. If the burden of debt is too high then there is a negative impact of debt on theeconomic growth.

Notes

[i]Sub-Saharan Africa is, geographically, the area of the continent of Africa that lies south of the Sahara Desert. Politically, it consists of all African countries that are fully or partially located south of the Sahara.

[ii]What is Laffer curve? Credited to Economist Arthur Laffer, the term "Laffer curve" was first coined in U.S. and popularized by the policymakers during President Ford Administration in 1974. The Laffer curve is a representation of the relationship between possible rates of taxation and the resulting levels of government revenue. It illustrates the concept of taxable income elasticity—i.e., taxable income will change in response to changes in the rate of taxation. The chart below shows the Laffer curve:



[iii]Panizza & Presbitero (2013) paper surveys the recent literature on the links between public debt and economic growth in advanced economies. They find that theoretical models yield ambiguous results. Whether high levels of public debt have a negative effect on long-run growth is thus an empirical question. While many papers have found a negative correlation between debt and growth, one's reading of the empirical literature is that there is no paper that can make a strong case for a causal relationship going from debt to economic growth.

[iv]Dritsaki (2013) paper examines the relationship between economic growth, exports and government debt of Greece over the period 1960-2011. The results show that both short and long run relationships exist among these variables. Specifically, the results show that there is a unidirectional Granger causality that runs from exports to economic growth as well as from economic growth to government debt, whereas there is no short run causal relationship between exports and government debt. In the long run, the results show that there is a unidirectional Granger causality that runs from economic growth to government debt.

[v]Panizza & Presbitero (2012) points out that most of the policymakers seem to think that high public debt reduces long-run economic growth referring to many papers that find a negative correlation between debt and growth that becomes particularly strong when debt approaches 100 percent of GDP. To test this relationship, the authors utilize an instrumental variable strategy based on the valuation of foreign debt and exchange rate on a sample of OECD countries and find that the valuation effect variable does not have a direct effect on economic growth if controlled for debt composition and the for the effective exchange rate. In the case of the low-debt countries, the authors find that the negative correlation between debt and growth disappears. In the case of the high-debt countries, they get a similar result using Fisher’s (1966) covariance restrictions method.

[vi]Reinhart & Rogoff (2010) study economic growth and inflation at different levels of government and external debt. Their main findings are: First, the relationship between government debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90 percent of GDP. Above 90 percent, median growth rates fall by one percent, and average growth falls considerably more. They find that the threshold for public debt is similar in advanced and emerging economies. Second, emerging markets face lower thresholds for external debt (public and private)—which is usually denominated in foreign currency. When external debt reaches 60 percent of GDP, annual growth declines by about two percent; for higher levels, growth rates are roughly cut in half. Third, there is no apparent contemporaneous link between inflation and public debt levels for the advanced countries as a group (some countries, such as the United States, have experienced higher inflation when debt/GDP is high.) The story is entirely different for emerging markets, where inflation rises sharply as debt increases.

[vii]Reinhart (2010) present a chart book of the pictorial history, on a country-by-country basis, of public debt and economic crises of various forms. It presents several important observations including (i), Prior to World War II, serial banking crises in the advanced economies was the norm; (ii), as the larger emerging markets developed a financial sector in the late 1800s - these economies joined the "serial banking" crisis club; (iii), Banking crises most often either precede or coincide with sovereign debt crises; (iv), Public debts follow a repeated boom-bust cycle; many (if not most) of the bust phase involved a debt crisis in emerging markets. Public sector borrowing surges as the crisis nears, and the short term debts (public and private) escalate on the eve of the banking crisis and sovereign defaults.

[viii]As reported in Table 1a

[ix]Table 1b presents the names of the 48 countries in the study

[x] Data Source: World Development Indicators. The World Bank. http://data.worldbank.org/data-catalog/world-development-indicators

[xi]GDP Per Capita Constant US $ for 2005 (real GDP at 2005 prices) as the dependent variable.

[xii]We later added new three variables for further test. They are Labor force with secondary education (% of total); Literacy rate, adult total (% of people ages 15 years and above); CPIA (transparency, accountability, corruption, in the public sector). The variables were put both for in the random effect and fixed effect variables, but test results showed they had no influence, as their coefficients were insignificant. For sake of brevity, we are not reporting the findings. Available upon request.

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