African Research Review
AN INTERNATIONAL MULTI-DISCIPLINARY JOURNAL,
BAHIR DAR, ETHIOPIA
AFRREV VOL. 11 (3), SERIAL NO. 47, JULY, 2017: 142-152
ISSN 1994-9057 (Print) ISSN 2070-0083 (Online)
DOI : http://dx.doi.org/10.4314/afrrev.v11i3.14

Empirical Investigation of External Debt-Growth Nexus in Sub-Saharan Africa

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Abstract

The long run debt-growth nexus in sub-Saharan Africa is the main focus of this study. Its analysis is conducted on the basis of theoretical discussions and data considerations. The study employs both panel autoregressive distributed lag (PARDL) model and panel non-linear autoregressive distributed lag (PNARDL) model to examine the relationship between external debt and economic growth using a panel dataset of 22 countries from 1985 to 2015. Its results find that the level of investment significantly influences the long-run economic growth in both linear and non-linear models. However, the long-run coefficient of external debt is only significant in the non-linear model. There is strong evidence of error correction as the lagged GDP per capita is highly significant and negative in the two models.

Key Words*:* debt, debt and growth, public debt and growth, linear regression models

Introduction

Recently, there have been more attentions on examining the connections between government-debt and economic growth. From the work of Reinhart & Rogoff, (2010 a, b), numerous studies have analysed relationships and the existence of non-linearities. This study aims at analysing the link between external debt and economic growth and then examines the existence of common or country-specific thresholds in which magnitude changes occur. This study contributed by narrowing the public debts into

external debts and analysing the connection by applying the recently developed techniques from panel data studies. It provides answers to the following research questions: what is the long-run relationship between external debt and economic growth? Does this link differ based on each of the two models employed? Does level of investment perform any significant role in the region?

Eberhardt and Presbitero (2015) examined the links between debt and growth in a panel dataset of over 118 countries using linear and non-linear specifications. Their findings indicated a negative relationship between public debt and long-run growth across countries. However, there are no evidences for systematic within-country non-linearity in the debt-growth nexus for all the concerned countries. The study employed a standard neoclassical growth model to empirically analyse the external debt-growth nexus. Recent studies such as Cordella et al. (2010), Checherita-Westphal & Rother (2012), Kourtellos et al. (2013), Panizza & Presbiteri (2014), etc. provided empirical research that is similar to this study.

Employing a dataset of external debts from African countries over the sample period 1960-2012, the study finds that the long-run effects of external debt vary across the concerned economies, and reveals that countries characterized with higher average external debt-to-GDP ratios witness a negative impact on their economic performance in the long-run. This supports the evidence that higher debt ratios on average are connected with lower GDP growth rates (Reinhart and Rogoff, 2010a, b). Although, there are significant variations across countries and estimates of non-linearities do not indicate the presence of a common pattern in the sample period. The external debt-growth nexus is complex and the identification of a specific threshold which causes a growth slowdown needs to consider debt composition and a variety of country features which may limit government choices and influence how a country is vulnerable to crises.

Its analysis depends on total government debt that allows making comparison across countries and using a huge panel dataset. However, non-inclusion of private debt is delicate in the sense that private debt is a potential source of financial instability and crisis (Gourinchas and Obstfeld, 2012; Schularick and Taylor, 2012). Also, failure to consider foreign currency –denominated debt could reduce financial stability and trigger sub-optimal macroeconomic policies as indicated in the literature (Hausmann and Panizza, 2011). Net debt might be more appropriate to measure government indebtedness rather than gross public debt (Panizza and Presbitero, 2013). Using the face value of public debts is inappropriate, because countries' borrowing conditions are differed in terms of maturity and contractual deals (Dias et al., 2014). The absence of sufficient data constrains the study to explore these issues.

Review of Relevant Literature

Numerous theoretical studies establish an inverse long-run connection between public debt and growth. In the standard generation models of growth, public debt decreases saving and capital accumulation through higher interest rates, hence, deteriorating growth (see Modigliani, 1961; Diamond, 1965; Blanchard, 1985). In endogenous growth models, public debt has an adverse effect on long-run economic growth (Barro, 1990; Saint-Paul, 1992). Put differently, debt must be settled through future decline in public spending or distortionary taxation, with adverse influences on growth. In the

same vein, studies such as Bohn (1998), Mendoza and Ostry (2008) and Lo & Rogoff (2015) pointed out that the government responds to an increasing public debt by boosting the basic surplus or operating smaller deficits. In addition, high public debt constrains productive level of public expenditures on long-run growth (Teles and Mussolini, 2014), poses uncertainty or expectation of future financial repression (Cochrane, 2011), and could trigger higher sovereign yield spreads (Codogno et al., 2003) could contribute to higher real interest rates and reduces private investment (Laubah, 2009).

Another stream of literature considers whether the debt-growth nexus is significantly different across countries. Temple (1999) identified a difference in production technology as among the reasons behind the variations in the debt-growth nexus. Recent studies like (Reinhart et al., 2012; International Monetary Fund, 2012) conducted a country-specific analysis on debt overhang using a qualitative technique. The ability to tolerate huge debt is a function of country-specific features in relation to past circles and the macro and institutional framework (Reinhart et al., 2003; Kraay & Nehru, 2006; Manasse & Roubini, 2009). However, most are difficult in setting up the model empirically.

In addition, the vulnerability to public debt basically depends on debt composition in terms of domestic versus external, foreign or domestic currency denominated; long term versus short term public debts (Reinhart et al., 2012; Dell'Erba et al., 2013).

The concept of non-linear debt-growth nexus is addressed in this study by employing Panel Non-linear Autoregressive Distributed Lag (PNADL) technique. The non-linearity is attached to heterogeneity. Thus, its analysis of non-linearity is performed on a country-specific thresholds or vulnerability regions. This approach is in line with the past studies on the asymmetric effects of fiscal policy which triggers an investigation on a non-linear impact of government debt on economic performance in developed countries (see Sutherland, 1997; Perotti, 1999). Fiscal sustainability may also account for the non-linearity in the debt-growth connection (Krugman, 1988; Aguiar et al., 2009). As debt-to-growth ratio increases, it makes creditors to demand for higher interest rates to mitigate the default risk. Thus, this leads to a rise in the cost of financing, which limits investment (Greenlaw et al., 2013). Some research confirms the existence of common debt threshold across countries (e.g. Kumar and Woo, 2010; Cecchetti et al., 2011; Checherita-Westphal and Rother, 2012; Greenlaw et al., 2013). However, Ghosh et al. (2013) postulated that debt limit depends on countries' structural features and GDP growth.

Empirical Strategy and Data

This study begins its empirical investigation on debt-growth nexus by examining the relationship across countries. For this purpose, the study adopted linear regression models to capture both observed and non-observed heterogeneity. It utilizes the ARDL approach to identify the long-run and short-run coefficients on debt. Then, it examined the non-linear relationship between debt and growth at the country-level using panel non-linear ARDL technique. The model specifications and identification strategies are fully discussed below.

The section below presented the data utilized in the analysis as well as robustness checks.

Empirical Specifications

Linear Dynamic Model

A double-log Cobb-Douglas production function augmented with an external debt stock term is used as the basic model of its analysis:

$$Y_{it} = \gamma_i^k K_{it} + \gamma_i^d D_{it} + \varepsilon_{it}, \quad \varepsilon_{it} = \delta_i + \pi_i S_t + \epsilon_{it} \qquad 1$$

Non-Linear Dynamic Model

$$Y_{it} = \gamma_i^k K_{it} + \gamma_i^d D_{it} + \pi_i^k {K_{it}}^2 + \pi_i^d {D_{it}}^2 + \varepsilon_{it} \qquad 2$$

Where Y denotes aggregate GDP, K is capital stock and D represents the total external debt stock (all variables are expressed in logarithms of per capita terms). These variables form the observed component of the model, with their parameter coefficients γ_i^j (for $j = K, D$) to account for difference across countries.

Eq. 1 also entails country –specific intercepts (δ_i) and a set of unobserved common factors S_t with country-specific 'factor loadings' π_i to capture the levels and evolution of unobserved Total Factor Productivity (TFP) respectively.

The non-stationarity of common factors plays a critical role in the empirical analysis because all observed and unobserved components of the model are integrated and standard inference is not valid (Kao, 1999). These general factors do not only affect output but also the capital and debt stocks, based on the assumption of endogenous inputs to production. The regression parameters, γ_i^K and γ_i^D are not the same except if they account for the unobservable factors in the disturbance term ε or a valid and informative set of instruments. Therefore, pooled data framework is not appropriate because of its failure to account for both valid and informative arising from the existence of unobserved factors and different underlying balanced conditions across countries.

The common factor framework entails a number of specifications in the existing studies on the debt-growth nexus. Considering the relevance of time series properties and dynamic nature of macro panel analysis, this study utilizes an error correction model (ECM) in line with the above equation. This provides three following benefits: a) Separation of short-run and long-run impacts b) Examination of the error correction term and deduction of the speed of adjustment to the long-run equilibrium, and c) provision of co-integration test.

Data Nature and Source

The main variables are real GDP per capita, capital stock per capita (gross fixed capital formation), and total external debt stock. Data are obtained from the World Bank World Development Indicators (WDI) database. The entire sample entails 22 countries in the sub-Saharan African region. Number of countries in this study is constrained by data availability. Insufficient data availability hinders the study from carrying out a detailed analysis of the debt-growth nexus using more granular definitions of debt, distinguishing between gross and net debt, and between foreign and domestic-currency denominated total debt. The puzzle of foreign currency denomination is specifically

critical in the sub-Saharan Africa, based on the issue of financial fragility. Therefore, the study utilizes external debt data.

Empirical Results and Discussion

This study conducted a preliminary analysis by examining the descriptive nature of all the concerned variables as well as their panel unit root tests. Results are reported in Table 1-5 under the Appendix.

Linear dynamic Model

The results of long-run and short-run ARDL model are represented in Table 4. In the model, the study focuses on long-run coefficients as well as the estimates of the lagged level of GDP in order to examine the behaviour of error term and provide evidence for a long-run equilibrium. The results show that the long-run coefficients on external debt is statistically insignificant but negative throughout, whereas the long-run coefficient of per capita investment are significant and positive. In addition, there is strong evidence of error correction as the lagged GDP per capita is highly statistically significant and negative. This indicates the speed of adjustment of about 9 percent per annum if there is any disturbance to the long-run equilibrium. On the other hand, the level of investment has a significant and positive on the short-run per capita real GDP in the region. The short-run coefficient of external debt remains negative and insignificant.

Non-Linear dynamic Model

The results of non-linear model presented in Table 5, supports the evidence of non-linear relationship established in the literature. The results reveal that the long run coefficients of all explanatory variables are statistically significant and positive, whereas short-run coefficients with the exception of lagged per capita real GDP are insignificant. In addition, there is strong evidence of error correction as the lagged GDP per capita is highly statistically significant and negative. This indicates the speed of adjustment of about 16 percent per annum if there is any disturbance to the long-run equilibrium. In comparing with the result of the linear model, the non-linear model outcomes perform better and also confirms to a prior expectation. The coefficient of its error correction term is relatively higher.

Conclusion

This study examined the external debt-economic growth nexus with the aim of providing crucial insights to the recent on-going debate on non-linearity relationship between debt and growth emanated from the research of Reinhart and Rogoff (2009, 2010, & 2011). In addition, it empirically provides a more understanding on the implications of continuous external borrowing by most government in sub-Saharan Africa.

The research adds to existing empirical literature in three folds: first, it examined the long-run relationship through the use of ARDL empirical model and the adoption of time-series properties to prove the existence of a long-run equilibrium, considering the possibility of endogeneity issues. Second, it accounted for heterogeneity in its empirical framework as reflected in theoretical and empirical literature. This study served as the first panel research on external debt and growth using panel non-linear

ARDL approach. Third, it employed PNARDL technique to shed light on the potential non-linearity in the debt-growth nexus in the region.

Findings revealed that the level of investment has a significant influence on short-run and long-run economic growth in the region, whereas the level of external debt does not have any significant effect in both the long-run and short-run economic growth under the linear dynamic model.

Under the non-linear model, the long-run coefficients of all the independent variables are highly significant and positive. However, only the coefficient of the lagged per capita real GDP (error correction term) is statistically significant in the short-run. This implies that external debt as well as investment is not the key driver of short-run economic growth in the region.

Based on the study's findings, governments in the region need to pay more attention on other relevant variables such as conducive business climate and good institutional quality that might influence the level of investment and efficient utilization of external debts in the short-run. Thus, these measures could lead to the achievement of sustainable long-run economic growth aspiring in the region.

In addition, the external debts have to be spent prudently on capital and human infrastructure in order to make the region's economic growth robust, sustainable and inclusive. Therefore, provision of adequate facilities for ensuring that capital projects are properly implemented within their timeframes should be encouraged. Role of institutional quality in external debt-growth relationship calls for an important area of research in the future.

References

Aguiar, M. A., Manuel, G., & Gita, M. (2009). Investment cycles and sovereign debt overhang. *Rev. Econ. Stud.* 76 (1), 1–31.

Barro, R. J., (1990). Government spending in a simple model of endogenous growth. *J. Polit. Econ.* 98 (5 pt 2), S103–S125.

Blanchard, M., & Olivier, J. (1985). Debt, deficits, and finite horizons. *J. Polit. Econ*. 93 (2), 223–247.

Bohn, H., (1998). The behaviour of US public debt and deficits. *The Quarterly Journal of Economics*, 113(3), 949-963.

Cecchetti, S., Mohanty, M., Zampolli, F., (2011). Achieving growth amid fiscal imbalances: The real effects of debt. *Economic Symposium Conference Proceedings*. Federal Reserve Bank of Kansas City, pp. 145–196.

Checherita-Westphal, C., Rother, P., (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. *Eur. Econ. Rev*. 56 (7), 1392–1405.

Cochrane, J. H. (2011). Understanding policy in the great recession: some unpleasant fiscal arithmetic. *Eur. Econ. Rev.* 55 (1), 2–30.

Codogno, L., Favero, C., Missale, A. (2003). Yield spreads on EMU government bonds. *Econ. Policy* 18 (37), 503–532.

Cordella, T., Ricci, L. A., & Ruiz-Arranz, M. (2010). Debt overhang or debt irrelevance? *IMF Staff*. pp. 57 (1), 1–24.

Dell'Erba, S., Hausmann, R., & Panizza, U. (2013). Debt levels, debt composition, and sovereign spreads in emerging and advanced economies. *Oxf. Rev. Econ. Policy* 29 (3), 518–547.

Diamond, P. A., (1965). National debt in a neoclassical growth model. *Am. Econ. Rev*. 55 (5), 1126–1150.

Dias, D. A., Richmond, C., Wright, M. L.J., (2014). The stock of external sovereign debt: Can we take the data at 'face value'? *J. Int. Econ*. 94 (1), 1–17.

Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. *Journal of International Economics* 97, 45–58

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., Qureshi, M. S., (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *Econ. J*. 123 (566), F4–F30.

Gourinchas, P., & Obstfeld, M., (2012). Stories of the twentieth century for the twenty first. *Am. Econ. J*. Macroecon. 4 (1), 226–265.

Greenlaw, D., Hamilton, J., Hooper, P., & Mishkin, F. S., (2013). Crunch time: Fiscal crises and the role of monetary policy. *Proceedings of the U.S. Monetary Policy Forum 2013*.

Hausmann, R., & Panizza, U., (2011). Redemption or abstinence? Original sin, currency mismatches and counter cyclical policies in the new millennium. *J. Glob. Dev*. 2 (1), 1–35.

International Monetary Fund, (2012). *World economic outlook — coping with high debt and sluggish growth*. International Monetary Fund.

Kao, C., (1999). Spurious regression and residual-based tests for cointegration in panel data. *J. Econ*. 65 (1), 9–15.

Kourtellos, A., Stengos, T., & Tan, C. M., (2013). The effect of public debt on growth in multiple regimes. *J. Econ.* Macroecon. 38, 35–43.

Kraay, A., Nehru, V., (2006). When is external debt sustainable? *World Bank Econ. Rev*. 20 (3), 341–365.

Krugman, P., (1988). Financing vs. forgiving a debt overhang. *J. Dev. Econ.* 29 (3), 253–268.

Kumar, M. S., Woo, J., (2010). Public debt and growth. *IMF Working Papers* 10/174. International Monetary Fund.

Laubach, T., (2009). New evidence on the interest rate effects of budget deficits and debt. *J. Eur. Econ. Assoc.* 7 (4), 858–885.

Lo, S., & Rogoff, K., (2015). Secular stagnation, debt overhang and other rationales for sluggish growth, six years on. *BIS Working Papers* 482.

Manasse, P., & Roubini, N., (2009). Rules of thumb for sovereign debt crises. *J. Int. Econ.* 78 (2), 192–205.

Mendoza, E. G., & Ostry, J. D., (2008). International evidence on fiscal solvency: Is fiscal policy "responsible"? *J. Monet. Econ.* 55 (6), 1081–1093.

Modigliani, F., (1961). Long-run implications of alternative fiscal policies and the burden of the national debt. *Econ. J.* 730–755.

Panizza, U., & Presbitero, A. F., (2013). Public debt and economic growth in advanced economies: A survey. *Swiss J. Econ. Stat.* 149 (2), 175–204.

Panizza, U., Presbitero, A. F., (2014). Public debt and economic growth: Is there a causal effect? *J. Econ.* Macroecon. 41, 21–41.

Perotti, R., (1999). Fiscal policy in good times and bad. *Q. J. Econ.* 114 (4), 1399–1436.

Reinhart, C. M., & Rogoff, K. S., (2009). *This Time is Different — Eight centuries of financial folly*. Princeton, New Jersey: Princeton University Press.

Reinhart, C. M., & Rogoff, K. S., (2010a). Debt and growth revisited. *MPRA Paper 24376*. Germany: University Library of Munich.

Reinhart, C. M., & Rogoff, K. S., (2010b). Growth in a time of debt. *Am. Econ. Rev. Pap. Proc.* 100 (2), 573–578.

Reinhart, C. M., & Rogoff, K. S., (2011). A decade of debt. *NBER Working Papers 16827*. National Bureau of Economic Research, Inc.

Reinhart, C. M., Rogoff, K. S., & Savastano, M. A., (2003). Debt intolerance. *Brook. Pap. Econ. Act.* 34 (1), 1–74.

Reinhart, C. M., Reinhart, V. R., & Rogoff, K. S., (2012). Public debt overhangs: Advanced-economy episodes since 1800. *J. Econ. Perspect.* 26 (3), 69–86.

Saint-Paul, G., (1992). Fiscal policy in an endogenous growth model. *Q. J. Econ.* 107 (4), 1243–1259.

Schularick, M., Taylor, A. M., (2012). Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870–2008. *Am. Econ. Rev.* 102 (2), 1029–1061.

Sutherland, A., (1997). Fiscal crises and aggregate demand: Can high public debt reverse the effects of fiscal policy? *J. Public Econ.* 65 (2), 147–162.

Teles, V. K., Mussolini, C. C., (2014). Public debt and the limits of fiscal policy to increase economic growth. *Eur. Econ. Rev.* 66, 1–15.

Temple, J., (1999). The new growth evidence. *Journal Economics Literature*, 37(1), 112-156.

Appendix

Table 1: Variables Description

Symbol	Definition
DEBT	External debt stocks, total (DOD, current US$)
GDPC	GDP per capita (constant 2010 US$)
GFCF	Gross fixed capital formation (constant 2010 US$)
LDEBT	Log of External debt stocks, total (DOD, current US$)
LGDPC	Log of GDP per capita (constant 2010 US$)
LGFCF	Log of Gross fixed capital formation (constant 2010 US$)

Table 2: Summary Statistics

Statistics	LDEBT	LGFCF	LGDPC
Mean	21.77	21.13	6.98
Median	21.75	21.06	6.76
Maximum	25.65	25.43	9.40
Minimum	19.25	15.14	4.87
Std. Dev.	1.29	1.51	1.01
Skewness	0.55	0.52	0.65
Kurtosis	3.24	3.82	2.54
Jarque-Bera	36.28	49.98	54.00
Probability	0.00	0.00	0.00
Sum	14847.59	14390.81	4762.93
Observations	682	681	682

Table 3: Panel Unit Root Tests

Table 3.1: No intercept & No Trend

Statistics		LDEDT	LGDPC			LGFCF
	Level	First Diff	Level	First Diff	Level	First Diff
LLC t	3.91	-15.52***	6.73	-11.48***	8.97	-14.64***
ADF-Fisher	7.07	316.02***	8.71	258.54***	2.76	303.90***
PP-Fisher	4.84	483.35***	10.57	424.54***	2.91	504.10***

Note: ***, **, and * represents 1%, 5% and 10% significant level respectively

Table 3.2: Individual Effects

Statistics	LDEBT		LGDPC		LGFCF	
	Level	First Diff	Level	First Diff	Level	First Diff
LLC t	-1.41*	-10.50***	-1.80**	-7.86***	0.76	-9.50***
IPS W-stat	-1.41*	-10.96***	2.26	-11.33***	3.86	-13.39***
ADF-Fisher	58.32*	205.03***	41.60	213.46***	35.54	255.64***
PP-Fisher	69.22***	363.86***	40.87	373.86***	27.15 430.07***	

Note: ***, **, and * represents 1%, 5% and 10% significant level respectively

Table 3.3: Individual Effects, Individual Linear Effects

Statistics	LEXCH		LGDPC		LGFCF	
	Level	First Diff	Level	First Diff	Level	First Diff
LLC t	0.69	-9.20***	-3.47***	-6.33***	-4.85***	-6.79***
Breitung t-stat	-1.14	-6.84***	1.45	-5.76***	0.61	-7.15***
IPS W-stat	0.07	-8.17***	-1.75**	-10.01***	-3.26***	11.80***
ADF-Fisher	41.25	146.75***	66.27**	177.16***		90.87*** 210.60***
PP-Fisher	45.41	374.23***	68.59**	719.52***		67.11** 702.22***

Note: ***, **, and * represents 1%, 5% and 10% significant level respectively

Table 4: Panel Autoregressive Distributed Lags Model – PARDL (1, 1, 1)

Variable	Coefficient	Prob.*
Dependent variable: LGDPC		
Long run Estimates		
LDEBT	-0.006	0.742
LGFCF	0.428	0.000
Short run Estimates		
Constant	-0.176	0.000
D(LDEBT)	-0.014	0.270
D(LGFCF)	0.074	0.000
Error	-0.094	0.000

Prob* is the p-values

Table 5: Panel Non-linear Autoregressive Distributed Lags Model–PNARDL (4, 4, 4, 4, 4)

Variable	Coefficient	Prob.*
Dependent variable: LGDPC		
Long run Estimates		
LDEBT	-3.024	0.000
LGFCF	3.139	0.000
LDEBT^2	0.061	0.000
LGFCF^2	-0.055	0.000
Short run Estimates		
Constant	0.174	0.030
D(LGDPC (-1))	-0.099	0.369
D(LGDPC(-2))	-0.099	0.286
D(LGDPC(-3))	-0.087	0.399
D(LDEBT)	-5.324	0.137
D(LDEBT(-1))	-2.950	0.448
D(LDEBT(-2))	-2.556	0.501
D(LDEBT(-3))	-4.026	0.305
D(LGFCF)	1.966	0.171
D(LGFCF(-1))	-1.085	0.609
D(LGFCF(-2))	1.970	0.240
D(LGFCF(-3))	1.067	0.279
D(LDEBT^2)	0.127	0.119
D(LDEBT(-1)^2)	0.068	0.451
D(LDEBT(-2)^2)	0.063	0.470
D(LDEBT(-3)^2)	0.088	0.313
D(LGFCF^2)	-0.046	0.168
D(LGFCF(-1)^2)	0.022	0.673
D(LGFCF(-2)^2)	-0.048	0.225
D(LGFCF(-3)^2)	-0.027	0.245
Error	-0.156	0.091

Prob.* is the p-values