Does Public Debt Matter For Economic Growth? Evidence From South Africa

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ABSTRACT

This paper investigates the dynamic relationship between accumulated public debt ratio and real GDP growth in the South African economy over the period 1980-2014. Using two macroeconomic control variables – inflation rate and Openness trade – the link between public debt and real GDP growth is found to depend upon the level of indebtedness of the country. Indeed, public debt in South Africa becomes an impediment to economic growth if it crosses the limit of 31.37% of GDP.

Our empirical results have therefore important implications for fiscal policymakers in South Africa to foster economic growth in a context of high public debt level.

Keywords: Debt-to-GDP Ratio; Real GDP Growth; South Africa

INTRODUCTION

The recent sovereign debt crisis that hit several countries in Europe and in the world brought forth the issue of the dangers of high and increasing indebtedness. Policymakers, lenders and borrowers are constantly faced with the difficulty of determining the optimal level of the public debt that could threaten the economic growth.

Over the last two years, the debate on the relationship between government debt and economic growth has become lively with growing series of empirical papers. The older literature on this topic can be summarized by three strands of thought.

The first sees public debt as determinant to domestic saving, investment and thus to growth (Eisner, 1992). The second strand considers that higher public debt may endangering the domestic saving and investment through the *crowding-out effect* and thus reduces economic growth (Krugman, 1988; Alesina and Tabellini, 1989; Tornell and Velasco, 1992). This is due to the so-called the *debt overhang theories*, which show that the future debt is going to be greater than the country's expected repayment ability.

In contrast to these theoretical achievements, the *Ricardian equivalence theory* (Barro, 1989) argues that the level of the debt does not have any impact on economic growth because larger increase in private saving due to more tax cut financed by higher borrowing will offset the fall in public saving. This is because taxpayers save the full tax cut in order to repay the future tax liability and thus, it does not change aggregate demand. Summarily, government debt has no short-run effect on growth.

Based on these conflicting views, more recent studies intend to examine the possible nonlinear impact of debt on growth by employing threshold models; at low levels debt has positive effect on growth but above a certain threshold – called also turning point - debt starts having a negative effect on economic growth.

The objective of this paper is to add to the existing literature on public debt and economic growth by using a long historical data series on the government debt ratio for South Africa to shine a light on the existing collective knowledge concerning this issue.

The rest of paper is organized as follows: in section 2 we provide a brief literature review on the link between public debt and economic growth. Section 3 outlines the empirical methodology. Section 4 discusses the data. The empirical results are presented and discussed in section 5. Finally, section 6 summarizes the main conclusions.

LITERATURE REVIEW

The recent literature on the link between public debts on GDP growth witnessed an upsurge of empirical studies covering the issue of high indebtedness and its impact on economic growth. One of the most influential studies on this topic is the one of Reinhart and Rogoff (2010). This study is based on an extensive dataset including forty-four countries spanning about two hundred years and it shows that there is a turning point at 90 percent public debt to GDP beyond which growth deteriorates sharply.

The findings in Reinhart and Rogoff (2010) are also consistent with those of Cecchetti et al. (2011), covering a sample of 18 OECD countries over the period 1980-2010. They also find a nonlinear impact of public debt on growth with a threshold of 86% of GDP.

In a paper investigating 12 old euro area countries from 1890-2010 and using a dynamic threshold panel methodology, Checherita and Rother (2010) address the issue of causality by regressing per capita real GDP growth against the ratio of government debt to GDP. They demonstrated that economic growth slows down considerably if the public debt-to-GDP ratio exceeds a turning point at about 90% of GDP in these twelve EMU countries.

This is in line with Kuman and Woo (2010) who also find that for high debt-to-GDP ratio (above 90%), additional debt has a negative impact on growth for the whole sample of 30 advanced and emerging market economies over 1970-2007.

Focusing on the Euro area, Baum et al. (2013) suggest that GDP growth decrease to around zero and loses significance at debt to GDP ratio above 67 percent, under which debt has a positive impact on growth. They also find a threshold for public debt exceeding 95 percent of GDP above which growth slows down.

Thus, in a similar vein as with the estimated relationship between debt and growth, the literature holds that growth tends to decline if the public debt to GDP ratio exceeds a certain threshold level.

Overall, our reading of the existing literature suggests that the approval to estimating a nonlinear relationship between debt and growth has gained popularity in empirical literature.

Sarno (2001) argues that a linear model seems to be too restrictive to adequately capture the asymmetries that may exist between the debt to GDP and GDP growth suggests the use of nonlinear debt sustainability in the estimated relationship between debt and growth.

The goal of the present manuscript is to examine the possible nonlinear relationship between government debt and economic growth in South Africa over the period 1980-2014. South Africa is an interesting case study since it has experienced high levels of debt for a significant part of its history.

Empirical Methodology

We develop a nonlinear Smooth transition Regression (STR) model in order to highlight the potentially asymmetric effect of public debt on economic growth by distinguishing two regimes; during the period of high and increasing indebtedness, the effect of public debt on economic growth differs from that observed during tranquil periods.

In this regards, the transitional behavior of government debt on economic growth seems to be better studied using the LSTR model, which is appropriate to capture asymmetry, heterogeneity and time-varying potential influence of the accumulation of public debt on economic growth. In addition, the effect of debt on growth is

governed by a transition variable that traces well heterogeneity and specificity of each country and even each study period.

The LSTR model with two extreme regimes and a single transition function can be formulated as follows:

$$y_t = \alpha + \beta_0 x_t + \beta_1 x_t * g(d_t, \gamma, c) + \varepsilon_t \quad t=1, \dots, T \quad (1)$$

In Eq. (1) above, the dependent variable y_t is the output gap which is considered as a proxy of the activity.

x_t : is the vector of control variables that contains exogenous variables are considered as independent variables.

α : is the intercept of the model.

ε_t : is the residual term.

The transition function $g(d_t, \gamma, c)$ is a continuous function of the observed variable d_t , that refers to the government debt and is bounded by 0 and 1; these extreme values are associated with regression coefficients β_0 and β_1 .

β_0 measures the effect of debt growth when the government debt is expected to be below the threshold level c while β_1 measures the effect of debt on growth when d_t is greater than the threshold c .

In the event $\beta_0 = \beta_1$; the model collapses into a homogenous or linear regression model with.

The transition function $g(d_t, \gamma, c)$ is modelled using the following logistic function discussed in Terasvirta (1998).

$$g(d_t, \gamma, c) = [1 + \exp \left\{ \frac{-\gamma}{\sigma_{d_t}^k} \prod_{k=1}^k (d_t - c) \right\}]^{-1} \quad \text{with} \quad \gamma > 0 \quad (2)$$

where c indicates the location parameter while the slope parameter is denoted by γ ; the latter determines the smoothness of the transition.

Van Dijk et al. (2002) demonstrate that as $\gamma \rightarrow 0$, the transition function becomes constant, in which case the model becomes indistinguishable from the linear autoregressive model.

More specifically, we regress the dependent variable (the growth rate of GDP) on the government debt and a set of control variables such they are used in the relative literature.

In particular, two control variables are used namely Openness and Inflation.

OPENNESS is considered as an indicator of openness trade of the economy and external competitiveness, which is defined as imports plus exports as share of GDP.

INFLATION is computed as the log of the average inflation rate over the time interval sampled from 1980 to 2014.

In this regards, we can proceed with estimating the following STR model:

$$y_t = \alpha + \beta_0 (d_t + OPENNESS_t + INFLATION_t) + \beta_1 (d_t + OPENNESS_t + INFLATION_t) * g(d_t, \gamma, c) + \varepsilon_t \quad t=1, \dots, T \quad (3)$$

In the above model d_t indicates the public debt as portion of real GDP growth.

Data Description

As we mentioned in section 3, public debt is presumed to have a significant impact on the real GDP growth and the above control variables; inflation and trade openness.

In this regards, we choose real GDP growth as dependent variable; government debt is used as a transition and independent variable and both trade Openness and inflation as control variables.

The annual data for all the variables under consideration is spanning the period 1980-2014. This data is compiled from the international Financial Statistic (IFS) and the Carmen Reinhart and Kenneth Rogoff website at www.reinhartandrogoff.com/data for the Debt to GDP ratio.

Before turning to econometric testing, the descriptive statistics are provided in table 1 over the full sample.

Table 1. Summary Statistics					
	Observation	Mean	Std. Dev.	Maximum	Minimum
y_t	35	3.209	2.173	4.37	-4.685
d_t	35	37.09	6.555	48.52	25.91
$OPENNESS_t$	35	-1.202	3.378	6	-7.2
$INFLATION_t$	35	9.545	4.435	18.75	1.39

The minimum, maximum and mean levels of all variables under consideration over the last three decades (1980-2014) are presented, as well as the standard deviation. Table 1 shows that the debt-to-GDP ratio peaked at 48.52% in 1998 and plunged to 25.91% in 2008. While the real GDP Growth ranged from 4.37% in 1980 to -4.685% in 2010.

Figure 1 shows the time path of the public-to-GDP ratio and GDP growth variables. We notice that a significant part of South Africa's history is marked by relatively high levels of public debt mainly between years 1994 and 2002. In addition, the public debt experienced a, upward trend starting in 2008 and reached a high level – comparable to the peak reached in 1998, in 2014:Q4

Figure 1 show also that – around the peak time - the debt-to-GDP ratio and GDP growth seem to be positively correlated with debt. This pattern provides evidence that higher debt is associated with upward trends of Growth. Thereafter, the Growth posted a decline of 3.5 point while debt rises continuously.

Thus, the latter period is characterized by a strong negative correlation between the two variables. This pattern appears in line with the proposition that the debt level show a nonlinear relationship with Growth.

Figure 1. Time series dynamics

South Africa experienced a similar scenario; debt started rising again in 2008, Growth appears to be positively correlated with debt and reached a peak of 3.2% in 2012. Thereafter, growth reduced while debt rose continuously.

The above patterns support the existence of a turning point that drives the direction of the link between debt-to-GDP ratio and real GDP growth.

Moreover, prior to applying the estimation procedure, it is essential to check for the stationarity of the considered time series. The results of ADF, Zivot-Andrew and the KPSS test are gathered in table 2.

Table 2. Stationarity results

	y_t	d_t	$OPENNESS_t$	$INFLATION_t$	Δd_t	$\Delta INFLATION_t$
ADF	-3.137***	-0.1365	-1.7332**	-1.2166	0.1262**	-4.4203***
KPSS	0.1328***	0.1912	0.4817**	0.9838	-1.887**	0.0591***
ZA	-7.341***	-2.1678	-6.1442**	-3.4213	-6.375**	-8.342***

Note: This table reports the results of ADF, KPSS and Zivot-Andrews stationarity tests. y_t , d_t , $OPENNESS_t$ and $INFLATION_t$ stand for the real GDP Growth, the public debt-to-GDP ratio, openness trade and inflation rate, respectively. 1% and 5% Critical values for the ADF test are -2.56 and -1.94 whereas those of the KPSS test are 0.463 and 0.739, respectively. ***, ** and * indicate significance at the 1%, 5% and 10% significance levels respectively.

The ADF test rejects the null hypothesis of unit root for y_t and $OPENNESS_t$ at 1% significance level. Consequently, the real GDP Growth and the Openness trade are stationary. However, the public debt-to-GDP ratio (d_t) and the inflation rate $INFLATION_t$ are not stationary and the hypothesis of unit root is not rejected.

Likewise, the KPSS test fails to reject the null hypothesis of stationarity for debt-to-GDP ratio and the inflation rate.

We also apply the Zivot-Andrew stationarity test which is robust to the presence of a structural break either in the mean, in the trend or in both. Results of this test show that the null of unit root is strongly rejected for the real GDP Growth and the OPENNESS trade series while the public debt and INFLATION series are found to be non-stationary.

Empirical Results

We start our analysis by estimating a nonlinear regression of real GDP growth on inflation, openness trade and public debt-to-GDP ratio. We also include the lagged real GDP growth to the vector of regressors. We use annual data for the period 1980-2014.

Table 3. Estimation results of LSTR model

	Stimulus Regime	Crowding-out Regime
<i>Intercept</i>	-27.89 (40.8876)	23.651 (41.257)
d_t	0.8218*** (3.166)	-0.7203*** (3.421)
y_t	-0.007*** (1.882)	0.019*** (1.751)
$INFLATION_t$	-0.284* (-3.115)	-0.1768* (-3.262)
$OPENNESS_t$	1.0305** (2.136)	1.1911** (2.338)
<i>Gamma</i>	13.302**	(0.5795)
<i>c</i>	31.37***	(1.112)
<i>AIC</i>		1.5904
R^2		0.631
<i>Jarque-Bera</i>	4.5492	[0.1028]
<i>ARCH(8)</i>	5.9172	[0.6565]

Note: This table reports the estimates of the Logistic Smooth Transition model. Standard errors are between () and p-values are between []. ***, ** and * indicate significance at the respective significance levels 1%, 5% and 10%.

Parameter estimates are reported in Table 3. Results clearly reveal the existence of two regimes. In the first regime the public debt is emphasized by the strongly positive and statistically significant relationship that it exhibits with economic growth. A one-percentage point increase in public debt is associated with a 0.8118% increase of economic growth. This evidence is in line with the stimulus view of Eisner (1992).

In contrast, in the second regime, this dependence becomes statistically negative; a 1% increase in the public debt is associated with a decrease of real GDP growth of 0.7203%. Thus, our results provide also some support to negative relationship, which is consistent with the crowding-out view (Krugman, 1988; Alesina and Tabellini, 1989; Tornell and Velasco, 1992).

In other words, the above findings are consistent with the proposition that the positive impact of debt on growth rapidly changes sign as the debt level increases above the threshold value of 31.37%.

A possible explanation for a positive impact of low levels of public debt on growth would be that those resources generated through public debt are basically used in productive manner whereas beyond a certain debt level an additional debt will threaten economic growth because a large part of this debt increase is related to higher public consumption and transfers.

Additionally, the empirical results are found to be satisfactory. As can be seen in Table 3, the regression explains about 63.1% of the variation in the economic growth of South Africa. Indeed, results of the Jarque-Bera test show respectively that model residuals are normally distributed whereas those of the ARCH test reveal absence of remaining heteroskedasticity.

The transition speed parameter is statistically significant and has an estimated value equal to 13.302 indicating a smooth change from one regime to another.

Furthermore, we observe that the inflation rate is negatively related to the real GDP growth in the two regimes; a 1% increase in the inflation rate leads to a fall of 0.284% in real GDP growth in the Stimulus Regime and a decrease of 0.1768% in the Crowding-out Regime.

These empirical findings are consistent with a number of relevant empirical papers in the literature which examine the relationship between inflation and economic growth. More specifically, high and volatile inflation is always correlated with increased price variability, which can lead to uncertainty about future inflationary pressure. It will ultimately induce distortions in investment decisions and hence impact negatively on the long-term economic Growth (Fisher, 1993; Khan and Sendhadj, 2000).

Moreover, inflation may also impact the economy's balance of payments by making exports more expensive; indeed, inflation would lead to the deterioration of the trade balance and capital outflows. Thereby, inflation has a negative effect on economic Growth (Dollar, 1992; Easterly, 1999).

The effect of Openness, as measured by terms of trade enters the regression positively and statistically at 5% level. Terms of trade movements can affect economic growth through innovation, technology discussion and transfer knowledge (Grossman and Helpman, 1991; Coe and Helpman, 1995 and Ben-David and Kimhi, 2000), which enhances the total factor productivity. Openness is thus a promoting factor for growth. Our results are in line with those of Herwartz and Walle (2014) for 78 countries, Trejos and Barboza (2015) for 23 Asian countries and Musila and Yiheyis (2015).

So far, this paper has provided evidence that it is possible to characterize the relationship between public debt and economic growth as a two-state regression, with different coefficients depending on whether the public debt is below or above an estimated threshold value. This means that when the public debt is above that value, the negative effect on growth prevails. Our findings represent an additional argument to keep debt under control and to exert a corrective action such as fiscal consolidation measure to reduce public debt. To better appreciate this nonlinear link, the figure below illustrates the trajectory of public debt and the estimated threshold.

Figure 2. The evolution of public debt around the estimated threshold

By looking at the trajectory of public debt using the estimated threshold plot, we can identify the timing of the change in the impact of public debt on growth. The estimated threshold value splits the sample into two distinct regimes characterized each by a different impact of public debt on growth. This impact is positive when the level of public debt is below the threshold value of 31.37% while it is negative in the opposite case. In this case, the threshold value of 31.37% could be regarded as a limit above which economic growth is sending a warning to policymakers to keep their debt under control. The shorter regime can be interpreted as a general regime that is at odds with the former one and is associated with the positive impact of public debt on growth.

CONCLUSION

This paper contributes to an important contemporary debate on the relationship between public debt-to-GDP ratio and economic growth. To this end, annual time series spanning the period 1980-2014 have been used to estimate a STR (Smooth Transition Regression) model for South Africa economy, allowing regression coefficients to vary depending on the level of public debt.

Estimation results of the STR model allows us to confirm the hypothesis of a nonlinear relationship in the public debt-Growth nexus in South Africa and the existence a critical level of public debt above which more public debt leads to a fall in real GDP Growth, all else equal.

In addition, the estimated threshold level that makes the positive correlation between public debt and the growth turns negative, is **31.37%**. In other words, once the accumulated public debt crosses this limit, its impact on the performance of South Africa economy becomes negative and statistically significant.

The findings in this paper send a strong warning about the need to exert corrective measures on fiscal situation so that they benefit from countercyclical fiscal policies and thus keep debt under control.

AUTHOR INFORMATION

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