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Public Debt and Economic Growth in Sri Lanka: Is There Any Threshold Level for Public Debt?

Hemantha Kumara and N. S. Cooray¹

Abstract:

The nexus between public debt and economic growth is multifaceted. Sri Lanka is not unique to this phenomenon, as there is growing concern about the implications of public debt on economic growth. By the end of 2012, public debt stood at Rs.6 trillion (79.14 per cent of GDP). The shares of domestic and external debt to total debt stock were 42.6 and 36.5 per cent of GDP, respectively. In 2012, the total interest paid on public debt was Rs.408.5 billion, which was equal to 5.39 per cent of GDP and 41.35 per cent of the government's total revenue. In addition to large interest payments, there are growing concerns about the huge public debt accumulation and its impact on the economy in the long run. The debt increases economic growth through investment, and it also involves costs because of interest payments. The government aims to reduce the current debt-to-GDP ratio of 79.14 per cent down to 60 per cent by 2016. One can also argue that if the borrowings help increase the growth through high returns, debt accumulation may not be a burden to the economy. The relationship between debt and economic growth in Sri Lanka is inconclusive and has been based on ideological predilections and circumstantial evidence. Although there seems to be an obvious positive linear relationship between debt and growth in Sri Lanka, it is difficult to establish a clear long-run link between the two without a thorough investigation.

This study aims to investigate several issues: What is the exact relationship (either positive or negative) between debt and economic growth? If the relationship is nonlinear, what is the optimum or threshold rate of debt that would minimise the economic cost of debt in terms of economic growth? That is, what is the sustainable level of debt for Sri Lanka? Is the Central Bank debt reduction target of 60 per cent by 2016 desirable? The paper develops an econometric model to address these issues based on a conditional convergence using time series data for the period 1960-2010. The study uses two-year non-overlapping averages to capture short-run fluctuations and instrumental variables to address the endogeneity problem.

The study finds that there is a nonlinear relationship between the public debt and GDP per capita growth in Sri Lanka. The threshold level for public debt is 59.42 per cent of GDP. Above this level, public debt makes a negative impact on GDP per capita growth. Our finding of a threshold level strongly justify and support the debt reduction target of the government, which aims to reduce the current debt ratio of 79.14 per cent down to 60 per cent by 2016.

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1. Introduction

While it is widely accepted that the private sector plays a vital role in economic growth, the government should provide necessary economic and social infrastructure for the efficient performance of the private sector. Similar to many other developing countries, Sri Lanka has been dependent on foreign finance for many of its infrastructure projects. Government investment through foreign borrowing is generally justified by its own low savings due to the budget deficit, low private sector savings, and deficits in the external sector mainly due to high import bills. Jha (2001, p. 1) argues that, “in the relative absence or perpetual weakness of institutions to mobilise and direct savings, the role of the state is crucial in harnessing the resources for development”.

Continued borrowings by developing nations increase the public debt stocks of those countries and create difficulties in their debt servicing. Therefore, debt management has become a key policy goal not only for the recipients but also for multinational lending agencies and bilateral donor countries. Clements et al. (2003); Malik et al. (2010); Pattillo et al. (2011); Reinhart & Rogoff (2010), Reinhart et al. (2012); Safdari and Mehriz (2011) argue that a higher debt-to-GDP ratio negatively affects the economic growth. Greiner (2011) shows that when there is an increase in the debt-to-GDP ratio, the primary surplus-to-GDP ratio increases. Lin (2000) shows that if the growth rate is greater than the real interest rate, debt will increase the growth rate of real per-capita output and if the growth rate is less than the real interest rate, debt will decrease the growth rate of real per-capita output. According to Kumara and Woo (2010), a higher level of debt stock increases the interest rate and inflation. Also, it leads to increasing future distortionary taxes. Accordingly, a reduction in capital accumulation and decreases in economic growth may create a situation where fiscal sustainability is very much challenged.

Despite the previously mentioned unfavourable concerns, Sri Lanka has accumulated a great deal of debt because of heavy borrowings either with concessionary or commercial interest rates. In 1950, the public debt was Rs.0.654 billion (16.9 per cent of GDP). By the end of 2012, public debt stood at Rs.6 trillion (79.14 per cent of GDP). The shares of domestic and external debt to total debt stock were 42.6 and 36.5 per cent of GDP, respectively. In 2012, the total interest paid on public debt was Rs.408.5 billion, which was equal to 5.39 per cent of GDP and 41.35 per cent of the government’s total revenue. According to the World Bank, Sri Lanka was in the less-indebted category in terms of external debt during the period 1992-2001 Kappagoda (2004). Sri Lanka has been able to maintain this favourable position because multilateral and bilateral donors had provided concessionary loans; government has also received a large amount of funds as grants during that period. The average annual interest rate on such concessionary loans was approximately 1.9-3.8 per cent during that period. However, the situation has since changed and Sri Lanka is now categorised as a moderately indebted country by the World Bank and the International Monetary Fund (IMF) Department of External Resources (2011)².

Furthermore, the current government is envisaged to achieve high economic growth and is willing to further continue its public investment through foreign finance as the government

² See appendix table 1 for critical values of external debt indicators.

revenue (as a ratio of GDP) shows a declining trend. Sri Lanka is now recognised as a middle-income country, and therefore, the country is forced to finance public investment more from borrowing than from grants, which will result in high public debt. The question remains of whether the government can achieve high growth by public investment through heavy borrowing. If the growth increases with high debt, how far can it continue? That is, is there any debt threshold level that maximises growth? The aim of the Central Bank of Sri Lanka (2011) is to reduce the debt ratio down to 60 per cent by 2016 from 79.14 per cent in 2012. Why is it necessary to reduce the ratio to 60 per cent? Does debt reduction increase growth? What is the threshold level of debt that maximises economic growth? These are some of the issues that this study attempts to address.

There are many studies dealing with the debt-growth nexus; they mainly focus on the countries that have vast access to international capital market. Therefore, policy inferences based on those studies have limited relevance to the Sri Lankan context. There are a few studies on the Sri Lankan public debt Jha (2001), Kappagoda (2004), Fonseka and Ranasinghe (2007), and Ekanayake (2011). None of those studies has addressed the public debt-growth nexus and the issues mentioned above.

Given the background mentioned above, the current research aims include the following: (a) to find the exact relationship between debt and economic growth; (b) to find the optimum or threshold rate of debt that would minimise the economic cost of debt in terms of economic growth; in other words, what is the sustainable level of debt for Sri Lanka? and (c) to critically examine if the debt reduction target of 60 per cent by 2016 set forth by the Central Bank of Sri Lanka is desirable or not. The paper is organised as follows: After this introduction, section two explains the trends and patterns of public debt in Sri Lanka. Section three reviews the related literature on the debt-growth nexus, while section four provides the model and analysis of the estimated results. Lastly, conclusions and policy recommendations are presented in section five.

2. Public Debt and Growth in Sri Lanka: An Overview

As a result of the continuously large fiscal deficit, the total public debt stock in Sri Lanka has rapidly accumulated since 1950. The public debt stood at Rs.6 trillion in 2012 (79.1 per cent of GDP), while the figure for 1950 was only s.654 million (16.9 per cent). As a percentage of GDP, the total debt in the 1950s was only 23.79 per cent and the ratio has increased to 52.64, 64.51, 85.76, 94.26, and 94.14 per cent levels in the 1960s, 1970s, 1980s, 1990s and 2000s, respectively. The ratio peaked at 108.7 per cent in 1989, and was above 100 per cent during the periods of 1988-89 and 2001-2004. From 1950 to 1983 and from 1997 to date, the main share of public debt was domestic debt because the budget deficit was heavily financed through domestic borrowing. During the last decade, the highest value of the ratio was 105.6 per cent, which was recorded in 2002, while the figure was 79.1 per cent in 2012. Public debt in Sri Lanka consists of both external and domestic debt. Domestic debt in terms of GDP was approximately 13.7 per cent in 1950, and recorded the highest in amount of 60.0 per cent in 2002. The domestic debt ranged between 41.6 and 43.6 per cent in the first four decades and the figure was 53.1 per cent in the last decade. The ratio decreased to 42.6 per cent by 2012, even though domestic debt now covers the lion's share of the total (see figure 1).

Figure 1: Government Debt-1950-2012 (as a percentage of GDP) is about here

Sri Lanka receives external loans from the both multilateral donor agencies and bilateral countries. The external debt stock in 1950 was Rs. 0.125 billion, representing 3.20 per cent of GDP, and currently, debt is Rs.2.767 trillion. Multilateral and bilateral donors began to provide assistance to finance development projects in Sri Lanka in 1955. In addition, the government of Sri Lanka began obtaining loans from the World Bank in 1959, and the Aid Group for Sri Lanka was established in 1965. As a result of financial assistance given by the Aid group, the external debt-to-GDP ratio peaked at 62.0 per cent of GDP in 1989 and declined since this time, reaching 36.5 per cent in 2012 (see figure 1). At present, the Asian Development Bank, the World Bank, the United Nations Agencies, the European Investment Bank, the International Fund for Agricultural Development (IFAD) and the OPEC Fund are the major multilateral donors that provide financial assistance to Sri Lanka, while China, Japan, India, South Korea and Iran are the leading bilateral donor countries.

It should be noted that debt service payments were higher than government revenue in 2002, 2003 and 2009 because of low revenue growth during this period, and loans with short maturity periods were taken at higher interest rate. As a percentage of government revenue, debt services were 105.72, 121.16 and 113.79 per cent for the three years mentioned, respectively. The total interest costs as percentages of government revenue were 43.32, 43.99, and 42.68 per cent for the same years. As percentages of government revenue and government expenditures, interest costs were 37.55 and 25.48 per cent in 2011, whereas the corresponding figures of total debt servicing were 94.25 and 58.89 per cent, respectively.

Over the course of the last five decades, the Sri Lankan economy grew at an average annual rate of 4.2 per cent. The per capita income, in nominal terms, increased from Rs. 397 (US\$120) in 1948 to Rs. 373,001 (US\$2,923) in 2012. The last decade (covering the period 2000-2009) recorded a 5.0 per cent growth (4 per cent per capita growth), showing a small decline from the growth rate of 5.3 per cent (4.4 per cent per capita growth) during the 1990s. The growth rates remained consistent and unchanged at approximately 4.0 per cent (2 per cent per capita income) in the 1960s, 1970s, and 1980s, while the lowest growth rate of 3.4 per cent was recorded in the 1950s. The introduction of neo-liberal policies in 1977 sought to accelerate long-run growth; “contrary to the expectation”, it did not facilitate high growth performance in the following decade (Lakshman 2010, p. 338); (Sarvananthan 2005, p. 25). It is worth mentioning that the last decade’s growth rate would have been higher than 5.0 per cent in the absence of the negative growth of 1.5 per cent recorded in 2001. This negative growth was caused by several factors, including the political unrest that prevailed in the country (particularly the terrorist attack on the Katunayaka International Airport), prolonged drought and subsequent power cuts, the terrorist attack on the World Trade Center of the US and the global economic recession. Having recovered in 2002 from the negative growth from the previous year, the economy continued to grow gradually, reaching 7.7 per cent growth in 2007. The situation has since changed due to unfavourable commodity and oil prices starting in 2007 and the global financial crisis beginning in September 2008 (IPS, 2010, p. 9). A pattern of increased annual growth (of 7.5 per cent) was exhibited again in the last three years, implying that the country may be heading into a high-growth era.

Figure 2: GDP Growth and Debt-to-GDP ratios 1950-2012 is about here

Although figure 2 shows an upward trend in both growth and debt over the last five decades, it is difficult to establish a strong linear relationship between the two. Data related to the different levels of growth and debt ratios during the period from 1950 to 2012 show that growth increased simultaneously with debt until the latter reached 62.5-79.1 per cent (see figure 3); above the level of that range, there is an inverse relationship between debt and growth. A similar trend is exhibited in GDP growth as well when it reaches 5.25 per cent. The data suggest that there is an observable nonlinear relationship between growth and debt in Sri Lanka. Figure 3 below reveals such nonlinearity for Sri Lanka.

Figure 3: Public Debt and GDP Growth Link, 1950-2012 is about here

3. Nexus of Public Debt and Economic Growth: A Literature Review

The views of the impacts of public debt on economic growth and a possible threshold of public debt are inconclusive. In Sri Lanka, according to the authors' knowledge, no literature is available on these two issues. Therefore, the present literature survey aims to bridge the gap of the non-availability of literature and to educate policy makers about the global-level empirical evidence and theoretical underpinnings.

Schclarek (2004) attempted to determine the relationship between growth and external debt in developing countries and industrial countries separately. The study found that in the developing countries, the relationship is linear and negative, whereas no linear or nonlinear relationship exists in industrialised countries. Growth in capital formation mainly acts as a source through which external debt affects growth. In addition, this study has provided empirical evidence that growth is not related to debt servicing. The results of the study imply that external debt may lower capital accumulation, resulting in crowding out economic activities in developing nations. However, the author has pointed out that an appropriate way to measure the crowding out effect is studying the relationship between capital accumulation and total public debt.

By analysing the impact of total debt on economic growth for sixteen developing economies covering data for the period 1971-1979, Cunningham (1993) concluded that there is a negative impact of debt on economic growth. Furthermore, he argued that a high debt level lowers the productivity of both capital and labour. By applying an overlapping-generations model, Lin (2000) examined the effect of an increase in government debt on the real interest rate. The study proved that if the real interest rate is greater than the growth rate, the accumulation of government debt does not increase the real interest rate. It has also shown that in the case that the growth rate is lower than the real interest rate; an increase in government debt lowers the growth rate.

Another empirical study by Lin and Sosin (2001), using cross-sectional data for 77 countries, examines the relationship between foreign debt and economic growth in terms of GDP per capita. The study found that foreign debt negatively affects the growth rate. However, while in the African economies the relationship between debt and foreign debt is significantly negative, for industrialised and Latin American nations, foreign debt is insignificantly related to the growth rate. Asian and other developing countries' foreign debt has a positive effect on the growth rate, but these results are insignificant. Using an overlapping-generations

model based on a panel data model covering 45 developing countries, Adam and Bevan (2005) examined the relationship between the fiscal deficit and growth for 45 developing countries. They find that the threshold level of deficit is 1.5 per cent of GDP. They also argued that high debt stock adversely affects the deficit.

Malik, Hayat and Muhammad (2010) examine the effects of external debt on economic growth in Pakistan using time-series data for the period 1972-2005. For this purpose, a simple linear econometric model has been employed with GDP growth as the dependent variable and external debt and debt servicing as independent variables. They find that both external debt and debt servicing negatively affect economic growth in Pakistan.

Reinhart & Rogoff (2010) exploit a long time-series dataset, covering 44 countries for a period of approximately 200 years and 3,700 annual observations on public debt to find the relationship between high public debt levels, growth and inflation. According to the debt-to-GDP ratios of a country, they grouped all of the countries into four categories; (a) below 30 per cent: low debt, (b) 30-60 per cent: medium debt, (c) 60-90 per cent: high debt and (d) over 90 per cent: very high debt. They find a weak relationship between growth and debt when debt levels are normal. For countries with public debt over approximately 90 per cent of GDP, median growth rates are about one per cent lower than otherwise. These results apply to both emerging markets and advanced economies. They conclude that the “link between growth and debt seems relatively weak at ‘normal’ debt levels, median growth rates for countries with public debt over approximately 90 per cent of GDP are about one per cent lower than otherwise; average (mean) growth rates are several per cent lower” (p. 573).

Studies on the public debt-related concepts are very few in Sri Lanka. Jha (2001) has used stationary and co-integration tests to analyse the debt sustainability in low-income countries (including Sri Lanka) using the data from 1950 to 1999. His study shows that the fiscal situation in Sri Lanka is stable during that period. Fonseka & Ranasinghe (2008) have shown that the public debt stock in Sri Lanka has increased over the years, and debt servicing has become high. They have suggested a reduction of government expenditures and an elimination of waste as a short-term solution for this problem, and in the long run, a sustainable level of high growth should be achieved. Ekanayake (2011, p. 31) assesses debt sustainability and identifies the key fiscal and macro-economic variables that affect debt sustainability in Sri Lanka. His model uses the real interest rate, the exchange rate and economic growth rate as determinants of the debt-to-GDP ratio. The paper reveals that “one standard deviation positive growth shock results in a reduction in the debt to GDP ratio by 2.4 per cent by 2015”. The author argues that if the country can maintain an annual growth rate of 8 per cent in the medium run, the debt-to-GDP ratio would reach approximately 65 per cent by 2015 assuming other macroeconomic variables remain unchanged.

Maintenance of the public debt stock at a threshold level is important because it has a deleterious effect on growth if debt goes beyond the threshold level. Most of the previous studies related to debt and economic growth have found that there is a nonlinear relationship between the two. It can be highlighted that while some studies have estimated the threshold level of external debt, others have used total public debt to find the threshold level.

We review the following three articles that apply the empirical growth model, incorporating debt variables to examine the nonlinear relationship between growth and debt and to find the optimal debt level. Clements, Bhattacharya, and Nguyen (2003) empirically analyse the impact of external debt on economic growth using data from 55 low-income countries for the period from 1970 to 1979. The study identifies that the effect of external debt on the efficiency of the usage of resources is the main factor through which debt affects economic growth. This impact is stronger compared to the impact on private investment through which external debt indirectly affects growth. The threshold level for external debt is approximately 50 per cent and 20-25 per cent for face value and net present value, respectively. Their threshold levels are in the range between 100-105 per cent. Pattillo, Poirson and Ricci (2004) analyse the impact of external debt on economic growth using data from 61 developing countries during the period from 1969 to 1998. The study has suggested that the threshold level of external debt is approximately 160-170 per cent and 40-50 per cent in terms of export and GDP, respectively. The model used in this analysis consists of per-capita growth as the dependent variable and two debt variables as independent variables with control variables of the income per capita, investment rate, secondary schooling enrolment rate, population growth rate, openness, fiscal balance, and the terms of trade growth. The finding shows “that the negative impact of high debt on growth operates both through a strong negative effect on physical capital accumulation and on total factor productivity growth” (p. 1). Checherita and Rother (2010) address the debt growth issue in 18 OECD countries using data from 1980 to 2010. They find approximately 85 per cent to be the threshold level of those countries, and if the debt exceeds this level, it is a drag on growth. The policy implication is that those countries should take action immediately and decisively to tame this fiscal problem.

Baum, Westphal and Rother (2012) and Chang and Chiang (2012) use a non-dynamic panel method to examine the relationship between growth and public debt. Based on data from the 12 Euro countries from 1990 to 2010, Baum, Westphal and Rother (2012) show that in the short run, public debt positively affects GDP growth. The study finds two threshold levels: 67 per cent for the lower and 95 per cent for the upper thresholds. However, the robustness tests prove that 67 per cent is the most significant threshold level of debt. The calculated confidence intervals have concluded that public debt may have a negative effect on GDP growth at the rate of 63 per cent of GDP. Chang and Chiang (2012) re-examined how the impact of debt on growth varies with an indebted level using data from 19 OECD countries for the period from 1993 to 2007, and the study has concluded that threshold level of the debt-to-GDP ratio is 97.82 per cent.

Some other studies that use panel data to find the threshold level include the following. Checherita and Rother (2010) examined public debt and economic growth and found that there is a nonlinear relationship between government debt and the growth of GDP per capita using a panel data set covering 12 Euro-area countries. Debt level in the range of 90-100 per cent of GDP has been estimated as the threshold level of public debt and above this level, the impact of debt on the GDP growth rate becomes negative. However, estimated confidence intervals for the threshold level indicate that there is a possibility that this negative impact occurs once the debt level exceeds 70 per cent. Another argument of the authors is that debt can affect growth through private saving, total factor productivity, public investment, sovereign long-term nominal and real interest rates as channels.

Kumar and Woo (2010) employ a panel data analysis to assess the relationship between high public debt and long-run economic growth. The analysis has been carried out using data for a period of 38 years from a range of advanced and emerging economies. They find that the initial debt stock is inversely related to the growth rate. Their findings also support the claim that a nonlinear relationship exists between growth and debt. Debt negatively affects growth when the debt level is above 90 per cent of GDP. Pattillo, Poirson and Ricci (2011) assess the nonlinear impact of external debt on the growth rates of 93 developing countries. The finding reveals that “the average threshold is approximately 70 per cent for debt to exports, and approximately 25 per cent (for) debt to income” (p. 22).

4. Data, Model and Analysis of the Results

Stationarity Test: Time-series data go through a stochastic process. The results of the regression of two non-stationary time-series data items are generated from two different stochastic trends. The results may be spurious. Such a regression may not result in accurate least squares estimators. Therefore, we need to check whether the time-series data used in the study are stationary or non-stationary before the regression. Accordingly, as the initial step of data analysis, an Augmented Dickey-Fuller Test is applied to the independent variable and all dependent variables separately to investigate the stationarity of those variables. The result of the stationarity test reported in Table 1 shows that all variables are stationary at all levels.

Table 1: Stationarity Test is about here

To capture the short-run fluctuations of the data, we calculate 2-year and 3-year overlapping and non-overlapping averages of the data. As tested in the original time-series annual data, after calculating 2-year and 3-year overlapping and non-overlapping averages, we carry out an augmented dickey-fuller test to check the stationarity of the calculated data. However, all regression variables are stationary only in the 2-year non-overlapping averages, and therefore, we report only the results of the stationary test of 2-year non-overlapping averages. Accordingly, the study uses annual data and 2-year non-overlapping data in order to capture short-run fluctuations

Model Specification: Following Checherita and Rother (2010) and Pattillo and Poirson (2011), the present model is developed using the empirical growth model based on a conditional convergence. Taking the theoretical and empirical literature on growth and convergence into account, our basic model is developed with several control variables such as the initial level of GDP per capita, investment and population growth and the GDP per capita growth rate. A log of lagged GDP per capita income is used as the initial per-capita income.

Because we aim to analyse the effect of public debt on the growth of GDP per capita in Sri Lanka and to find the threshold level of public debt, the convergence equation is augmented by incorporating the public debt variable. This public debt-to-GDP ratio is the threshold variable of the model. As seen in the literature review, several previous studies have shown that there is a nonlinear relationship between debt and economic growth. To check whether a nonlinear relationship exists between public debt and the GDP per capita growth, we use a quadratic form equation. Accordingly, public debt-to-GDP ratio and its squared value are

included in the model as explanatory variables. These two variables are used in log form, and our initial model takes the following form:

$$\begin{aligned} \text{GDP Per Capita Growth}_t &= \alpha_0 + \alpha_1 \text{Initial GDP Per Capita income}_t \\ &+ \alpha_2 \text{Public Debt to GDP ratio}_t + \alpha_3 \text{Public Debt to GDP ratio}_t^2 \\ &+ \alpha_4 \text{Invertment}_t + \alpha_5 \text{Population Growth}_t + \delta_t \end{aligned}$$

According to the literature, there are some other related control variables that influence GDP per capita growth. Controlling for the fiscal policy effect on growth is vital, and therefore, the government deficit is included. The terms of the trade growth rate as an indicator of an open economic system are used to capture the external shock. Growth in openness is added to control for differences in total factor productivity. Most of the previous studies have used the secondary school enrolment rate as a proxy for human capital. However, we could not find time-series data for this variable. Therefore, the current study uses growth in the literacy rate instead of the secondary school enrolment rate. The interest rate is included to capture the impact of monetary policy.

Dummy variables are also included in the model to control for the unusual behaviours of the economy experienced in some years. In 1971, 1972 and 2001, the GDP per capita growth rate was recorded as a negative value. To avoid the effect of this unusual status on the results, three dummies are included in the model. These dummy variables take the value 0 when an event is present and 1 otherwise.

As explained in the conditional convergence theory, while coefficients on initial GDP per capita income and population growth should have negative signs, the sign of the coefficient on growth in gross capital formation-to-GDP ratio is positive. Because the terms of trade growth are used to capture external shock, we expect a positive coefficient on the terms of the trade growth variable. The coefficient on the growth in the literacy rate is expected to be positive. A positive coefficient of the growth in openness is predicted. We expect a negative coefficient on the logarithm of the deficit to GDP because deficit is defined as the difference between expenditures and revenue. This deficit variable is used in the log form.

After incorporating other control variables and dummy variables into the initial model, we design the following model to find the threshold level of public debt in Sri Lanka.

$$\begin{aligned} g_t = \beta_0 + \beta_1 \ln(\text{GDPP})_{t-1} + \beta_2 \ln(\text{Debt to GDP}_t) + \beta_3 [\ln(\text{Debt to GDP}_t)]^2 + \beta_4 \text{GCF}_t \\ + \beta_5 \text{Popg}_t + \beta_6 X_t + \beta_7 D_{1971} + \beta_8 D_{1972} + \beta_9 D_{2001} + \epsilon_t \end{aligned}$$

Variable definitions and descriptions

Variable	Description
g_t	GDP per capita growth rate in year t
$\ln(\text{GDPP})_{t-1}$	Natural logarithm of lagged GDP per capita income in year t
$\ln(\text{Debt to GDP}_t)$	Natural logarithm of public debt-to-GDP ratio in year t
GCF_t	Growth in gross capital formation to GDP in year t
Popg_t	Population growth in year t

X_t	Represents other control variables: terms of trade growth, growth in openness, growth in the literacy rate, the natural logarithm of the government deficit-to-GDP ratio, interest rate in year t
D_{1971}	Dummy Variable - 1 if year is 1971 and 0 otherwise
D_{1972}	Dummy Variable - 1 if year is 1972 and 0 otherwise
D_{2001}	Dummy Variable - 1 if year is 2001 and 0 otherwise

The model is estimated using the annual time-series data from 1960 to 2010. As described in the literature, an endogeneity problem may arise in the model. In particular, reverse causality from low growth to high public debt may exist. Some earlier studies measuring the relationship between the two variables have used the instrumental variable (IV) approach in order to address the endogeneity problem³. This study also uses the IV approach to control the endogeneity problem. For this purpose, this study uses the lagged public debt-to-GDP ratio and lagged values of other control variables as instrumental variables.

The previous literature (see section 3) related to growth and debt has shown that a nonlinear relationship between growth and debt exists. We propose the following model to examine the nonlinear relationship between GDP per capita growth and public debt in Sri Lanka. This model includes the same dependent variable and control variables that are used in the main model. The only difference between the two models is the inclusion of one debt-to-GDP ratio variable in log form.

$$g_t = \beta_0 + \beta_1 \ln(GDPP)_{t-1} + \beta_2 \ln(Debt\ to\ GDP)_t + \beta_3 GCF_t + \beta_4 Popg_t + \beta_5 X_t + \beta_6 D_{1971} + \beta_7 D_{1972} + \beta_8 D_{2001} + \epsilon_t$$

Analysis of results: First, the main model is estimated by employing OLS. The previous literature has pointed out that autocorrelation is a common problem in the models for time-series data. There are several different tests checking whether autocorrelation exists in econometric models. The current study applies a serial-correlation LM test with a null hypothesis of no autocorrelation. The p value reported in the LM test is 0.66. Therefore, the test does not reject the null hypothesis of no autocorrelation at the 1 per cent significance level. Therefore, autocorrelation does not exist in the model. We also apply the Breusch-Pagan-Godfrey test to check the heteroskedasticity.

Table 2: Results about here

Column 1 of the table 2 presents the Ordinary Least Square (OLS) results of the main model estimated with annual time-series data. The sign of the coefficient on the lagged value of the logarithm of GDP per capita income that this study used as initial per capita income is positive. However, the estimated coefficient on this variable is highly significant.

The coefficient on the logarithm of the public debt-to-GDP ratio is positive, and this coefficient is significant at the 1 per cent level. In addition, the coefficient on the squared

³ Checherita and Rother (2010) have used time lags of the debt variables (up to five) in finding the threshold level of public debt using a panel data set covering twelve Euro countries.

logarithm of the public debt-to-GDP ratio is significant at the 1 per cent level, and the coefficient is negative. Coefficients on the logarithm of the public debt-to-GDP ratio and the squared logarithm of the public debt-to-GDP ratio are 78.59 and -9.306, respectively. However, growth in capital formation, population growth, the terms of trade growth, growth in openness, the logarithm of government deficit, growth in the literacy rate and the interest rate are not significant. The most important variables in this model are the logarithm of public debt-to-GDP ratio and the squared logarithm of the public debt-to-GDP ratio because the main objective of this study is to estimate the threshold level of public debt for Sri Lanka. Accordingly, it can be finalised that coefficients on these two variables are highly significant. The coefficients on these two debt variables prove that a highly significant nonlinear relationship exists between GDP per capita growth and public debt in Sri Lanka.

OLS Result of the model with 2-year non-overlapping data: The model is run using 2-year non-overlapping averages. Although the main model used dummy variables for the years 1971, 1972 and 2001, in the model with 2-year non-overlapping averages, we use a dummy variable for 1971 only because the calculated 2-year non-overlapping average of GDP per capita growth is negative in only the period starting in 1971. Then, the existence of autocorrelation is examined by applying a serial-correlation LM test. The reported p value is 0.6426, which implies that there is no autocorrelation. We also apply the Breusch-Pagan-Godfrey test to check the heteroskedasticity and conclude that heteroskedasticity does not exist. The OLS results of the 2-year non-overlapping average model are presented in column 2 of Table 2. The coefficients of the logarithm of the public debt-to-GDP ratio and the squared logarithm of the public debt-to-GDP ratio are 75.62 and -9.26, respectively. Both variables are significant at the 10 per cent level. These estimations also prove that a significant nonlinear relationship exists between GDP per capita growth and public debt in Sri Lanka.

Instrumental Variable (IV) Estimations: We use the IV approach to control the endogeneity problem. For this purpose, this study uses the lagged public debt-to-GDP ratio and lagged values of other control variables. Table 2 presents the econometric results of the IV estimations. Column 3 of table 2 presents the estimated results of the main model, which was instrumented with lagged values of debt variables and lagged values of control variables. Coefficients on the logarithm of public debt to GDP and the squared logarithm of the public debt-to-GDP ratio are 127.732 and -15.046, respectively. These two coefficients are significant at the 10 per cent and 5 per cent levels, respectively. However, the magnitudes of both coefficients are higher than those coefficients of the OLS results of the main model. However, signs of the coefficients are the same in both regressions. These estimated coefficients also provide evidence of a nonlinear relationship between public debt and GDP per capita growth in Sri Lanka. Similar to the OLS result of the main model, the coefficients on other control variables are not significant.

Column 4 of table 2 presents the IV results based on the 2-year non-overlapping averages. The coefficients on the logarithm of the public debt-to-GDP ratio and the squared logarithm of the public debt-to-GDP ratio are 138.549 and -16.175, respectively. Neither coefficient is significant at conventional levels.

Testing the linear model: We estimate the linear model using OLS and report the results in Column 1 of table 3. Then, the model is estimated using 2-year non-overlapping averages. The OLS results of this estimation are presented in column 2 of Table 3. In the both cases, the logarithm of the public debt-to-GDP ratio is not significant. These insignificant coefficients indicate that there is no evidence for the existence of a linear relationship between GDP per capita growth and public debt in Sri Lanka.

Table 3: Results of Linear Model about here

Threshold level calculation: The econometric results of the main model indicate that there is a nonlinear relationship between public debt and the GDP per capita growth in Sri Lanka. By using the following equation, we calculate the threshold level of the public debt. The equation includes two steps. The first step is that the first order condition is applied to find the turning point. The second step is to ensure that the turning point is the maximum point. For this purpose, a second-order condition is used.

$$\frac{dg_t}{d\ln(\text{Debt to GDP}_t)} = \beta_2 + 2 * \beta_3 [\ln(\text{Debt to GDP}_t)] = 0$$

The first-order condition result shows a turning point of the debt-to-GDP ratio at 68.22 per cent. The negative sign of the second-order derivative at this debt level proves that there is a maximum at the turning point. Therefore, according to the results of the main model, the threshold level of the debt-to-GDP ratio is 68.22 per cent. However, if we use 2-year non-overlapping variables, the threshold level is 59.42 per cent. Given these two threshold levels based on these approaches, we believe that the latter model with 2-year non-overlapping variables gives better results regarding the threshold level. Therefore, our final calculation for the threshold level of public debt-to-GDP ratio for Sri Lanka is 59.42 per cent.

5. Conclusion and policy recommendation

This study examined the relationship between the public debt and GDP growth in Sri Lanka and attempted to find a threshold level of public debt-to-GDP per capita using time-series data from 1960 to 2010. We also conducted an extensive literature survey with to the goal of educating the relevant stakeholders about the current global-level understanding of the issue. Our literature review suggests that the relationship between growth and debt for many countries is nonlinear. Reinhart & Rogoff (2010) conclude that “link between growth and debt seems relatively weak at “normal” debt levels, median growth rates for countries with public debt over approximately 90 per cent of GDP are about one per cent lower than otherwise; average (mean) growth rates are several per cent lower” (p. 573).

Several quantitative models using various econometric techniques were developed to investigate the true nature of the relationship between the debt-to-GDP ratio and per-capita growth. The estimated results, based on a conditional convergence equation, show that there is a nonlinear relationship between the public debt-to-GDP ratio and GDP per capita growth in Sri Lanka. The first model, estimated using normal time-series data, suggests a threshold level of public debt at 68.22 per cent of GDP. Our second model, estimated using 2-year non-overlapping averages in order to capture the short-run fluctuations, proposes a threshold level of 59.42 per cent of GDP. The threshold figure of 59.42, suggested from the second model is highly significant and supported by Akaike

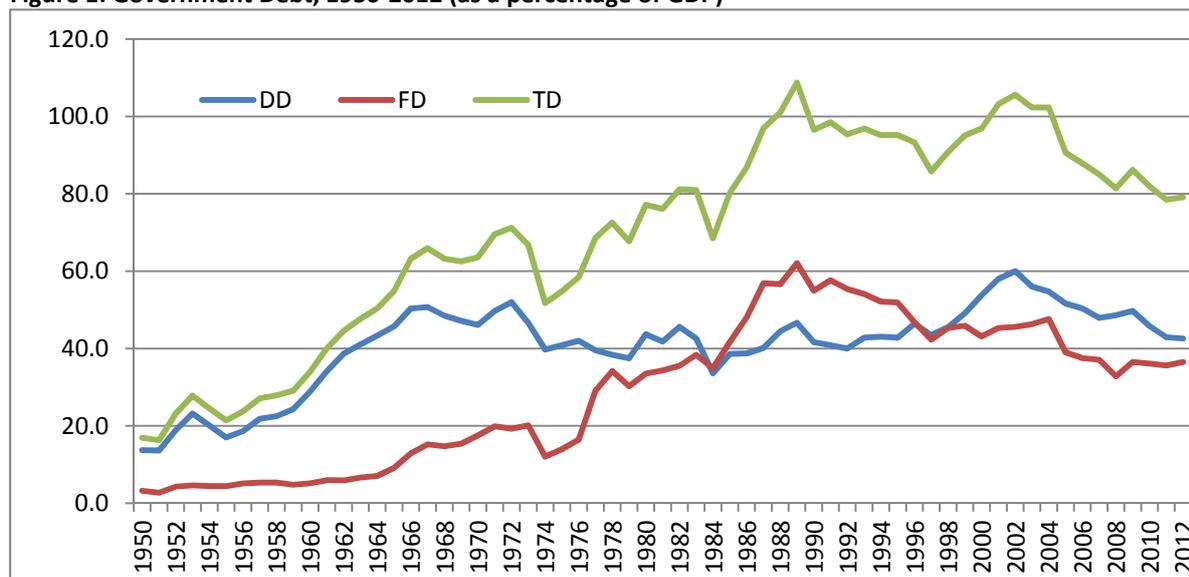
criteria, and therefore, one can conclude that 59.42 per cent is the proper threshold level for Sri Lanka. If debt-to-GDP ratio exceeds 59.42, it will negatively affect the GDP per capita. It should be noted that our model-estimated threshold level strongly justify and support the debt reduction target of 60 per cent set forth by the Central Bank of Sri Lanka by 2016. The debt-to-GDP ratio of 79.1 per cent in 2012 is higher than our estimated threshold level of 59.42 per cent, and therefore, it is necessary to take immediate and decisive policies to achieve the target threshold level. However, given the government's mega-development projects and limited revenue due to weak tax administration and base, the government may need to finance the resultant deficits through the borrowing of more funds even at high interest rates, leading to high debt ratios that may hinder the long-term growth potential of the country. What is feasible now for the government is to prioritise projects funded through borrowed money that generate high returns?

References

- Adam, C.S., & Bevan, D.L. (2005). Fiscal deficits and growth in developing countries. *Journal of Public Economics*, 571-597.
- Aiyagari, S.R.; McGrattan R.E. (1998). The optimum quantity of debt. *Journal of Monetary Economics*, 447-469.
- Baum, A., Westphal, C.C., & Rother, P. (2012). *DEBT AND GROWTH NEW EVIDENCE FOR THE EURO AREA*. European Central Bank.
- Central Bank of Sri Lanka. (2011). *Public Debt Management in Sri Lanka*.
- Clements, B., Bhattacharya, R., & Nguyen, T.Q. (2003). *External Debt, Public Investment, and Growth in Low-Income Countries*. IMF Working Paper.
- Greene, J. & Villanueva, D. (1991). Private Investment in Developing Countries: An Empirical Analysis. *Palgrave Macmillan Journals*, 33-58.
- Kumar, Manmohan S.; Jaejoon Woo. (2010). Public Debt and Growth. *IMF Working Paper (WP/10/174)*, 1-46.
- Chang, Tsangyao; Gengnan Chiang. (2012). Transitional Behavior of Government Debt Ratio on Growth: The Case of OECD Countries. *Romanian Journal of Economic Forecasting*, 2, 24-37.
- Checherita, C. & Rother, P. (2010). *The impact of high and growing government debt on economic growth an empirical investigation for the euro area*. European Central Bank.
- Clements, B.; Bhattacharya, R.; and Nguyen, T. Q. (2003). *External Debt, Public Investment, and Growth in Low-Income Countries*. IMF Working Paper.
- Cohen, D. (1997). Growth and External Debt: A New Perspective on the African and Latin American Tragedies. *CEPR Discussion Paper No. 1753*, 1-11.
- Cunningham, R. T. (1993). The Effects of Debt Burden on Economic Growth in Heavily Indebted Developing Nations. *Journal of Economic Development*, 18(1), 115-126.
- Drakes, L. (2008). Estimating a sustainable Public Debt Level for Barbados. *Annual Review Seminar Research Department Central Bank of Barbados*.
- Ekanayake, D. (2011). *Assessing Government Debt Sustainability in Sri Lanka*. Retrieved 10 14, 2013, from Central Bank of Sri Lanka:
http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/IRC/2011/Govt._Debt_Full.pdf
- Fonseka, A. T., & Ranasinghe, S. S. (2008). Sustainability of Sri Lanka's Public Debt. *Sri Lankan Journal of Management*, 13(1 and 2), 185-212.
- Greiner, A. (2011). Sustainability of public debt: Some theoretical considerations. *Economics Bulletin*, 3311-3319.
- Gujarathi, D. N. (2003). *Basic Econometrics* (Fourth ed.).

- Hill, R. L. (2012). *Principles of Econometrics* (Third ed.).
- Jha, R. (2001). Macroeconomics of Fiscal Policy in Developing Countries. *WIDER Discussion Paper, 2001/71*, 1-39.
- Kappagoda, N. (2004). Public Debt: Institutional Issues. In S. Kelegama, *Economic Policy in Sri Lanka: Issues and Debates* (pp. 153-176). Colombo, Sri Lanka: Vijitha Yapa Publication.
- Kumar, M. S., & Woo, J. (2010). *Public Debt and Growth*. IMF Working Paper.
- Lin, S. (2000). Government Debt and Economic Growth in an Overlapping Generations Model. *Southern Economic Journal, 66*(3), 754-763.
- Lin, S., & Sosin, K. (2001). Foreign Debt and Economic Growth. *Economics of Transition, 9*(3), 635-665.
- Malik, S., Hayat, M. K., & Hayat, M. U. (2010). External Debt and Economic Growth: Empirical Evidence from Pakistan. *International Research Journal of Finance and Economics*(44), 1-10.
- Muhammad, M., S Hayat, K., & Hayat, M.U. (2010). External Debt and Economic Growth: Empirical Evidence from Pakistan. *International Research Journal of Finance and Economics*.
- Pattillo, C., & Poirson, H. R. (2011). External Debt and Growth. *Review of Economics and Institutions*.
- Pattillo, Catherine; Helene Poirson; and Luca Ricci. (2004). What Are the Channels Through Which External Debt Affects Growth? *IMF Working Paper*, 1-33.
- Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. *The American Economic Review, Papers and Proceedings of the One Hundred Twenty Second Annual Meeting of The American Economic Association, 100*(2), 573-578.
- Reinhart, C. M., Reinhart, V. R., & Rogoff, K. S. (2012). Public Debt Overhangs: Advanced-Economy Episodes since 1800. *Journal of Economic Perspectives, 26*(3), 69-86.
- Safdari, M. & Mehriz, M.A. (2011). External debt and economic growth in Iran. *Journal of Economics and International Finance, 322-327*.
- Schclarek, A. (2004). *Debt and Economic Growth in Developing and Industrial Countries*.
- Smyth, David J.; Yu Hsing. (1995, October). In Search of an Optimal Debt Ratio for Economic Growth. *Contemporary Economic Policy, XIII*, 51-59.
- Topalova, P., & Nyberg, D. (2010). *What Level of Public Debt Could India Target?*

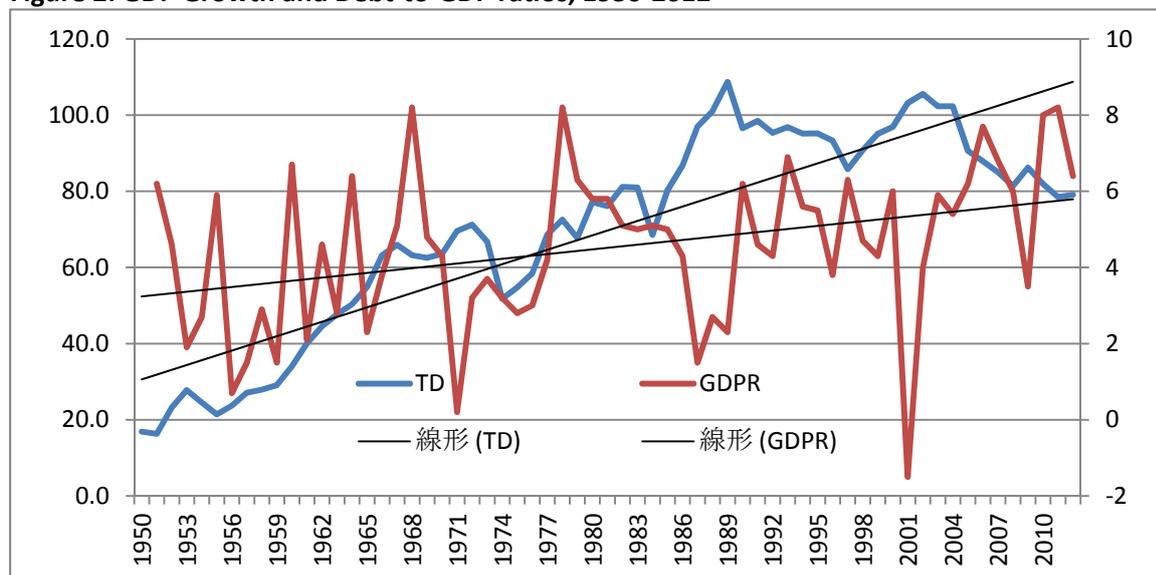
Figure 1: Government Debt, 1950-2012 (as a percentage of GDP)



Source: Central Bank of Sri Lanka, Annual Report (Various Issues)

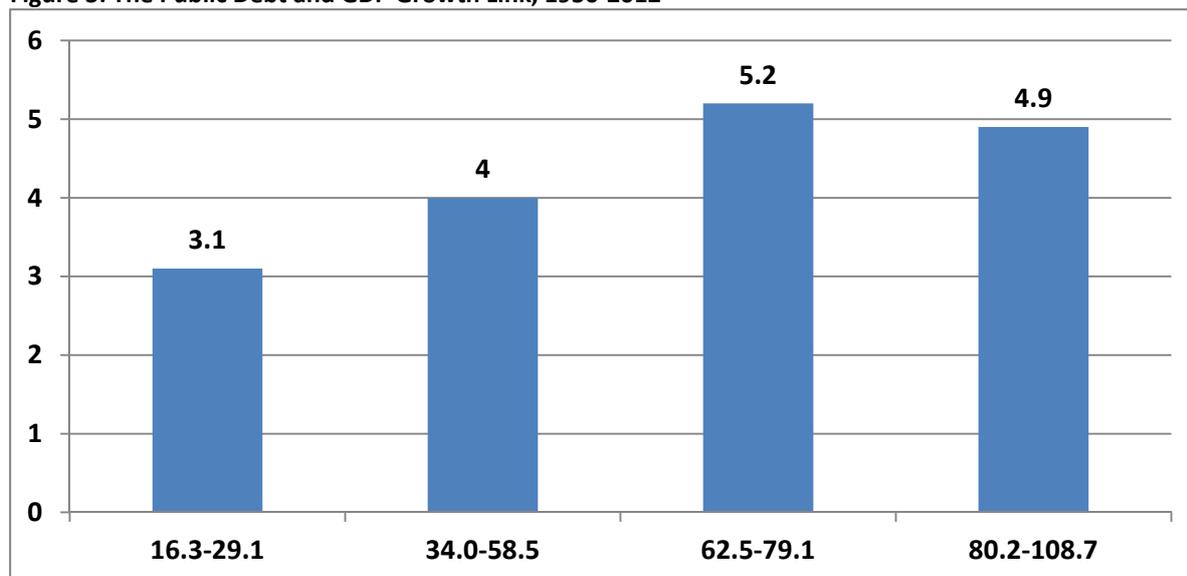
Notes: DD= Domestic debt, FD= Foreign debt and TD= Total debt

Figure 2: GDP Growth and Debt-to-GDP ratios, 1950-2012



Source: Central Bank of Sri Lanka, Annual Report (various issues)

Figure 3: The Public Debt and GDP Growth Link, 1950-2012



Compiled by the author using data from the Central Bank of Sri Lanka, Annual Report (various issues)
 Notes: GDP growth rates are given on the vertical axis, while the debt-to-GDP ratios are given on the horizontal axis.

Appendix Table1: Critical Values of External Debt Indicators

Indicator	Highly Indebted Countries	Moderately Indebted Countries	Less-Indebted Countries
DOD/GNP	>50%	>30% and <50%	<30%
DOD/XGS	>275%	>165% and <275%	<165%
TDS/XGS	>30%	>18 %and <30%	<18%
INT/XGS	>20%	> 12 % and <20%	<12%
NPV/GNI	>80%	> 48 % and <80%	<48%
NPV/XGS	>220%	> 32 % and <220%	<220%

Source: Manual on Effective Debt Management, Economic and Social Commission for Asia and the Pacific, 2006. Notes: DOD=Total Disbursed External Debt Outstanding; GNI=Gross National Income; GNP=Gross National Product; INT=External Interest Payment; NPV=Net Present Value of External Debt Service; TDS=Total External Debt Service; and XGS=Exports of Goods and Non-Factor Services

Table 1: Stationarity Test

Variable	Annual Data			2-year Non-overlapping Data		
	Critical Value	Test Statistics	Stationarity	Critical Value	Test Statistics	Stationarity
GDP Per Capita Growth	-4.16	-5.91***	I(0)	-4.37	-4.89***	I(0)
Log(GDP per capita income)	-3.51	-3.56**	I(0)	-3.24	-3.42*	I(0)
Log(Debt-to-GDP ratio)	-2.92	-3.42***	I(0)	-2.63	-2.91*	I(0)
Population Growth	-3.57	-4.02***	I(0)	-3.60	-3.72**	I(0)
Growth in Gross Capital Formation-to-GDP ratio	-3.57	-6.43***	I(0)	-3.72	-4.00***	I(0)
Terms of Trade Growth	-3.57	-8.10***	I(0)	-3.74	-7.23***	I(0)
Growth in Openness	-3.57	-6.23***	I(0)	-3.72	-5.26***	I(0)
Log(Deficit-to-GDP ratio)	-2.92	-3.53**	I(0)	-2.63	-2.89**	I(0)
Growth in Literacy Rate	-3.57	-3.99***	I(0)	-4.50	-5.14***	I(0)
Interest Rate	-3.57	-4.84***	I(0)	-3.72	-3.83***	I(0)

*** Significant at the 1 per cent level, ** Significant at the 5 per cent level, * Significant at the 10 per cent level

Table 2: Results

Independent Variable	Dependent Variables			
	OLS Estimations		Instrumental Variable Estimations	
	Column 1	Column 2	Column 3	Column 4
	GDP per capita growth	2-year non-overlapping GDP per capita growth	GDP per capita growth	2-year non-overlapping GDP per capita growth
$\ln(\text{GDPP})_{t-1}$	0.677*** (-0.221)	0.621 (-0.364)	-0.898 (-1.478)	-0.154 (-0.749)
$\ln(\text{Debt to GDP})_t$	78.590*** (-26.943)	75.618* (-36.959)	-0.304 (-0.96)	138.549 (-149.872)
$[\ln(\text{Debt to GDP})_t]^2$	-9.306*** (-3.178)	-9.257* (-4.339)	-0.045 (-0.127)	-16.175 (-17.136)
GCF_t	0.011 (-0.025)	0.068 (-0.044)	-3.184 (-2.501)	0.031 (-0.091)
Pop_t	0.262 (-0.616)	-0.773 (-1.492)	-4.104 (-2.608)	-2.452 (-2.865)
Terms of trade growth	-0.023 (-0.025)	0.007 (-0.043)	-5.016** (-2.331)	-0.098 (-0.121)
Growth in Openness	0.008 (-0.027)	0.032 (-0.057)	-274.548 (-137.749)	-0.124 (-0.126)
$\ln(\text{Deficit})$	-0.769 (-0.749)	-0.184 (-1.129)	0.004 (-0.082)	-2.595 (-2.202)
Growth in literacy rate	0.357 (-0.343)	-0.015 (-0.525)	0.128 (-0.082)	-0.061 (-1.408)
Interest Rate	-0.032 (-0.047)	0.056 (-0.073)	-0.003 (-0.09)	0.032 (-0.153)
D_{1971}	-3.195** (-1.444)	-3.919** (-1.588)	-0.317 (-1.304)	-7.588** (-2.914)
D_{1972}	-5.590*** (-1.52)		0.686 (-0.453)	
D_{2001}	-5.482*** (-1.496)		127.732* (-63.502)	
Constant	-170.359*** (-57.754)	-155.051* (-81.009)	-15.046** (-7.318)	293.476 (-324.755)

***, **, and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively. Standard errors are indicated in parentheses.

Table 3: Results of the Linear Model

Independent Variable	Dependent Variable	
	Column 1 GDP per capita growth	Column 2 2-year non-overlapping GDP per capita growth
$\ln(\text{GDPP})_{t-1}$	0.609** (0.241)	0.359 (0.380)
$\ln(\text{Debt to GDP})_t$	-0.171 (1.712)	-3.117 (2.222)
GCF_t	0.010 (0.027)	0.100** (0.046)
Popg_t	0.090 (0.672)	-2.035 (1.523)
Terms of trade growth	-0.023 (0.027)	-0.002 (0.047)
Growth in Openness	0.008 (0.030)	0.008 (0.062)
$\ln(\text{Deficit})$	-0.443 (0.813)	-0.182 (1.255)
Growth in literacy rate	0.524 (0.371)	0.097 (0.581)
Interest Rate	-0.064 (0.050)	0.036 (0.081)
Y_{1971}	-2.627 (1.571)	-4.174** (1.761)
Y_{1972}	-5.296*** (1.664)	
Y_{2001}	-6.320*** (1.612)	
Constant	-2.680 (8.233)	16.106 (12.515)

***, **, and * indicate significance levels at 1 per cent, 5 per cent and 10 per cent, respectively. Standard errors are indicated in parentheses.