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Optimal public debt level and size of the public sector: evidence from developed and developing countries including Sri Lanka

Abstract

Research on fiscal policy and public debt has been increasing due to indebtedness of many countries at national level. A lot of countries including both developed and developing have run into massive debt. Any country may run into debt especially in time of natural disasters, wars and sudden economic crises. However, the majority of nations borrow money to perform their role of the state or government. Continuous borrowing accumulates into an unsustainable amount of debt. Therefore, discussion on optimal level of public debt needs to be broadened. Secondly, borrowing may pave the ways to an expanded public sector. This study, examines the relationship between public debt and economic growth, and analyzes optimal level of public borrowing and influence of national borrowing on the size of the public sector. These objectives are achieved by developing models, analyzing the relationships of national debt in developed and developing countries with their per capita income and size of the public sector. Both econometric and qualitative analyses were conducted in the light of secondary data. The study finds that high levels of debt offers a target of high growth to developed countries and contributes to expand the public sector in both developed and developing countries. Debt threshold for developed economies depends on payability of loans of those countries. Among developing countries, Sri Lanka is one who is going forward with a significant growth by decreasing its national debt levels and so controlling the expansion of the public sector.

Key words: Growth rate; public debt; public sector; tax rate
JEL classification: H6

1. Introduction

"The progress of the enormous debts which at present oppress, and will in the long-run probably ruin, all the great nations of Europe, has been pretty uniform (Adam Smith). Somebody may surmise that Adam Smith's view is correct. The crisis of 2008 put fiscal policy back and role of the state on the table for policy-makers. Fiscal policy is a major policy instrument through which government intervenes in economic activities. Budget deficit may be financed through borrowing. In both developed and developing countries, government expenditure may increase due to expansion of government activities and contingencies such as natural disasters and wars.

However, at any point of time, the accumulated value of deficit financed after borrowing is the public debt. Thus, the deficit is a flow whereas the debt is a stock.

Literature on fiscal deficit and public debt is so massive and contains ideas of both proponents and opponents. David Hume stated that public debt was likely to lead to injurious tax increases in the short term and possibly to default in the long term. Adam Smith also considered that debt financing would lead to default. On these arguments, debt financing is to be used only under exceptional circumstances, such as wars (Shaviro 1997). Ricardo tackled the question in terms of debt neutrality. According to him the cost of debt is borne when resources are used and therefore falls onto current generations. The neutrality hypothesis fully formalized by Barro (1974) who highlighted the relevance of intergenerational altruism as an alternative hypothesis to the one concerning infinite time horizons. According to Keynesian approach, markets are generally unable to ensure full employment of available resources, the “real resources view” argued that debt finance was necessary to ensure an adequate level of aggregate demand because intended savings cannot be fully absorbed by private investments (Domar, 1944:147). Nobel laureate James Buchanan (1989) does not recommend public debt. He states “the financing of current government spending by debt is equivalent to an ‘eating up’ of our national capital value.” (p. 3). Buchanan and Flowers (1987) also do not recommend borrowing, if the full employment objective is promoted in the economy, because borrowing reduces current purchasing power that the deficits are designed to increase (p.287-288). According to above views, four main ideas arise regarding public debt, namely distortion of the economic environment, default problem, debt burden, and resources view. Out of them rather than first three the last directly holds for the debt.

1.1 The optimal debt level

If public debt is recommended, how far it is possible for an economy. Thus, discussion on public debt sustainability was revived in the 1980s, when public finances came into focus owing to a growing public sector. Several characteristics of public debt suggest conceptual and methodological similarities to the analysis in resource economics. First, public debt has some similarities to a renewable resource. Renewable resources, like fishing grounds, can be used up to a certain threshold. Beyond that point, the reproductive capacity of the resource is harmed; the resource becomes a nonrenewable one and is finally used up. Second, deficits have the character of a pollutant. Pollutants can be released with no harm up to a certain level given by nature’s absorptive capacity. Beyond that level, they may cause negative externalities for other individuals in the short run until the system eventually collapses in the long run. The parallel to public finances is straightforward here. Finally, the formal analysis of both environmental and fiscal policy sustainability involves the use of dynamic intertemporal or intergenerational models (Neck and Sturm 2008). According to these ideas, like in many others there is a limit in public debt also.

Up to which level can a country go with public debt? What is the threshold level? In this regard also there is no agreement among economists. Pescatori, Sandri and Simon (2014) after analyzing 24 developed countries finds that there is no simple debt threshold ratios. However, the study says

that countries with high but declining levels of debt have historically grown just as fast as their peers. According to Aiyagari and McGrattan (1994) optimal quantity of government debt is 2.5 times GNP, the optimal interest rate is a little under 5 per cent and optimal tax rate is about 33 per cent. Debt sustainability is a central tenet of the Maastricht Treaty too. Article 109j(1) makes a sound government financial position an explicit criterion for a country's eligibility to EMU. The fiscal rules set in the Treaty and subsequently integrated by the Stability and Growth Pact require budget positions close to balance or in surplus in the medium term, deficits lower than 3 per cent of GDP and the reduction of debt to GDP ratios below 60 per cent. Compliance with these rules, which aims at combining fiscal discipline and flexibility, clearly excludes divergent and unsustainable fiscal dynamics. Three other studies (Kumar and Woo 2010; Reinhart and Rogoff 2010; Cecchetti et al. 2011) propose somewhat higher rates than that of Stability and Growth Pact. All these three find that beyond a certain threshold—about 80-90 per cent of GDP—higher public debt lowers potential growth. Vogel (2014) shows that the optimal debt level varies between 110-180 per cent of GDP. Cottarelli and Jaramillo (2012) in an IMF working paper recommend that government debt in advanced economies needs to be lowered over time—as stabilizing debt to GDP at current elevated levels would penalize potential growth in these advanced economies. Thus, one of the above studies declines the threshold in national debt but all others proposed debt threshold ranges from 60-250 per cent in GDP. Then it is obvious that there is no clear agreement among economists on optimal level of public debt issue.

1.2 Optimal government size

Budget is related to the public sector. Debt is mainly due to expansion of budget deficit and thus debt may contribute to increase the size of the public sector. As government grows relative to the market sector, the law of diminishing returns begins operating. Public expenditures are increasingly channeled into less productive activities, and the government undertakes ill-suited activities for it and it leads to negative returns and retardation of economic growth (Chobanov and Mladenova 2009). Based on the theoretical framework of Barro (1989), Karras (1997) develops an empirical methodology to investigate the role of government services in the process of economic growth. He examines 20 European countries and finds out that the optimal government size is 16 per cent (+/-3 per cent) for the average European country. Following the theoretical framework of Barro (1989) and the methodology of Karras (1997), Gunalp and Dincer (2005) estimate the productivity of government services and the optimal government size for 20 transition countries based on annual data for the period 1990-2001. The optimal government size is estimated to be 17.3 per cent (+/-3 per cent) for the average transition country.

Peden (1991) studies the government's effects on productivity in the USA for the period 1929-1986. His analysis validates the classical supply-side paradigm and shows that maximum productivity growth occurs when government expenditures represent about 17-20 per cent of GNP, far less than the 35 per cent which existed in 1986. Scully (1994) concludes that in order to maximize economic growth in the USA, the average rate of federal, state and local taxes combined

should be between 21.5 and 22.9 per cent of GNP. Using Scully's method to estimate the optimal size of government in Canada, Chao and Grubel (1998) find that the optimal rate of taxation and government spending in Canada is about 34 per cent. Tanzi and Schuknecht (1996) report that "taking 1960 as the benchmark, over the long run, total public expenditure could be reduced to, perhaps, less than 30 per cent of GDP without sacrificing much in terms of social or economic objectives." (p.3). Davies (2008) by analyzing panel data set of 154 countries over the period 1975 through 2002, concluded that, over all countries, the estimated levels of government consumption and investment expenditures that are associated with maximal growth in per-capita RGDP are 8.5 per cent and 6.2 per cent, respectively. This implies an optimal level of government expenditures of 14.7 per cent.

All above studies on optimal size of the public sector except Chao and Grubel (1998) propose that the maximum size of the government needs to be less than 30 per cent. However, IMF data (in Government Financial Statistics) show that public expenditure in developed countries has gone up. In other words, public sector in these countries has enlarged, some times higher than 50 per cent. Countries should be familiar with the limitations of the fiscal policy and economic effects of debt. Thus, this study analyzes (a) the relationship between public debt and growth in developed and developing countries and the threshold level of borrowing and (b) the relationship between public debt and public sector in developed and developing countries. Sri Lanka's experience is separately analyzed in the study. These objectives are achieved by reviewing literature, developing two simple models, analyzing theoretical issues and examining the empirical relations between fiscal variables such as debt, income, and expenditure in light of secondary data available from IMF, World Bank and country sources. The data are analyzed in terms of scatter diagram and regression models. Also they are compared with the findings of other studies. The paper consists of five sections. In the next section, some theoretical aspects of government borrowing is discussed. Third section presents a mathematical model with view of analyzing how debt is related to both national income and size of the public sector. Fourth section respectively applies equation (1) and (3) to calculate required growth rate and to determine the optimal debt levels especially in developed economies. This section also analyzes empirical data in both developed and developing countries. The final section presents conclusions.

2. Theory of borrowing

Both individuals and government may borrow money. Individuals (or private sector), if borrowed for investment, has to pay interest and then borrowed money is a form of capital. Borrowers can decide whether borrowing is economically advantageous or not. If borrowed money today can be invested in a profitable business so that the value of output is adequate to cover all factor payments, there is no problem of borrowing money. In other words, borrowing is profitable. Mathematically stated, in this situation the present value of output (benefits) is in excess of the present value of all factor payment (costs). Thus, for the private sector both borrowing and repayment of loans is not a problem if investment is sufficiently profitable. For the private sector, borrowing for consumption increases present expenses and it may take longer time period to settle

the loan. In future, the borrower will have to earn sufficiently to settle the loan. Thus, in the case of borrowing for consumption, it takes longer time to clear the debt obligations, needless to state that longer time leads to greater interest. Furthermore, greater amount of accumulated interest in borrowing for consumption is the only difference between borrowing for consumption and investment.

The case of borrowing by the government is somewhat different. Government is a collective organization functioning in an economy. It is operated through elected representatives with collected member fees from the citizens as taxes. In any country, once the economy is affected by a natural disaster, the collective organization (government) has to look after its victims. In such a situation, if the government has no money in its hand, it can borrow and help victims. Later on, if necessary, by increasing taxes, government can clear debt obligations. By doing so, government can help its people as the economic and political leader. If a country is less developed or developing, in such a situation, to promote growth and development, government cannot laide burden on people since their per capita income is low. However, in such a situation, a government can borrow money, sometimes from overseas, and spend to perform the role of the state. Thus, government provides education, health and infrastructure which empower people, promote labor, develop entrepreneurial skills of citizens and background of the private sector. In other words, those are investment by the government. Sometime later as a result of increase in per capita income, government can raise taxes and settle the loans. This means that there is no scope for government to borrow unless there are potentials for growth. If the economy reached to full employment level, additional payability of the government borrowing depends growth acquired by technological progress only. Thus, governments in advanced economies have to limit their borrowings.

Recently, governments in some advanced economies, especially in Europe, have increased their welfare expenditure even if they are with the problem of higher national debts. Based on that, one may argue that growth is not the only macroeconomic objective. However, if welfare spending is based on public debt, government cannot increase it continuously without increasing taxes which again makes negative influences on private consumption and growth.

3. A simple model

The relation between public debt and growth can be mathematically examined. For ideal debt management, tax revenue needs to be increased at least to repay interest on borrowing. If so, $\tau \Delta Y_t = r D_t$, where τ is tax rate; Y is national income; D is government debt; r is the rate of interest and t is the time. Divide both sides of the equation by Y_t .

$$\tau \frac{\Delta Y_t}{Y_t} = r \frac{D_t}{Y_t}$$

$$\tau g = r \frac{D_t}{Y_t}$$

$$g = \frac{r D_t}{\tau Y_t} \dots \dots \dots (1)$$

The right side of the equation (1) gives periodic interest payment as a proportion of government tax revenue. A part of that also shows a proportion of the government debt in GDP $\left(\frac{D_t}{Y_t}\right)$. In the equation (1) the required growth rate is positively related with the rate of interest and borrowing and negatively related with the tax rate. In this equation, D_t is stock variable that can be defined in two ways, first as the government borrowing for a given period of time and secondly as the accumulated debt at the end of several periods of time. Equation (1) defines the growth rate as a proportion of due interest payment in tax revenue. It is the required growth rate to clear periodic debt obligations. Value of this growth rate is zero if a government, like Libya, does not borrow. Its value is very low in the case of economies of which borrowing is close to zero, like Oman and Hong Kong. Also, it is the growth rate that has to be acquired especially for ideal debt management. Therefore, it can be labeled as *debt oriented growth rate* or *debt-based growth rate*. In a country, which has borrowing obligations, the value of this proportion (or growth rate) is definitely positive and for ideal debt management, its value should be less than actual growth rate. Even so, as World Bank data show, actual growth rates of 10 developed countries were negative in 2012. If average growth rate for the period 2010-2014 is considered it is negative in four advanced economies (Appendix 1).

The relationship between debt and size of the public sector can also be examined mathematically. If total budget deficit is financed by borrowing (or total government expenditure consists of both tax income and borrowing), government expenditure in year t can be expressed as,

$$G_t = \tau Y_t + D_t \dots\dots(2)$$

In the following year, if there is no new borrowings, government expenditure is given by,

$$G_{t+1} = \tau Y_{t+1} + rD_t$$

Let's divide equation (2) by Y_{t+1} .

$$\frac{G_{t+1}}{Y_{t+1}} = \tau + r \frac{D_t}{Y_{t+1}} \quad (3)$$

In this equation, D_t is defined as the accumulated public debt in a country by the time period 't'. The equation says the size of the public sector is determined by tax rate, borrowing rate, and volume of borrowing. When borrowing increases, size of the public sector also increases. To the equation (3) once administration cost of debt is added the size of the public sector further increases.

4. Data and empirical analysis

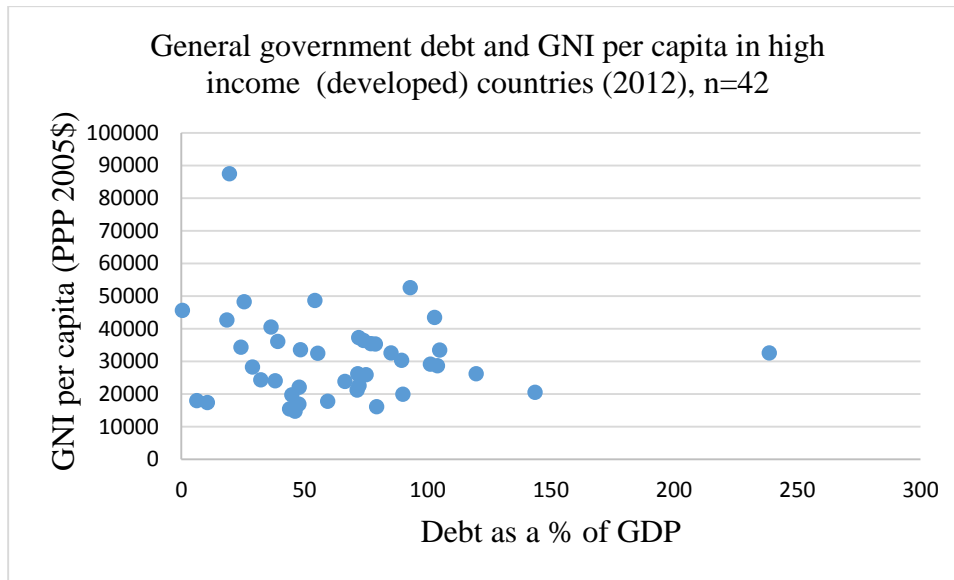
Country wise secondary data on annual GDP growth rate and tax rate are available in the World Bank web site. However, in the case of public debt, World Bank provides only borrowings by central government of each country. Thus, country wise data on government debt were collected from the <http://chartsbin.com/view/2108>. By applying these data required growth rate for each country can be calculated in terms of formula (1), when rates of interest and tax are available.

Interest rate for government loans varies but is assumed to be four per cent. Applying actual tax rate of each country in 2012, required growth rates were calculated in terms of formula (1) and results are presented in Appendix 1. When the calculated growth rates are compared with the actual growth rates in the selected 18 advanced economies, in 14 countries actual growth rate in 2012 is respectively lower than required growth rate. These countries include Belgium, Denmark, Finland, France Greece, Hungary, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, UK and USA. Once the required growth rates in 2012 are compared with the average growth rates for the period 2010-2014, the latter is still far below than the former in Greece, Italy, Netherland, Portugal, Spain and USA and in Denmark, Finland, Ireland and France required growth rate is very close to the average growth rate in 2010-2014.

4.1 Effects of borrowing on growth and public sector: further analysis

Some economists including Keynes have recommended debt finance. However, for which type of countries is it most relevant, is the problem. This urges researchers to examine the effects of public debt on macro variables in developed and developing countries. Graphical analysis shows that in advanced economies, higher debt rates do not show a significant contribution on GDP per capita in 2012 (Figure 1). Many countries have exceeded 50 per cent in their debt-to-GDP ratio. Accumulated debt in some have exceeded their annual GDP. Japan has doubled its proportion of debt in GDP. The overall picture shows a negative relationship between borrowing and per capita income. Even if the coefficient of the independent variable (debt) is not significant, regression results confirms this situation further (Figure 1). In the case of developing countries, the relationship between income per capita and government debt is not so clear. Many countries are with high proportions of debt but with low levels of income per head, while some others have reached higher income levels with low levels of debt. However, only a few have increased their income with increased debt (Figure 2). Even though the estimated regression results show a negative relationship between debt and income per head, coefficient of the controlling variable is not significant. In developing countries, growth is affected by many other factors such as low quality of governance, lack of competition and low level of investment by the private sector. In this situation, countries with per capita income less than PPP\$ 1000 were removed from the sample in Figure 2 and a new scatter diagram was constructed for remaining economies (Appendix 2). However, then also a clear relation between GNI per capita and debt level in low income economies cannot be observed.

Figure 1

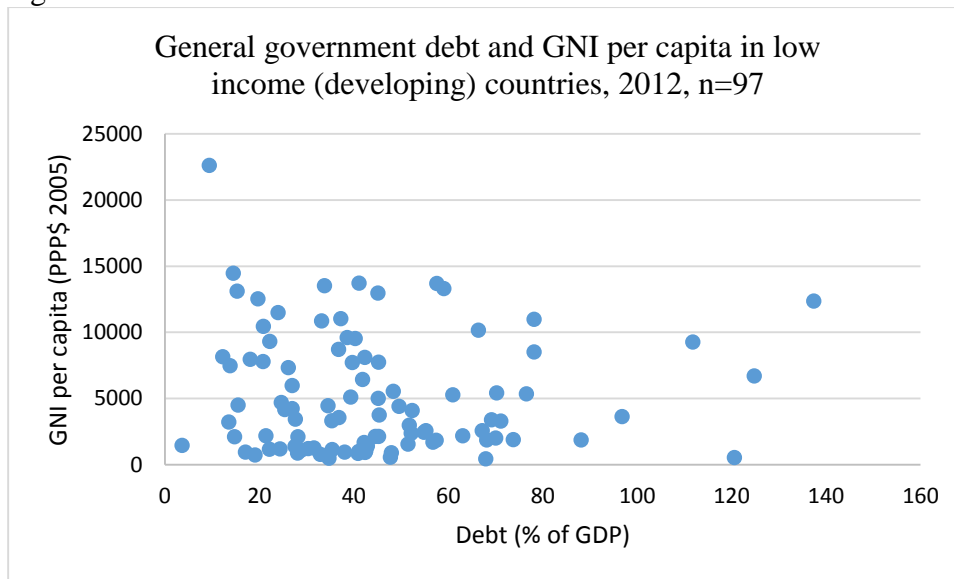


$$\widehat{GNI} = 33100 - 33.6DEBT$$

(t=8.6) (-0.7)

Sources: Basic data on GNI per capita – UNDP (2013); Government debt - <http://chartsbin.com/view/2108>

Figure 2



$$\widehat{GNI} = 5481.8 - 8.3DEBT$$

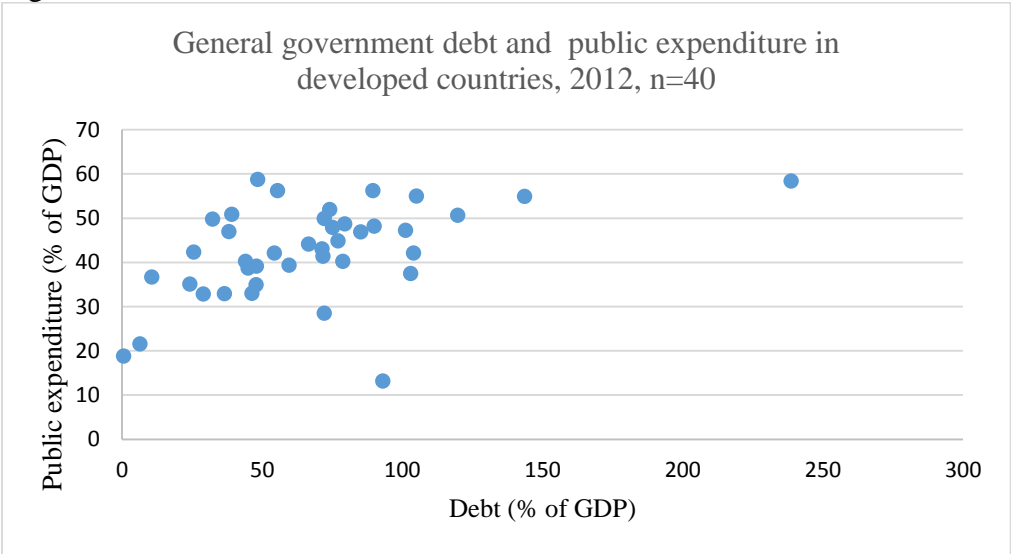
(t=5.9) (t= -0.45)

Sources: Basic data on GNI per capita – UNDP (2013); Government debt - <http://chartsbin.com/view/2108>

Discussion in the introductory section shows that the optimal size of the government needs to be less than 30 per cent. IMF publication Government Financial Statistics shows that in terms of public expenditure, many advanced economies have exceeded this critical level. In terms of tax also developed countries have become over-sized. Denmark is the country which reports the highest tax rate (33.4 in 2012) and in many other developed countries the size of the government is around 20 per cent in terms of tax income (Appendix 1). According equation (3), if the interest rate for public borrowing is 4 per cent, then the size of the government increases by that proportion. In addition, when government borrows, its expenditure further expands through addition of administrative cost of debt.

The relationship between public debt and size of the public sector can also be analyzed in light of secondary data. In this regard, the scatter diagram with respect to developed countries shows a clear positive relationship between these variables. The regression coefficients estimated based on these variables are highly significant with proper (positive) signs (Figure 3). In the case of size of the public sector in terms of expenditure, according to available data regarding developed countries, the scatter diagram is upward sloping and shows a positive correlation between national debt and size of the public sector. The estimated linear regression model also shows a positive relation between variables, but coefficient of the regressor is not significant, may be due to heterogeneity in economic performance in developing countries (Figure 4).

Figure 3

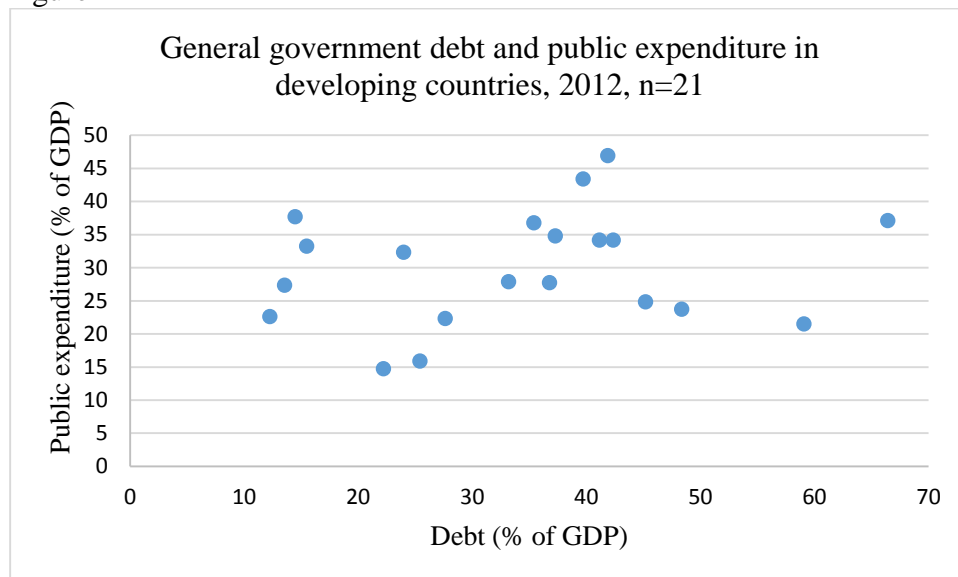


$$\overline{EXP} = 34.6 + 0.12DEBT$$

(t=12.3) (t=3.3)

Sources: Basic data on public expenditure – IMF (2014); Government debt - <http://chartsbin.com/view/2108>

Figure 4



$$\overline{EXP} = 25.9 + 0.12DEBT$$

$$(t=5.3) (t=0.88)$$

Sources: Basic data on public expenditure – IMF (2014); Government debt - <http://chartsbin.com/view/2108>

4.2 The optimal debt level

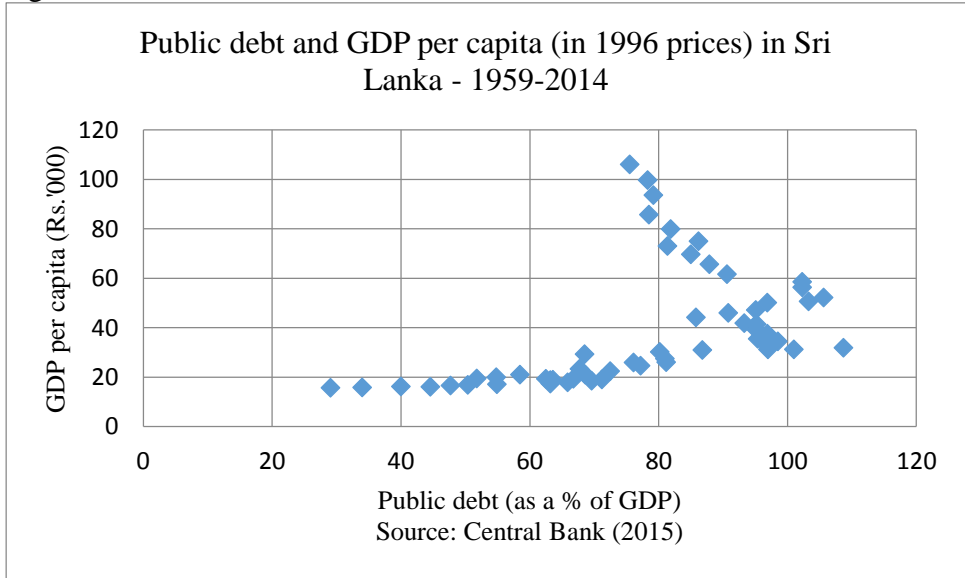
Four separate indicators are used to measure the importance of governmental activity: (a) the value of governmental goods and services; (b) the real cost of governmental services; (c) the extent to which collectively made decisions replace private or individual decisions in the economy; and (d) the extent to which resources are organized by the market economy or by the governmental bureaucracy (Buchanan and Flowers 1987:61). This means public expenditure can be used as a measure of proportion of the government in the economy and in many empirical studies, it has been used as a measure of the size of the government (Matteo 2013). Equation (3) gives determinants of the size of the public sector in terms of expenditure. In that equation, there are three determinants government borrowing namely tax rate, interest rate for borrowing and public debt. According to explanation in sub-section “optimal government size” of section 1, optimal size of the government should not exceed 30 per cent. In high income countries the tax rates are higher. Out of 18 developed countries given in Appendix 1, tax rate in 2012 is 20 per cent or more in 13 countries. (Australia, Iceland, Luxembourg, New Zealand, Norway, UK are some other countries where tax rate is greater than 20 per cent as World Bank shows). If the optimal size of the public sector is 30 percent, governments in economies that exceed that boundary cannot borrow. For example, Denmark where the tax rate has already exceeded 30 per cent cannot run into debt. New Zealand whose tax rate is 29.3 (World Bank) also has little scope to borrow. Belgium, Norway, Luxembourg, and UK are with the tax rates of 25 percent or more, and can borrow up to 1.25 times of their GDP, according to the equation (3). However, in developed countries tax rates are very low. In Canada and Japan it is 11.7 and 10.1 per cent respectively in 2012. Even if Japan’s

debt level has gone up to 238 per cent in 2012 (Appendix 1), Japan is still tolerating it due to country's low tax rate. It's size of the public sector, according to formula (3) is 20 per cent in 2012 at the 4 per cent of rate of interest. In 2014, Japan's debt level has increased up to 246 per cent to GDP. However, with a low tax rate Japan may go further. To analyze management of high public debt with low tax rates, further research is required.

4.3 Situation in Sri Lanka

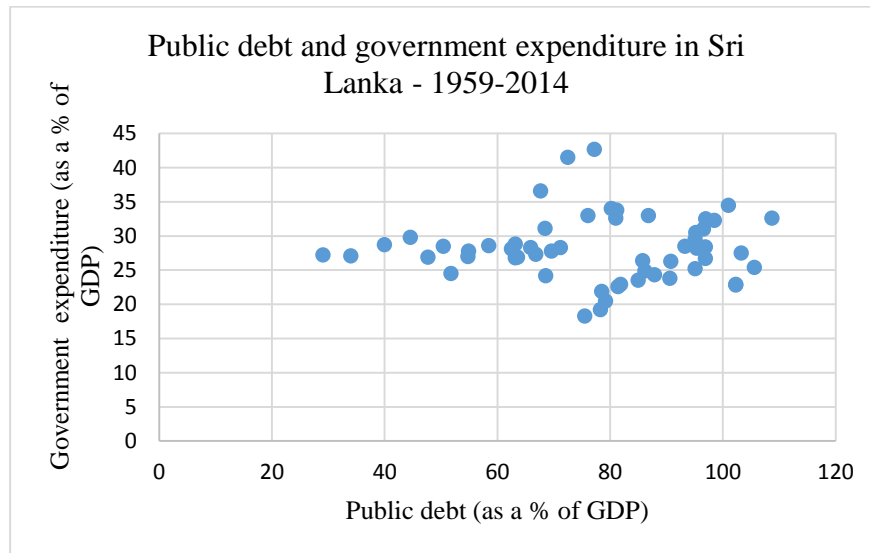
Sri Lanka has been adopting a deficit budget throughout its postcolonial period. According to available data, the country has been borrowing for more than five decades. However, deficit budget with borrowed funds has contributed to growth up to about 1990s but not after that (Figure 5). During the second millennium, the economy has turned towards a new economic path by reducing national borrowing. Consequently, during the recent past the economy has increased its growth. From 2010-14 Sri Lanka recorded 7.4 per cent of average growth rate (Appendix 1) The required growth rate calculated in terms of equation (1) for the year 2012 taking borrowing rate as 4 per cent, is much lower than the country's actual growth rate in the same year and average growth rate during the period of 2010-14 is much well above the required rate of growth. Moreover, Sri Lanka's fiscal policy with deficit finance has not expanded the public sector (Figure 6). Therefore, country's government debt is well-managed and less problematic.

Figure 5



Source: Basic data - Central Bank of Sri Lanka (2015)

Figure 6



Source: Basic data – Central Bank of Sri Lanka (2015)

5. Conclusions

Public debt is, at present, a problem of many countries and has become an attractive topic among economists and policy makers. To analyze tolerable and sustainable debt levels for economies, two simple mathematical models were developed. The first gives the required rate of growth for proper debt management, if government borrows. This growth rate can be recognized as ‘debt-based required rate of growth’. Both graphical and econometric analyses show a negative relationship between income per capita and national debt levels in developed countries. That observation can further be confirmed by the comparison of calculated required growth rates for developed countries with actual growth rates of the same countries (Appendix 1). Secondly, the second model (equation 3) shows that public debt expands the size of the public sector of an economy at least by the rate of interest of public borrowing and accumulated borrowing. This idea is further confirmed by the graphical and econometric analysis on developed countries, where borrowing is positively correlated with size of the public sector. In developed countries, tax rate shows a high variation; in Denmark it is around 33 per cent in 2012 and in Japan it is 10 per cent in the same year. According to the equation (3), the optimal debt level depends mainly on the tax rate. Thirdly, when annual growth rates of developed countries from 2010 to 2014 is examined, in many developed countries, they are less than the required growth rates and therefore those growth rates are not sufficient to repay loans of the government. On these background, present debt levels of developed countries are unbearable and need to be brought down.

Both equation (1) and (3) say about debt threshold of a country. Equation (1) explains debt payability of a country and equation (3) explains the limitation of borrowing based on the size of the public sector. Optimal debt level may depend mainly on the tax rate. The case of the relationship between growth and public debt in developing countries is not clear. However, indebtedness leads to expanded public sector in developing countries too. As a developing country Sri Lanka, has interesting experiences. Its government has been borrowing for more than five decades and borrowing has increased growth for some decades since beginning but not later. Sri Lanka's borrowing has not expanded the public sector. By achieving a significant rate of growth Sri Lanka is proceeding with well-managed debt policy.

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Appendix 1

Comparison of actual growth rate with required growth rate calculated in terms of equation (1*)

Country	Tax rate ¹ (%) (2012)	GDP growth rate ¹ (%) (2012)	Borrowing in 2012	GDP In 2012	Required growth rate (%) as per formula (1), $r=0.04$	Average annual GDP growth rate ³ (%) (2010-2014)
Austria	18.3	0.9	7.919 (E/B)	307 (E/B)	0.56	1.3
Belgium	24.9	0.1	15.5 (E/B)	375.9 (E/B)	0.66	1.1
Canada	11.7	1.9	62.9 (C\$/B)	1817.6 (C\$/B)	1.18	2.6
Denmark	33.4	-0.7	71.9 (Kr/B)	1825.6 (Kr/B)	0.47	0.5
Finland	20.0	-1.4	4.2 (E/B)	192.3 (E/B)	0.44	0.5
France	21.4	0.2	99.3 (E/B)	2031.7 (E/B)	0.90	1.0
Greece	22.4	-6.6	17.2 (E/B)	193.3 (E/B)	1.6	-4.8
Hungary	22.9	-1.5	605.3 (For/B)	28048 (For/B)	0.37	1.2
Ireland	22.0	-0.3	13.2 (E/B)	172.7 (E/B)	1.39	1.4
Israel	22.1	3.0	36.3 (N.S/B)	991.7 (N.S/B)	0.67	3.8
Italy	22.4	-2.8	45.4 (E/B)	1566.9 (E/B)	0.5	-0.5
Netherlands	19.7	-1.6	23.9 (E/B)	599.7 (E/B)	0.8	0.3
Poland	16.0	1.8	61.7 (Zl/B)	1595.2 (Zl/B)	0.9	3.1
Portugal	20.3	-4.0	10.6 (E/B)	169.8 (E/B)	1.2	-0.9
Spain	7.1	-2.1	109.2 (E/B)	1029 (E/B)	6.0	-0.5
Sweden	20.7	-0.3	26.4 (Kr/B)	3684.8 (Kr/B)	0.13	2.4
UK	25.3	0.7	95.4 (P/B)	1655.3 (P/B)	0.9	1.7
USA	10.2	2.3	1566.7 (US\$/B)	16163.2 (US\$/B)	3.8	2.2
Sri Lanka	12.0	6.3	867 (Rs/B)	7578 (Rs/B)	3.8	7.4

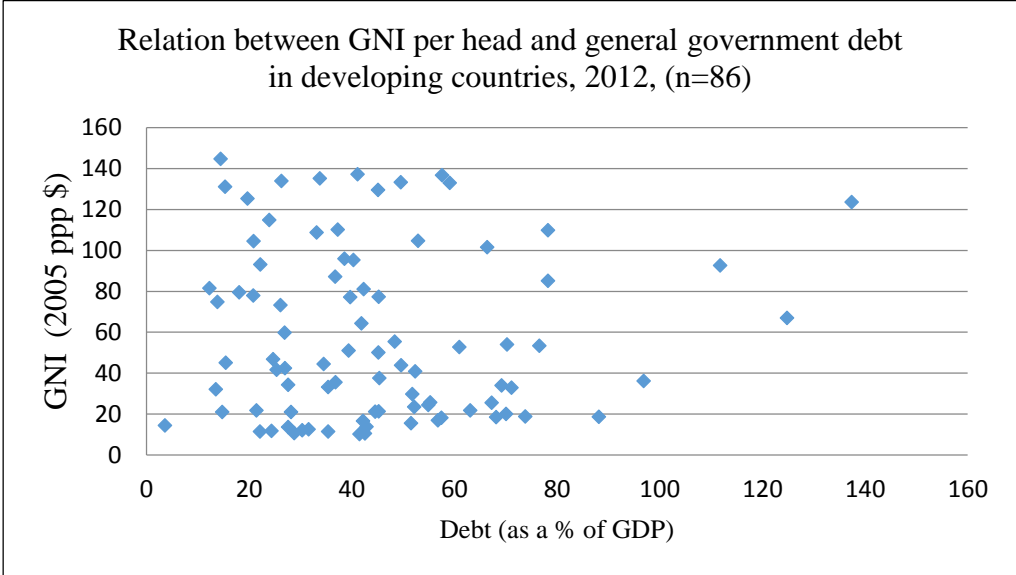
Notes: E/B – Euro billion; C\$/B – Canadian dollar billion; Kr/B –Kroner billion; For/B - Forint billion; N.S/B – New Shekel billion; Zl/B – Złoty billion; P/B – Sterling pound billion; Rs/B – Sri Lankan rupees billion.

* D_t is defined as government borrowing in year 2012

Sources: 1 and 3 basic data - <http://data.worldbank.org>

2 - <http://chartsbin.com/view/2108>

Appendix 2



$$\widehat{GNI} = 5772.1 + 1.1DEBT$$

(t=6.2) (0.06)

Sources: Basic data on GNI – IMF (2014); Public debt - <http://chartsbin.com/view/2108>