EMPIRICAL EXAMINATION OF DEBT AND GROWTH NEXUS IN SOUTH ASIAN COUNTRIES

*Naeem Akram**

Over the years, South Asian countries have been facing the problem of a twin deficit and the need to rely on public external and domestic debt to finance their developmental activities. The positive impact of public debt relates to the fact that in resource-starved economies debt financing, if done properly, leads to higher growth and adds to the borrower's capacity to service and repay external and internal debt. The negative effect works through two main channels, namely "debt overhang" and "crowding out". In the present study, the consequences of public debt for economic growth and investment are examined for the four countries in South Asia, namely Bangladesh, India, Pakistan and Sri Lanka, for the period 1975-2011. To conduct the study, a hybrid model that explicitly incorporates the role of public debt in growth equations was developed. The standard panel data estimation techniques have been used. The results show that both public external debt and debt servicing negatively affect economic growth and investment, which points to the existence of the "debt overhang effect" and the "crowding out effect". Similarly, domestic debt also exhibits a negative and significant relationship with economic growth and investment. The results suggest that reliance on debt for development purposes is not a safe option and countries need to extend the efforts to increase the revenue to finance the development expenditure.

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Key words: Public debt, economic growth, investment, panel data.

* Assistant Chief, Ministry of Economic Affairs, Islamabad, Pakistan (Tel: +92-51-5124074, e-mail: naeem378@yahoo.com). Author's note: the viewpoints expressed in the present study are those of the author and do not reflect the viewpoints of his affiliated institution. The author is also thankful to Dr. Syed Nawab Haider Naqvi for his valuable suggestions and encouragement in conducting the present research.

I. INTRODUCTION

> What makes some countries rich and others poor? Economists have asked this question since the days of Adam Smith. Yet after more than two hundred years, the mystery of economic growth has not been solved.
>
> (Elhanan Helpman, 2004)

Since the beginning of the twenty-first century, heavy indebtedness of the developing countries has been one of the major development policy issues. Public debt is classified as sum of external debt and domestic debt. Indeed, much of the extraordinary growth in the developing countries since the 1950's can be described as debt-related. According to traditional neoclassical models, at initial stages of economic development, developing countries have limited capital stocks and investment opportunities; therefore, capital mobility increases the economic growth (Chowdhury, 2001). As long as these borrowed resources are used for productive investment, countries do not face macroeconomic instability and economic growth increases (Burnside and Dollar, 2000). Similarly, domestic savings and investment are also positively affected by external debt, leading towards positive impacts on economic growth (Eaton, 1993).

However, a high level of accumulated debt has adverse implications for investment and economic growth. A broad rationalization of these effects is referred as the "debt overhang" theory. The theory asserts that if there is a probability that country's future debt will be more than its repayment ability, then the anticipated cost of debt-servicing can depress the investment (Krugman, 1988). However, the extent to which investment is discouraged by debt overhang depends on how government generates resources to finance debt service obligations (Karagol, 2002). Similarly, if a greater share of foreign capital is used to service the external debt, very little would remain available to finance investment and growth; this channel is known as the "crowding out" effect (Diaz-Alejandro, 1981). It is noteworthy that various authors (Pattillo, Poirson and Ricci, 2002; 2004) are unable to find out the empirical significance of the crowding out effect. However Chowdhury (2004), Clements, Bhattacharya and Nguyen (2003) and Elbadawi, Ndulu and Ndungu (1997) have found that both debt service obligations and debt burden have negative implications on economic growth and investment and according to Cohen (1993) and Hansen (2002), investment and growth are negatively affected by only debt servicing.

In developing countries, domestic debt has received far less attention as compared to external debt. Yet, in many countries, domestic financing is becoming increasingly vital because foreign donor's willingness to lend has reduced over time. In developing countries,

justification behind the creation of domestic debt is that it defends them from adverse external shocks and foreign exchange risks and kindles the development of internal financial markets. Barajas and Salazar (1999), Barajas, Steiner and Salazar (2000) and Kumhof and Tanner (2005) are of the view that the government securities in developing countries are an attempt by banks to guard against high private sector credit risk. Hence, banks are more willing to lend to the private sector and in a way that domestic debt helps in increasing the private investment (Aizenmann, Pinto and Radziwill, 2004).

Internal financing, nevertheless, entails problems of its own. For instance, financing done through the central bank by printing more money is inflationary in nature and would likely promote financial repression. Using the commercial banks to finance the domestic deficit tends to create other distortions in economy. According to Beugrand, Loko and Mlachila (2002), domestic debt is more expensive in comparison with external debt. Moreover, due to high yields on public domestic debt, banks become self-satisfied about costs and consequently, decrease efforts to mobilize deposits and finance private sector projects. Similarly, from a risk-weighted point of view, government borrowing is more attractive to the banks and domestic debt can crowd out private investment (Hauner, 2006).

The organization of the paper is as follows. After a brief introduction, in section II a review of the literature is presented. Section III contains a discussion on the model specification by giving some theoretical background. Empirical methodology applied in the paper along with data sources and main variables are discussed in detail in section IV. Section V is devoted to the discussion of results, while in the last section, the conclusions and policy implications emerging from the present study are presented.

II. LITERATURE REVIEW

Over the last three decades, numerous studies have been conducted on the relationship between debt and economic growth. An overview of the available literature is summarized below.

Neoclassical models have concluded that taxes needed to finance the interest payments of the external debt directly curtail the disposable income and savings of the individual taxpayers. These taxes have led to the reduction in capital stock and economic growth (Diamond, 1965). Sachs (1990) has showed that if higher taxes cover the debt servicing then these taxes by creating distortions in the economy are likely to reduce economic growth. The distortion in the economy caused by taxes includes, among other things, tax evasion, reduction in work effort, capital flight and barriers to trade (taxes on trade). Levy and Chowdhury (1993) also find that due to an expected rise in future taxes,

an increase in public external debt discourages capital formation while encourages capital flight, which causes a reduction in economic growth.

Patillo, Poirson and Ricci (2004) and Fosu (1996; 1999) have estimated that countries having high levels of debt face approximately a 1 per cent reduction in GDP growth rate. They have also concluded that negative impacts of external debt on growth are transmitted through total factor productivity (TFP) and investment (physical capital accumulation). Cunningham (1993), Iqbal and Zahid (1998) and Chowdhury (2001) also have come to similar findings that debt is harmful for economic growth of a country. However, Lin and Sosin (2001) have found that for African countries, debt has a negative and significant relationship with economic growth while for Latin America, it is insignificant. For Asian and other developing countries, the relationship is positive but insignificant. This suggests that efficient utilization of debt is vital for economic growth.

As mentioned in the introduction, one important aspect of the indebtedness is the problem of debt overhang — according to Bauerfreund (1989) there are two debt overhang concepts. Sachs and Williamson (1986) presented the first concept — when indebted countries pay their debts then real resources are transferred from the private sector to public sector. Feldstein (1986) sets out the second concept — government needs to impose taxes on the private sector to finance the debt obligations, which, in turn, results in a reduction in investment. Sawada (1994) and Sen, Kasibhatla and Stewart (2007) conclude that debt overhang is depressing economic growth. Similarly, Elmeskov and Sutherland (2012) are of the view that public debt overhangs affects growth through the increased cost of capital. However, Afxentiou and Serletis (1996) fail to determine a causal relationship between debt and GDP and conclude that debt overhang is rather exaggerated and that if resources were transferred into inputs then external debt would have a positive effect on economic growth.

As mentioned earlier, the crowding out effect also curtails economic growth. Serieux and Samy (2001), Warner (1992) and Taghavi (2000) find that public debt tends to crowd out investment. According to Deshpande (1990), Mahdavi (2004) and Fosu (2007), expenditure on debt servicing may shift public expenditure away from social sectors, such as health and education. Such a shift severely affects economic growth. However, Cohen (1993) shows that, in highly indebted developing countries, the level of debt is not a factor behind slowing investment.

Another strand of literature estimates the optimal level of debt. Smyth and Hsing (1995) find the optimal level of external debt as 38.4 per cent of GDP for developing countries. Clements, Bhattacharya and Nguyen (2003) find that above the threshold level of 20-25 per cent for external debt's net present value and 50 per cent of GDP for its face value, debt depresses the economic growth. Whereas, Patillo, Poirson and Ricce (2002) finds that up to approximately 160 per cent of the export-to-debt level, external debt is growth enhancing;

thereafter it is growth reducing. Maghyereh, Omet and Kalaji (2002) conclude that the optimal threshold level of external debt is 53 per cent of the GDP in Jordan.

The above-mentioned studies focus only on the role of external debt with regard to economic growth. In this regard, they neglect domestic debt entirely or mention it only in passing. However, Abbas (2005) concludes that the relationship between domestic debt and economic growth is negative. Later on, Abbas (2007) finds that if domestic debt as a percentage of bank deposits exceeds 35 per cent, it undermines economic growth while Blavy (2006) finds that the threshold level for domestic debt is 21 per cent of GDP and that domestic debt above 21 per cent of GDP reduces economic growth.

The issue of public debt in developed countries has received considerable attention from the policymakers in the aftermath of the recent financial crisis. In this regard, Cecchetti, Mohanty and Zampolli (2011) find that once the public debts crosses the threshold level of 85 per cent of GDP, it starts reducing the economic growth in Organization for Economic Cooperation and Development (OECD) member countries. Kumar and Woo (2010) also find that an increase of 10 percentage points in the debt/GDP ratio results in a reduction in economic growth of about 0.2 percentage points. However, Panizza and Prebistero (2012) conclude that in advanced economies public debt depresses future growth to a limited extent and in the case of developing countries the debt overhang argument has more power as a significant fraction of debt is external.

Reinhart and Rogoff (2010) find that a debt to GDP ratio of 90 per cent and above is associated with lower economic growth in advanced and emerging market economies. However, lower levels of external debt/GDP ratio of about 60 per cent are associated with adverse outcomes for economic growth of only emerging market economies. These findings have been criticized by Herndon, Ash and Pollin (2013), who have found certain coding errors, as well as a selective exclusion of available data in Rogoff (2010). Consequently, they noted that if these issues are corrected, GDP growth at public debt/GDP ratios of more than 60 per cent is not dramatically different than lower debt/GDP ratios.

The review of literature suggests that divergent opinions exist on every aspect of the relationship of debt with economic growth. Over the years, South Asian countries have been facing a financial crunch. Inadequate resource mobilization and rising expenditures have made the situation with respect to persistent fiscal deficit critical.[1] Similarly, the balance of payments has remained far from satisfactory and most of the countries are facing a current account deficit. The persistence of twin deficit has resulted in the creation of large domestic and external public debt that has prevented these countries from earmarking

[1] For details see Akram (2012).

enough resources for development and social spending. The need to service the debt obligations has undermined efforts pertaining to long-term economic planning. Therefore, it is very important that impacts of public debt on economic growth are analysed. Similarly, most of the studies are focused entirely on external debt (limited studies are focused on domestic debt), leaving out a very important part of total indebtedness — that is impacts of both external and domestic debt. The present study analyses the combined effects of domestic and external debt on economic growth and investment for the countries of South Asia.

III. MODEL SPECIFICATION

According to classical economists, government has a very limited role. The "Ricardian Equivalence Theorem" suggests that taxes and debt are similar and they do not affect the real variables differentially. Hence, in the classical growth model, public debt has no role in determining economic growth. On the contrary, Keynesian and neo-Keynesian models of growth (the Keynesians more than the neo-Keynesians) put greater emphasis on the role of government in economic growth process. They suggest that if there is a gap between saving and investment then this deficit can be filled by public debt. After World War II, the "Marshal Plan" strategy of enhancing economic growth in the war devastated Europe by foreign aid, paid off rich dividends. Due to this success, in almost all the growth models that gained popularity after the Second World War, public debt has been given significant importance.

The present study has attempted to adopt a hybrid model of Cunningham (1993), Romer (1994) and Yakita (2008). The complete derivation of the model is presented in appendix I. The growth equation for the panel data in reduced vector form can be written as under:

$$y_{it} = \alpha + \sum_{j=1}^{k} \delta x_{itj} + \sum_{m=1}^{p} \pi\, Debt_{itm} + \varepsilon_{it} \quad (1)$$

where y_{it} is real GDP growth of i_{th}country at t time and x_{itj} is a vector of control variables, $Debt_{itm}$ is the vector of various public debt indicators, and ε_{it} is the classical error term. Keeping in view the importance of investment, many authors, including, among them, Presbitero (2005), have suggested that it is better that the relationship between public debt and investment also be analysed. To do so, the following reduced form equation of investment also is estimated.

$$Inv_{it} = \alpha + \sum_{j=1}^{k} \delta x_{itj} + \sum_{m=1}^{p} \pi\, Debt_{itm} + \varepsilon_{it} \quad (2)$$

where Inv_{it} is investment of i^{th}country at t time and x_{itj} is a vector of control variables, $Debt_{itm}$ is the vector of various public debt indicators, and ε_{it} is the classical error term.

IV. DATA AND EMPIRICAL METHODOLOGY

To empirically test the relationship between public debt and economic growth, panel data of the four South Asian countries for the period 1975-2011 have been used. The selection countries due to their experience of facing a crisis on balance of payments along with low revenues and savings, which forced them to rely on borrowed resources for economic development. A brief description of the variables used in the present study is summarized in table 1 below.

In order to tackle endogenity along with various other panel data estimation problems[2] and to obtain robust results, five different estimation methodologies are being applied, the Fixed Effect Model (FEM), the Random Effect Model (REM), Pooled OLS, the Dynamic Panel Data Model/Dynamic GMM (DGMM) and the System GMM (SGMM).

Various biases exist. This can result in making the coefficient estimates inconsistent in the panel data analysis in different techniques. In this regard, first is the omitted-variables bias, which is also known as heterogeneity. The omitted-variables bias results due to the correlation between the regressors and country-specific fixed effects. The second one is the endogeneity problem, which occurs due to the correlation between error term and regressors. The third important issue is the measurement errors in the independent variables.

The pooled OLS experiences both measurement errors and omitted-variables bias. However, it reduces the heterogeneity bias because the measurement errors have a propensity to lessen the correlation between country-fixed effects and the regressors. On the other hand, FEM addresses the problem of omitted-variables bias through controlling for fixed-effects, however, in comparison to pooled OLS, it is likely to worsen the measurement error problem (Hauk and Wacziarg, 2009).

Theoretically, the dynamic panel GMM estimator addresses the omitted-variables bias, endogeneity and measurement errors, but it exhibits a weak instruments problem (Roodman, 2009; Bazzi and Clemens, 2009). SGMM is generally more robust to weak instruments than Dynamic GMM, but it can still suffer from weak instruments biases. However, according to Hauk and Wacziarg (2009) and Kumar and Woo (2010), SGMM is the preferred estimation technique.

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2 For details of the panel data estimation see Baltagi (2005).

The selection of valid instruments is the most difficult and tricky issue in all the GMM methodologies. Following the methodologies proposed by Murray (2006), and availability of data, lagged values of the independent variables have been used as instruments. It is worth noting here that in the Dynamic GMM model, an additional instrument of dynamic real GDP growth rate also has been used.

Table 1. Description of the variables

Sr. No.	Name of variable	Data source	Definition	Comment
1.	Real GDP growth (Yt)	WDI	Growth rate real GDP	Different measures of economic growth have been used in literature, such as per capita GDP, GDP growth rate, real GDP and real GNP. In the present study real GDP growth has been used as an indicator for growth.
2.	Investment (KT)	WDI	Gross capital formation as percentage of GDP	For investment, variables used in the literature are gross capital or gross fixed capital formation, investment/output ratio and capital stock calculated by using the hedonic valuation and the perpetual inventory methods. Gross capital formation as a percentage of GDP was used.
3.	External debt (ED_Y)	IDS	Public and publicly guaranteed external debt as percentage of GDP	The indicators of public debt are categorised into two groups. Stock variables: the stock variables relate the value of debt burden to different key economic indicators, such as debt/exports ratio, debt/GDP ratio and domestic debt/ GDP ratio. Public debt as a percentage of GDP is the most commonly used stock measure of debt.
4.	Domestic debt (DD_y)	IFS*	Domestic debt as percentage of GDP	Flow variables: flow variables focused on debt service payment and relate debt servicing to GDP. Public debt consists of two parts, namely external debt and domestic debt. External debt servicing as a percentage of export earnings is the most widely used follow variable. In the study, public external debt/GDP, domestic debt/GDP and debt servicing/exports in percentage was used.
5.	Debt servicing (DS_X)	IDS	Debt servicing of public and publicly guaranteed external debt as percentage of exports	

Table 1. ***(continued)***

Sr. No	Name of variable	Data source	Definition	Comment
6.	Openness (OP)	WDI	(Exports + imports)/GDP*100	The measures used to measure openness include tariffs and quotas, real exports, real imports, balance of trade and the ratio of exports and imports as percentage of GDP (used in the present study).
7.	Labour force (POP)	WDI	Population growth rate	In the growth models, labour force is considered as a key ingredient of economic growth. The number of workers/labour force, employment rate, population growth rate and number of hours worked are among the variables that are most widely used. Population growth rate has been used as a proxy for labour force.
8.	Human capital (SC_ED)	WDI+Data maintained by Easterly (2001)	Secondary school enrolment	Due to the non-availability of data, the selection of an indicator for human capital is the most tricky issue. Among the proxies that are extensively used in the literature are average years of schooling, the enrolment rate, life expectancy ratio, infant mortality rate, and literacy rate. As continuous data for most of these variables are difficult to obtain, secondary school enrolment was selected.
9.	Urbanization (UR)	WDI	Percentage of population living in urban areas	The relationship between economic growth and industrialization is ambiguous because urbanization stimulates industrialization, but it may have some negative impacts on the agriculture sector, which is very important in the developing countries for economic growth.
10.	Inflation (INF)	WDI		There are a number of indicators to measure inflation. Consumer price index and GDP deflator are the most widely used indicators for this purpose. In the present study, CPI is used as an indicator of inflation.

Note : *Abbas (2007) has defined domestic debt as "all domestically held claims of central government" on the analogy of the definition of public & publicly guaranteed external debt by Global Development Finance. In this regard, the International Financial Statistics (IFS) database series 22a+42a and 20c+40c serve the purpose. Hence, **Domestic Debt** = Bank's claims on government + Central bank securities = IFS [(22a+42a)+(20c+40c)].

V. ESTIMATION RESULTS

This section contains a report of the results of the model featuring all the control variables. The results of the estimation exercise are presented in table 2.

Table 2. Estimation results (dependent variable: Yt)

Variables	Pooled OLS	FEM	REM	Dynamic GMM	System GMM
Constant	0.386 (0.605)	0.228 (0.591)	0.472 (0.958)	—	0.201 (3.050)
KT	0.001* (2.007)	0.102* (2.900)	0.057* (4.676)	0.038* (2.090)	0.006* (2.458)
SC_ED	0.488* (3.440)	0.533* (6.484)	0.537* (7.388)	0.102* (3.626)	0.029* (3.226)
ED_Y	-0.316* (-2.819)	-0.109* (-2.276)	-0.115* (-3.445)	-0.032** (-1.920)	-0.009* (-2.075)
DS_X	-0.551* (-4.834)	-0.241* (-3.336)	-0.215* (-4.220)	-0.012* (-2.241)	-0.038** (-1.862)
DD_Y	-0.015* (-3.348)	-0.093** (-1.910)	-0.114 (-0.384)	-0.009** (-1.745)	-0.045** (-1.898)
POP	-0.128** (-1.971)	-0.207* (-3.145)	-0.158** (-1.714)	-0.051* (-6.183)	-0.014* (-3.893)
UR	0.158** (1.715)	0.045* (2.086)	0.020** (1.676)	0.011* (3.004)	0.005* (2.356)
OP	0.933* (11.845)	0.705* (9.864)	0.709* (2.502)	0.074* (2.257)	0.036* (6.722)
Yt(-1)	—	—	—	0.851* (11.637)	—
R-squared	0.7500	0.8459	0.8329	—	0.5227
Adjusted R-squared	0.7358	0.7958	0.8240	—	0.4801
F-statistic	17.982	16.8898	94.0786	—	—
Prob(F-statistic)	0.0000	0.0000	0.0000	—	—
Durbin-Watson stat	2.0523	1.9239	1.804	—	2.1822
J statistic	—	—	—	0.1458	0.000
Hausman test Chi-Sq. statistic	—		4.305	—	—
Prob(Chi-Sq. statistic)	—		0.0102	—	—

Note : * and ** denote significance at 5% and 10% levels, respectively.

These results confirm a negative relationship between external debt variables and economic growth. It is shown in table 2 that external debt as a percentage of GDP and debt servicing as a percentage of exports both have a significant and negative relationship with economic growth. This result is robust because it is invariant with different estimation methodologies used in the study. The reason behind this seems to be that, when domestic resources are mobilized to repay and service external debt (if it is too large in relation to the GDP) not much remains available for investment. As a result, the terms of trade of a country is overburdened with large external debt liabilities. Furthermore, as in most of the studies conducted on the subject, it is pointed out that the debt "overhang effect" of external debt tends to reinforce the "crowding out" of the external debt. It may be noted that this result is similar to those obtained by Chowdhury (2004), Clements, Bhattacharya and Nguyen (2003) and Elbadawi, Ndulu and Ndungu (1997).

The effects of domestic debt are also found to be negative and significant on economic growth. The most important concern about domestic debt is its crowding out effect on private investment, which results in a declining private investment demand, and therefore capital accumulation, growth and welfare (Diamond, 1965).[3] Secondly, domestic debt is comparatively more expensive than external debt (Beaugrand, Loko and Mlachila, 2002).

As mentioned earlier, gross fixed capital formation has been used as a proxy for investment. It comes out as having a significant impact on economic growth. The finding is in accordance with theory that investment enhances economic growth and is supported by numerous studies on the subject, such as Pattillo, Poirson and Ricce (2002), Mankiw, Romer and Weil (1992) and Abbas and Christensen (2007).

Consistent with expectations, openness is significant with a positive sign in all the specifications. It supports the findings of Pattillo, Poirson and Ricci (2002), Coe and Helpman (1995) and Lucas (1988). The reason supporting this is that greater openness of an economy to the outside world represents improved competitiveness and productivity of the economy, which, in turn, leads towards a better economic performance.

The results of the present study suggest that population growth is depressing economic growth. This is supported by numerous studies on the subject. The estimation results also show that secondary education (proxy for human capital) has a positive

[3] It is important to point out that in the Keynesian framework the crowding out effect works only under conditions of full employment, which classical economics regards as the norm. So an argument, such as the one made by Diamond (1965), hold because of the author's implicit acceptance of the classical and neoclassical positions.

and significant relationship with economic growth. It supports the conventional wisdom regarding the impact of human capital on economic growth (Naqvi, 2010).

The results also suggest that urbanization is helpful for economic growth. This supports the findings of Harris and Todaro (1970) and Naqvi (2010). As industrialization gets under way, more people migrate to big cities in search of better job opportunities and improved health and education facilities.

The high value of R2 shows that overall goodness of fit of the model is satisfactory considering the number of variables. The F-statistic measuring the joint significance of all the regressors in the model is also statistically significant. Durban-Watson statics in all the models lies between acceptable range ($1.8 \leq DW \leq 2.2$), indicating that no autocorrelation exists. It is worthwhile to mention here that the models are corrected for heteroskedasticity. The J statistic value (Sargan test) for GMM estimation models is less than 1 suggesting that the instruments are well identified. The Hausman test is also applied to choose between a fixed effect model and a random effect model. The significant value of the test indicates that a fixed effect model is more appropriate.

It may also be of interest that the effects of debt indicators on economic growth, and the non-linear relationships are analysed separately. In this regard three different specifications are tested by using the System GMM method. In the first specification only external debt as percentage of GDP is used as a debt indicator. In the second specification, debt servicing as a percentage of exports and in the third specification, domestic debt as percentage of GDP are used as the only debt indicators. These models are also tested by using both linear and non-linear specifications. The results of the estimations are summarized in table 3.

The results suggest that in linear specifications external debt as percentage of GDP and domestic debt as percentage of GDP have negative and significant impacts on economic growth. The impact of debt servicing as a percentage of exports on economic growth is insignificant. It reveals that debt servicing only in the presence of external debt has a negative impact on economic growth.

As far as the non-linear relationships are concerned, the results show that both coefficients of (squared terms as well as non-squared term) for the external debt as a percentage of GDP are statistically significant. It suggests that there is a quadratic relationship between external debt as a percentage of GDP and economic growth. It is worth noting here that the positive sign of debt as a percentage of GDP seems to contradict the main finding of the present study that external debt exhibits a negative impact on economic growth. In fact, effects of debt could be positive at a low level of debt; however, it becomes negative at higher levels as debt overhang is growth retarding.

Pattillo, Poirson and Ricci (2002) have found similar results. They described the reasoning behind it as follows: "We believe the linear estimation would underestimate the impacts by failing to capture the non-linear relation between debt and growth and therefore imposing a flatter slope even when managed to capture a negative coefficient". However, coefficients of the squared terms of debt servicing as percentage of exports and domestic debt as percentage of GDP are statistically insignificant. It reveals the non-existence of any non-linear relationship between domestic debt and economic growth.

Table 3. Estimation results (dependent variable: Yt)

Name of variables	Specification 1		Specification 2		Specification 3	
	Linear	Non-linear	Linear	Non-linear	Linear	Non-linear
Constant	0.188* (3.056)	0.232 (1.155)	0.162* (2.179)	0.416 (1.510)	0.140* (2.090)	0.148* (2.140)
KT	0.012* (2.050)	0.012* (3.040)	0.017 (1.215)	0.002* (2.127)	0.012* (3.686)	0.013* (3.804)
SC_ED	0.030* (3.096)	0.034* (2.933)	0.027* (2.436)	0.018 (1.390)	0.024* (2.490)	0.023 (1.365)
ED_Y	-0.010* (-2.092)	0.038* (2.351)	—	—	—	—
Squared ED_Y	—	-0.004* (-3.257)	—	—	—	—
DS_X	—	—	-0.004 (-0.679)	-0.201 (-1.112)	—	—
Squared DS_X	—	—	—	-0.037 (-1.097)	—	—
DD_Y	—	—	—	—	-0.004** (-1.909)	0.007 (1.469)
Squared DD_Y	—	—	—	—	—	-0.018 (-1.248)
POP	-0.033* (-4.223)	-0.041* (-3.453)	-0.039 (-1.517)	-0.037* (-3.077)	-0.043* (-3.513)	-0.051* (-3.372)
UR	0.019 (2.753)	0.012** (1.811)	0.011* (2.876)	0.009** (1.894)	0.007 (0.483)	0.006 (0.439)
OP	0.005** (1.877)	0.004* (2.797)	0.002* (2.514)	0.003 (0.686)	0.001* (2.366)	0.002** (1.838)
R-Square	0.4241	0.4182	0.3903	0.4682	0.4873	0.4088
Adjusted R-square	0.3926	0.3809	0.3721	0.4286	0.4544	0.3711
Determinant residual covariance	0.0005	0.0002	0.0006	0.0006	0.0006	0.0006
J-statistic	0.0003	0.0012	0.0450	0.0004	0.0001	0.0000

Note : * and ** denote significance at 5% and 10% levels, respectively.

Analysis of impact of public debt on investment

It is very important that, in order to further confirm the debt overhang hypothesis, the relationship between investment and public debt be analysed. The results are summarized in table 4.

Table 4. Estimation results (dependent variable: Yt)

Variables	Pooled OLS	FEM	REM	Dynamic GMM	System GMM
Constant	3.109 (7.165)	1.146 (3.549)	2.065 (9.228)	—	0.678 (2.777)
OP	0.177* (2.255)	0.283* (4.010)	0.081* (3.007)	0.391** (1.902)	0.011* (2.369)
INF	0.002 (0.117)	0.067* (4.593)	0.063* (2.281)	0.006** (2.899)	0.059** (1.870)
ED_Y	-0.225* (-3.390)	-0.042* (-2.285)	-0.030** (-1.765)	-0.046* (-2.378)	-0.046* (-4.063)
DS_X	-0.025* (-2.132)	-0.021** (-1.740)	-0.073** (-1.908)	-0.046** (-1.913)	-0.009* (-2.213)
DD_Y	-0.100** (-1.900)	-0.067** (-1.785)	-0.023 (-1.307)	-0.125** (-1.641)	-0.008* (-2.347)
SC_ED	0.163** (1.812)	0.363* (4.175)	0.337* (10.004)	0.134* (2.189)	0.093* (2.186)
KT(-1)	—	—	—	0.335** (1.824)	—
R-squared	0.7150	0.6996	0.6453	—	0.3960
Adjusted R-squared	0.6982	0.6772	0.6289	—	0.3482
F-statistic	21.9823	31.3271	39.4966	—	—
Prob(F-statistic)	0.0000	0.0000	0.0000	—	—
Durbin-Watson stat	1.7913	1.8425	2.0629	—	1.6449
J statistic	—	—	—	0.7302	0.0000
Hausman test Chi-sq. statistic	—	—	6.8286	—	—
Prob(Chi-sq. statistic)	—	—	0.0080	—	—

Note : * and ** denote significance at 5% and 10% levels, respectively.

These estimation results confirm that external debt as a percentage of GDP and debt servicing as a percentage of exports tends to affect investment negatively and significantly. These results tend to support, among other things, the plausibility that debt overhang tends to reinforce the crowding out hypothesis. They further strengthen the findings of the relationship between external debt and economic growth, as in the present study, the validity of debt overhang effect along with crowding out effect are confirmed. The domestic debt also seems to have a negative and significant relationship with investment. The results also reveal that openness, inflation and secondary education stimulate investment.

The diagnostic test confirms the goodness of fit, joint significance of all the regressors, non-existence of auto correlation and well identified instruments.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

In the present study, the consequences of contracting public debt for economic growth and investment for the selected South Asian countries is examined in principle. Also investigated is the impact of certain other variables on economic growth. Keeping in view the findings of the study, various policy implications have emerged.

The first implication of the study is that heavy reliance on external debt must be discouraged. Public external debt usually results in a deteriorating economic growth process, partly because it also adversely affects investment. The results suggest that public external debt has hampered economic growth through the debt overhang effect and the crowding out effect. Therefore, in order to accelerate economic growth, developing countries must adopt policies that are likely to result in a reduction in the debt burden, and at least to ensure that the rising debt burden does not reach an unsustainable level.

Given the downward rigidity of current expenditure and crucial importance of the development expenditure, the only way would be to mobilize additional resources by generating a higher level of tax and non-tax revenues. Therefore, there is an urgent need to implement tax reforms. To this end, these countries have to bring under-taxed and un-taxed sectors in the tax net. Above all, sincere efforts should be made to curb smuggling, corruption and tax evasion and the increasing size of the shadow economy.

In the present study, domestic debt is found to also have a negative relationship with economic growth, hence the tendency to acquire both external and internal debt to finance deficits without comprehensive analysis needs to be restricted and domestic debt should not be regarded as a risk-free option. Furthermore, privatization proceeds must be utilized to retire public external debt rather than to finance current expenditure.

It also follows from the estimation results that population growth rate is harmful to economic growth. Thus, in order to stimulate growth performance, these countries must adopt effective population control policies. Similarly, as secondary school enrolment, openness, urbanization and investment are growth enhancing, there is a need for encouraging the education, trade, investment and development of cities.

It may be interesting to highlight new areas of research as suggested in the present study. There is consensus that debt servicing results in reducing the development expenditure. To test this argument further, it is suggested that an empirical study be conducted that explores the relationship between 3D's of public expenditure, namely development expenditure, defense expenditure and debt servicing expenditure. In that study by analysing the interlinkages between 3D's, the government preferences for the development expenditure may be further explored.

Investment plays a pivotal role in the decisive impact domestic debt may have on economic growth. Domestic debt behaves differently for private and public investment; it stimulates public investment, but it can reduce the private investment. Obtaining data for public and private investment separately is a difficult task. Nevertheless, in order to determine the separate effects of public and private investment, it is very important that when conducting a study, the impacts of them are analysed separately.

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APPENDIX I

Model specification

Cunningham (1993) has introduced debt burden into the production function. This is because debt burden has important implications for the capital and labour productivity. Economies that carry a significant debt burden have to spend significant portion of their resources to service debt liabilities, which affect decisions pertaining to the employment of labour and capital in the production function. Therefore, a debt-inclusive production function can be written in the following form.

$$Y = A(K, L, Debt) \tag{1}$$

The main shortcoming of the Cunningham (1993) model is the assumption that the production function consists only of physical capital and labour, and does not include human capital. Romer (1994) eliminated this shortcoming by explicitly including human capital in the production function.

$$Y = A(K, L, Debt, H) \tag{2}$$

where *Y, K, L, H, debt* and *A* are the measure of GDP, capital stock, labour force, human capital public debt and other constant factors, respectively. This makes a standard assumption in the equation that input elasticities of output are constant and technical change is neutral. To begin, by the behaviour of a firm in economy as proposed by Yakita (2008) is applied.

Firms

Let assume that there are *i* firms. The production function of the firm can be written in the following form.

$$y_i = A_i G\ k_i^{\alpha} l_i^{1-\alpha} \tag{3}$$

where A_i is the best practice technology, k_i capital stock of the firm, and l_i the labour available to the firm in the preceding period, and *G* stands for the public capital/facilities available to all the firms. If *w* represent wage and *r* interest rate, then the profit maximizing conditions of the firm are as under:

$$\frac{\partial y_i}{\partial k_i} = \alpha\left(\frac{y_i}{k_i}\right) = r \tag{4}$$

$$\frac{\partial y_i}{\partial l_i} = (1-\alpha)\left(\frac{y_i}{l_i}\right) = w \tag{5}$$

Individuals

A representative worker consumes part of his wage and saves the remainder. The lifetime budget constraint of the individual can be written in the following form.

$$\left(1-\tau_{t-1}\right)w = c_{t-1} + \frac{c_t}{1+(1-\tau_t)r_t} \tag{6}$$

Utility function is of the form

$$U = (1-\delta)c_{t-1} + \delta c_t \tag{7}$$

The saving function of the individual is:

$$s = (1-\tau)w - c_t \tag{8}$$

Government

Government finances its budget from two main sources, taxes and public debt.

$$G_t - G_{t-1} = D_t - D_{t-1} + (1-\ell)T \tag{9}$$

where D and T are public debt and taxes, respectively.

It shows that governments finance their budgets partly by issuing public debt/bonds and partly by generating tax revenues. Where ℓ is the portion of tax revenue used for debt servicing as $rD = \ell T$.

$$T = \tau(w + rs_{t-1})N \tag{10}$$

N is the number of individuals, and rs_{t-1} is income generated from interest on savings. Using equation 10 in equation 9, the budget equation becomes:

$$D_t - D_{t-1} + \tau(w + rs_{t-1})N = G_t - G_{t-1} + rD \tag{11}$$

It is assumed that government invests a constant fraction of GDP, ψ, in public capital and finances a portion ω of expenditure by issuing bond.

$$G_t - G_{t-1} = \psi Y \tag{12}$$

$$D_t - D_{t-1} = \omega\left(G_t - G_{t-1}\right) = \omega\psi Y \tag{13}$$

where $Y = \sum_{i=1}^{n} y_i$

From equations 11, 12 and 13,

$$(D_t - D_{t-1}) - (G_t - G_{t-1}) = rD - T < 0 \tag{14}$$

Equation 14 tells that tax revenue must be greater than interest payment of public debt. Inserting equations 12 and 13 into equation 11, the budget constraint becomes

$$\tau Y = \psi(1-w)\mathrm{Y} + (1-\tau)rD \tag{15}$$

When ψ and w are kept constant then governments have to adjust the tax rate τ in order to satisfy the budget constraint.

Derivation of growth equation

Using equation 2 and assuming the linear homogeneity of the production function for each firm, the production function takes the following form:

$$Y_t = A_t K_t^{\alpha} H_t^{\beta} L_t^{\gamma} D_t^{1-\alpha-\beta-\gamma} \tag{A}$$

Let assume that A and L grow exogenously at rates η and ρ so

$$L_t = L_o e^{\eta t} \tag{16}$$

$$A_t = A_o e^{\rho t} \tag{17}$$

It can be said that the number of effective units of labour $A_t L_t$ will grow at rate $\eta + \rho$.The assumption of the model is that some part of output s will be invested. Defining k as capital stock of per unit of the effective of labour, i.e. $k = \frac{K}{AL}$. Similarly, h is defined as stock of human capital for per unit of the effective of labour, i.e. $h = \frac{\mathrm{H}}{AL}$. d as the stock of public debt per unit of the effective of labour $d = \frac{D}{AL}$, and y as the level of output per unit of the effective of labour, i.e. $y = \frac{Y}{AL}$, the growth of economy is determined by:

$$\dot{k}_t = s_k y_t - (\eta + \rho + \lambda)k_t$$
$$\dot{h}_t = s_h y_t - (\eta + \rho + \lambda)h_t$$
$$\dot{d}_t = s_d y_t - (\eta + \rho + \lambda)d_t$$

The model further assumes that physical and capital, and public debt depreciate at the same rate. It is also assumed that $(\alpha + \beta + \gamma) < 1$. The steady state conditions can be derived as:

$$\dot{k} = \left(\frac{s_k^{1-\beta-\gamma} s_h^{\beta} s_d^{\gamma}}{(\eta + \rho + \lambda)} \right)^{\frac{1}{1-\alpha-\beta-\gamma}}$$

$$\dot{h} = \left(\frac{s_k^{\alpha} s_h^{1-\alpha-\gamma} s_d^{\gamma}}{(\eta + \rho + \lambda)} \right)^{\frac{1}{1-\alpha-\beta-\gamma}}$$

$$\dot{d} = \left(\frac{s_k^{\alpha} s_h^{\beta} s_d^{1-\alpha-\beta}}{(\eta + \rho + \lambda)} \right)^{\frac{1}{1-\alpha-\beta-\gamma}}$$

Substituting the steady state condition in equation A and taking log, it shows the steady state equation of per capita GDP.

$$\ln\left(\frac{Y_t}{L_t}\right) = \ln A_0 + \rho_t + \frac{\alpha + \beta + \gamma}{1 - \alpha - \beta - \gamma} \ln(\eta + \rho + \lambda) + \frac{\alpha}{1 - \alpha - \beta - \gamma} \ln s_k + \frac{\beta}{1 - \alpha - \beta - \gamma} + \ln s_h + \frac{\gamma}{1 - \alpha - \beta - \gamma} s_d \quad \text{(B)}$$

Equation B shows that per capita GDP depends on physical capital, human capital, level of public debt and some other factors. The A term not only reflects technology, but it also includes institutional, climatic and all other variables. *Equation B is the basic empirical specification of the model.*