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Abstract

This study investigates the existence of non-linear relationship between debt and economic growth in South Asia and explored the channels through which debt has its nonlinear impact on the growth of economy. Panel data on four South Asian countries over the period of 1991 to 2013 utilized and fixed effect model employed for estimation. The results suggest that there is nonlinear relationship between debt and economic growth in South Asian countries and the channels through which debt transmits impact into the economy are private investment, public investment and total factor productivity. The government should stimulate the revenue generation and reduce its huge current expenditures. Reducing debt accumulation alone will not rectify the problem unless the supplementary macroeconomic policies are made sound. By removing political constraints, macroeconomic imbalances, improving governance, reducing dependency on foreign aids and eliminating structural distortions, the problem of debt can be resisted.

Keywords: Debt, Economic Growth, Investment, Total Factor Productivity, South Asia

1. Introduction

The primary objective of any developing nation is to ensure sustainable economic growth. Economic growth in a country depends on many factors. The emerging concern among policy makers is regarding debt accumulation and its effects on economic growth. Whenever a country falls short on supply of domestic saving, it faces high current account payment deficits. Under such circumstances the country with high current account deficit borrows to finance its expenditures which lead towards accumulation of debt. "Prior to early 1970's, the external debt of developing countries was relatively small and primarily an official phenomenon, the majority of creditors being foreign governments and international financial institutions such as the IMF, World Bank, and regional development banks" (Todaro & Smith, 2012, pp. 650). Debt accumulation was not a problem until 1980's primarily because before 1980's developing countries were borrowing only at concessional (low interest rates) terms but then commercial banks began to perform a major role in lending. The accumulated debt and increase in debt servicing considered as significant factors influencing the rate of growth of output. As a result of accumulated debt any developing country faces a severe loss in international market competitiveness largely as a consequence of improper adjustments in exchange rate. Moreover, worsening of term of trade between nations, mismanagement and failure in good governance halts economic growth in developing countries. The countries with higher debt burden face higher rates of interest, lowering foreign inflows, lesser export earnings, lower domestic output and fewer imports which slow down the pace of economic growth (Siddiqui & Malik, 2001).

Developing countries are facing serious problem of self-reinforcing debt and it is important to eradicate the debt crises. According to Chenery and Strout (1966) domestic savings and earnings from exports are inadequate to fulfill the demand for investment in less developed countries. The less developed countries borrow from external sources in order to fill the gap created by scarcity of savings. With the funds provided by external sources the recipient countries tend to grow as a result of increase in investment. So it is important to know that the borrowed funds are inserted in a productive stream such as investments or not and if the debt is not being a predicament for economic growth. In South Asia, many countries are plagued with the chronic problem of debt accumulation. According to World Bank (2001) India's ranking improved from moderately indebted to less indebted low income country. Contrary to this Pakistan's ranking changed from

moderately indebted low income country to severely indebted low income country. The rapidly growing debt accumulation increasing the burden of repayment and obstructing economic growth.

There has been increasing concern towards the significance of debt in setting the path of economic growth. The inclination of policymakers towards analysis of public debt and growth of economy has increased recently. The literature on debt and economic growth is divided by Oleksandr (2003) into three strands. The first strand advocates for presence of inverse relationship between debt and economic growth. The general argument in the literature is that when countries stock of debt increases, investors expect the tax rate imposed by government to rise in order to finance repayment of external debt. This anticipation of the investors leads to massive decline in investment and adversely affecting the growth (Geiger, 1990; Cunningham, 1993; Afxentiou, 1993; Cohen, 1993; Swada, 1994; Rockerbie, 1994; Deshpande, 1997; Were, 2001). Most of the studies in the literature found an inverse relationship between debt and economic growth (Sach, 1989; Saint-Paul, 1992; Krugman, 1998; Iqbal & Zahid, 1998; Aizenman et al., 2007; Boopen et al., 2007 Hameed et al., 2008; Cholifihani, 2008; Adesola, 2009; Safia & Shabbir, 2009; Ali & Mustafa, 2012;). In nutshell the findings of second strand of literature is that there is a positive link between debt and economic growth (Patillo et al., 2004; Baker & Hassan, 2008). The third school combined these two strands and suggested that impact of debt on growth has a nonlinear trend (Elbadawi et al., 1997; Cohen, 1997; Siddiqui & Malik, 2001; Clements et al., 2003; Reinhart et al., 2003; Checherita & Rother, 2012).

The emerging concern among policymakers is for channels through which debt of a country transmits into the economy and affects economic growth. Patillo et al. (2004) made a study suggesting that nonlinear relationship between debt and economic growth can be explained through certain channels, the first channel tested was capital accumulation and the second channel was total factor productivity. Schclarek (2004) examined the impact of external debt on growth through three channels, first channel was private savings rate, the second channel was total factor productivity growth rate and the last channel under examination was capital accumulation. The study was based on developing and advanced economies. Checherita and Rother (2012) found total factor productivity, public investment and private saving as main

channels through which nonlinear impact of government debt on economic growth can be explained.

In sum, the literature provides the existence of both positive and inverse relationships between debt and economic growth, presence of a non-linear impact of debt on economic growth, and there have been studies that empirically analyzed channels. However, there is limited empirical work on channels through which debt affects economic growth specifically in South Asian countries. This study aims at filling this gap and providing empirical analysis for the channels (at both aggregate and disaggregate levels) through which debt affects economic growth.

The objective of the study is to empirically analyze that how debt has its impact on growth of South Asian economies. The study is conducted for the period of 1990 to 2014. The specific objectives of the study are: to empirically explore existence of nonlinearity in growth due to accumulation of debt, to investigate how the nonlinearity is transmitted into the economy by testing its channels. The first channel is investment, the second channel is total factor productivity, third channel under investigation is interest rate channel and finally, the saving channel will be examined. Study contributes to the existing literature by examining the channels through which debt effects growth. The study uses conditional convergence equation which is augmented to include the variable of debt.

2. Literature Review

The issue of increasing debt accumulation has been a matter of much concern for policy makers. The countries with high debt burden are trying to combat with this predicament by all means. There is a wide literature that explores the way debt affects economic growth.

2.2 Literature on Debt and Economic Growth Relationship

The theory suggests that a developing country can accumulate debt till a point before which the debt enhances economic growth. The debt influences economic growth positively when borrowings are used in productive purposes such as investments in infrastructure, innovations in technology, productivity growth and capital accumulation. There are studies that found that debt imposes a positive impact on growth of economy, while many studies came up with the

conclusion that there is inverse link between these two variables. Other than linear relationships, there are many studies that examined the nonlinearity between debt and economic growth.

Geiger (1990) aimed at investigating the effect on GDP growth rate when there is an increase in debt service in South America. He provided insight regarding the issue that economic development is adversely effected by debt accumulation. He used data on 9 South American countries over the period of 1974 to 1986. The study used simple regression model and distributed lag model for estimation. The intra-country analysis supported the argument that when a country piles up the debt burden the economy of that country suffers. Chowdhury (1994) tested causality between external debt and GNP's growth rate. He used data on developing countries of two regions i.e. Asia and Pacific. The study was conducted for the period starting from of 1970 to 1988. The study employed Granger's causality test and structural simultaneous equation model. The results showed that causation flows from external debt to GNP for Indonesia, South Korea and Bangladesh. Fosu (1999) aimed at examining direct influence of external debt on growth in Sub Saharan countries. The paper used data on 35 Sub-Saharan African countries from 1980 to 1990. The study concluded that debt proves to be destructive for economic growth.

Were (2001) examined composition of external debt and it's implication on economic growth in Kenya. The study used time series data on Kenya over the period 1970 to 1995. The study utilized a growth equation for constructing the empirical model. He employed error correction formulation for the estimation of model. The results indicated that when external debt is lumped up it inflicts inimical impact on economic growth and investments made in private sector. Omet and Kalaji (2002) analyzed the impact of high external debt on the performance of economic growth of Jordan. They used annual data for Jordan over the period 1970 to 2000. The study followed endogenous growth model for examining this relationship. The empirical model was estimated using OLS. The optimal level of external indebtedness was found to be 53 percent of GDP which mean that the tendency for Jordanian economy to grow retards when the level of external debt exceeds this optimal level. Karagol (2002) analyzed the nature of the relationship between external debt and economic growth. The study employed standard production function model. The paper used time series data on Turkey over the period of 1956 to 1996. The study developed vector error correction model by making use of multivariate cointegration technique.

The result supported a negative relationship between these variables and highlighted a unidirectional relationship between debt and GNP level.

Siddiqui and Malik (2002) examined the nature of the debt-growth relationship in South Asian countries and tested existence of nonlinearities in this relationship. The study used panel data for 3 South Asian countries i.e. Sri Lanka, Pakistan, and India over the time frame of 1975 to 1998. They estimated the models by applying OLS and fixed effect models. The study detected that debt escalates economic growth till certain level beyond which it stagnates the economic growth in South Asian countries. Oleksandr (2003) aimed to find a non-linear trend in economic growth corresponding to magnifying foreign debt. The study used time series data for Pakistan from 1970 to 2012. The study used ordinary least square method for finding the non-linear relationship of external debt on economic growth. The results showed that external debt expands the growth of economy till certain point, after which the debt starts becoming fatal to economic growth. Clements et al. (2003) examined the sources through which external debt influences the growth of economy in low-income countries (LIC). Panel data for 55 LICs was used from 1970 to 1999. Standard growth model extended to include the debt variables was utilized and SGMM and fixed effect model was used. The study found negative link between debt and growth. Moreover, the public investment was found as significant channel.

Bakar and Hassan (2008) aimed at analyzing external debt's effect on the growth of Malaysian economy. The study used time series data for Malaysia from 1970 to 2005. The study used VAR analysis for estimation. The study found that external debt positively effects economic growth. Ayadi and Ayadi (2008) investigated the performance of economic growth in presence of external debt in Nigerian and South African economies. The study used time series data for Nigeria and South Africa starting from 1970 to 2007 and employed OLS and GLS methodology. The study provided evidence that external debt has abrogating repercussions on economic growth. Kohlscheen (2010) analyzed the infuriated domestic and external debt for 53 emerging economies over the time frame of 1980 to 2005. The study used simultaneous equation model for estimation and concluded that bulk of accumulated debt slows down the pace of economic growth. Ali and Mustafa (2012) using annual data from 1970 to 2010 analyzed the short run and long run impact of high external debt on the growth of Pakistan economy. They utilized set of time series techniques which included cointegration, error correction mechanism and ARDL test.

The study validated that the multiplication in debt stock is damaging for augmentation of economic growth.

Dogan and Bilgili (2014) examined the aftermath of foreign indebtedness on the growth variables. This paper used time series data for Turkey from 1974 to 2009. The study employed the multivariate dynamic Markov-switching maximum likelihood method for estimation. The results revealed that the economic development and borrowing variables do not follow a linear path. Ramzan and Ahmad (2014) examined the effect of economic growth to increasing debt for Pakistan. The study used time series data from 1970 to 2009 and employrd ARDL approach to cointegration. The study concluded that for Pakistani economy the rise in debt has led to decrease in economic growth. Zouhaier and Fatma (2014) focused on the influence of external debt on economic growth in developing countries. The study targeted on nineteen developing countries from 1990 to 2011. The study concluded that with both the variables of debt i.e. foreign debt as ratio of GDP and foreign debt as a percentage of GNI, the impact remained detrimental to economic growth.

2.3 Literature on Channels

The new concern among the policymakers is regarding the channels through which debts flows into the economy. The idea behind testing the channels is to check if a nonlinear effect of debt on growth prevails in relationship of debt with other sources of growth. Clements et al. (2003) focused on low income countries and investigated the channels which are responsible for carrying the demobilizing effects of foreign debt on the pace of economic growth. The paper targeted fifty five low-income countries and used the data from 1970 to 1999. The study used standard growth model extended to include debt variables and used fixed effect model and system of generalized method of moments (GMM). The results showed that per capita income growth would foster by reduction in the accumulation of the external debt. Public investment was detected to be an indirect source through which the lowering external debt can give significant boost to economic growth.

Pattilo et al. (2004) tested the nonlinearities in growth as a consequence of debt accumulation. Total factor productivity and factor accumulation were the channels which were investigated in this study. The study formed a panel of 61 developing countries from 1969 to 1998. Debt

variable was added in the conditional convergence equation to get the empirical model. The study used simple OLS, instrumental variable, fixed effects and system of GMM for estimation. The study concluded that it is the repercussions of debt on physical capital and growth of TFP which operates and ends up in making affect of consumption of debt funds on the economic growth negative. Schclarek (2004) aimed at exploration of the link between growth and debt for both developing and industrial economies. The channels investigated in this study included the TFP and capital accumulation. The study utilized a panel data on 24 industrial countries and 59 developing countries and used empirical model of Patillo et al. (2004). For estimation he used SGMM technique of Arellano and Bover (1995) and Blundell and Bond (1998). The conclusion suggested that in the case of developing countries deductions in the level of the external debt are associated with increasing growth rates and the negativity in this relationship is due to public external debt, while capital accumulation was declared to be a significant channel through which debt has its affects on the growth.

Kumar and Woo (2010) tested nonlinearity in debt-growth relationship and the channels with which debt affects growth. Panel data of 38 advanced and emerging economies from 1970 to 2007 was used. They used standard neoclassical framework which considered a Cobb Douglas Production function. The study used pooled OLS, Between Estimator (BE), fixed effects (FE), and SGMM for estimation. In this study initial debt was found to be detrimental to the subsequent growth. The results also suggested that the inverse relationship is largely explained by a decline in productivity growth of labor mainly due to reduction in investments and slowdown in growth of capital stock. Chechrita and Rother (2012) aimed at 12 Euro countries to support the existence of inverted U relationship between debt and per capita growth. The study also aimed at figuring out the channels which were important in explaining the hypothesis that the government debt has a nonlinear effect on growth, the channels being investment, total factor productivity, interest rates and savings. The paper used panel data for 12 European countries from 1970 to 2008. The conditional convergence equation was utilized for the construction of empirical model. The study used fixed effects and instrumental variable estimation technique. The results supported nonlinear link between debt and growth. The significant channels were total factor productivity, private saving, and public investment

3. Model, Methodology and Data

The study gets it theoretical background from basic growth model, which is based on the equation of the conditional convergence by adding a debt variable in it. The econometric model in the study is a conditional convergence equation that has GDP per capita growth as dependent variable. The explanatory variables in this model are investment and saving to GDP, log of the initial level of GDP, and growth rate of population. The model is extended to include variable of debt. The study utilizes the four of the South Asian countries over period 1991 to 2013. These South Asian countries are Bangladesh, India, Pakistan and Sri Lanka

3.1 The Model

3.1.1 The Basic Solow Model

The study adopts a Solow growth model starting from Cobb-Douglas production function of following form:

$$Y_{(t)} = K_{(t)}^{\alpha} \left(A_{(t)} \; L_{(t)} \right)^{(1-\alpha)}, \qquad 0 < \alpha < 1 \tag{1}$$

Where, Y is output, K is capital, L is labor and A is technology. The assumption of constant returns to scale is maintained, which implies that output can be expressed as

$$y_{(t)} = k_{(t)}^{\alpha} \tag{2}$$

Where, y = Y/AL is output per unit effective labor and k = K/AL is the amount of capital per unit effective labor.

The study makes assumptions regarding how the stock of knowledge, labor, and capital changes over time. These variables were taken on initial levels. It is assumed that L and A grows exogenously at rates n and g, respectively.

$$L_{(t)} = L(0)e^{nt} \tag{3}$$

$$A_{(t)} = A(0)e^{gt} \tag{4}$$

The above equations imply that growth rate of number of effective units of labor, $A_{(t)} \; L_{(t)}$, is (n + g). The model further assumes that the fraction of output which is devoted to investments (s) is also determined exogenously and constant. The net change in the capital stock equals gross investment less depreciation:

$$\dot{K}_{(t)} = sY_{(t)} - \delta K_{(t)} \quad (5)$$

Where, δ is rate of depreciation of capital. The behavior of economy depends on capital as the other two inputs are exogenous. Diving both sides of eq. (5) by AL will give:

$$\frac{\dot{K}_{(t)}}{A_{(t)}\, L_{(t)}} = sk_{(t)}^{\alpha} - \delta k_{(t)} \quad (6)$$

Where, $k_{(t)} = K_{(t)} / A_{(t)}\, L_{(t)}$. So, we can write $\dot{K}_{(t)}/\ A_{(t)}\, L_{(t)}$, as a function of k by using the condition $(\dot{K}_{(t)}/\ A_{(t)}\, L_{(t)}) = k_{(t)} + (\ n + g + \delta\ )\, k_{(t)}$. By substituting this expression in eq. (6) and rearranging:

$$\dot{k}_{(t)} = sk_{(t)}^{\alpha} - (\ n + g + \delta\ )\, k_{(t)} \quad (7)$$

The above equation is basic equation of Solow growth model. $\dot{k}_{(t)} = 0$, in steady state k will converge to k^*, the level of capital at steady state. At steady state, equation (7) implies that k^* can be described as $sk^{*\alpha} = (n + g + \ )\, k^*$, or

$$k^* = \left[\frac{s}{(n+g+\delta)}\right]^{\frac{1}{(1-\alpha)}} \quad (8)$$

Equation (8) shows that capital-labor ratio at steady state is positively related to saving and inversely related to growth rate of population. Given $y^* = k^{*\alpha}$, substituting y^* for $k^{*\alpha}$ in Eq. (8) gives:

$$y^* = \left[\frac{s}{(n+g+\delta)}\right]^{\frac{1}{(1-\alpha)}} \quad (9)$$

By taking log and rearranging, steady state per capita income is obtained:

$$\ln\left[\frac{Y_{(t)}}{L_{(t)}}\right] = \ln A(0) + g_t + \frac{\alpha}{(1-\alpha)}\ln(s) - \frac{\alpha}{(1-\alpha)}\ln (n + g + \delta) \quad (10)$$

It is assumed that g and δ are constant across nations. However, A(0) does not only include technology but also other factors so, that $\ln A(0) = a + \varepsilon$, where a is a constant and ε is country specific shock. By rewriting the log per capita income at time t following equation is obtained:

$$\ln\left[\frac{Y_{(t)}}{L_{(t)}}\right] = a + \frac{\alpha}{(1-\alpha)}\ln(s) - \frac{\alpha}{(1-\alpha)}\ln (n + g + \delta) + \varepsilon \quad (11)$$

Equation (11) explains income levels at steady state in Solow model is determined by predetermined variables. Now let's analyze how a country's per capita income approaches its steady state position. Dividing both sides of equation (7) by k gives growth rate of k as given by:

$$\gamma_k\,(t) \equiv \frac{\dot{k}_{(t)}}{k_{(t)}} = sk(t)^{(\alpha-1)} - (n + g + \delta) \quad (12)$$

Where, γ denotes the growth rate of k. Similarly, way we can examine the growth rate of output as:

$$\gamma_{y(t)} \equiv \frac{\dot{y}_{(t)}}{y_{(t)}} = \frac{ak(t)^{(\alpha-1)}\dot{k}_{(t)}}{k(t)^{\alpha}} \quad (13)$$

The above derivation implies that economies with lower capital/income per capita tend to grow faster in terms of per capita, which is referred to as convergence across economies.

3.1.2 Conditional Convergence and Endogenous Growth Models

The derivation given in section 3.1.1 describes that countries will tend to converge to their steady state points because they differ in initial level of capital, initial level of human capital and other predetermined variables. However it is also possible for a country to converge around balanced growth path. This section will take the above model by considering that how initial level of income matters in convergence. Considering that y approaches y^* the following equation is given:

$$\frac{dlny_{(t)}}{dt} = \lambda\,[\ln y^* - \ln y_{(t)}] \quad (14)$$

Where, $\lambda = (1 - \alpha)(n + g + \delta)$. Equation (14) implies that ln y converges to ln y^* exponentially.

$$\ln y_{(t)} - \ln y^* = e^{-\lambda t}[\ln y(0) - \ln y^*] \quad (15)$$

Where, ln y(0) denotes the value of y at some initial time. Rearranging the terms and adding ln y(0) on both sides of the equation (15) gives the following growth path equation:

$$\text{Lny(t)} - \ln y(0) = (1 - e^{-\lambda t}) \ln y^* - (1 - e^{-\lambda t}) \ln y(0) \quad (16)$$

Equation (16) implies that those countries will have higher tendency to grow which begin with comparatively lower initial levels of income as compared to their steady-state levels. Baumol (1986) examined convergence from 1870 to 1979 for 16 industrialized countries.

3.1.3 Growth Model Based on Conditional Convergence Augmented for Debt

The study gets its econometric model from traditional growth model established using conditional convergence equation which is extended to include debt variable in it. Cunningham (1993) tested the highly indebted developing nations to explain that debt burden can be deleterious to economic growth. The study also extended the growth model to include debt.

$$Y = F(K,L,D) \quad (17)$$

Where, D is the variable of debt.

3.2 The Methodology

3.2.1 The Econometric Model

The study has one basic econometric model which is adopted from growth model based on the equation of the conditional convergence. The basic model has GDP per capita growth as dependent variable. A number of explanatory variables are included in this model. The initial level of GDP per capita is included to account for the conditional convergence. The variable of growth rate of population, the investment or saving as a percentage of GDP and set of other explanatory variables are also included in the model. This model aims at testing the non-linearity between debt and growth. The second econometric model is constructed to test the channels through which debt has its impact on economic growth. A modified version of the basic model is used for channel and included as dependent variable. The study aimed at testing four channels i.e. investment, TFP, Interest rate and saving channel. The first subsection of this section describes basic econometric model and the second subsection illustrates econometric model for channels.

3.2.1.1 The Basic Model

The basic model that the study employs is derived from growth model based on conditional convergence. This model aims at analyzing economic growth when debt accumulation increases. Many studies have investigated this relationship by using a similar growth model (Fosu, 1999; Saddiqui & Malik, 2002; Oleksandr, 2003; Clements et al., 2003; Schclarek, 2004; Pattilo et al., 2004; Baker & Hassan, 2008; Ayadi & Ayadi, 2008; Kumar & Woo, 2010; Chechrita & Rother, 2012)

The empirical growth model is constructed adopting the equation of conditional convergence. The model has GDP per capita growth rate as a dependent variable which relates to several independent variables. The variables on the right side of equality include the initial level of

income per capita, the investment and saving-to-GDP and the growth rate of population. The basic estimation equation is as follows:

$$y_{it} = \alpha_0 + \beta \ln GDPPC_{it} + \gamma_1 debt_{it} + \gamma_2 \text{debt\_}sq_{it} + \varphi \, \text{pop}g_{it} + \delta Z_{it} + \alpha X_{it} + \mu_{it} \qquad (18)$$

Where, y_{it} is growth rate of GDP per capita for country i at time t, $\ln GDPPC_{it}$ is logarithm of initial level of GDP per capita for country i at time t, $debt_{it}$ is gross government debt as a share of GDP for country i at time t, popg_{it} is population growth rate, Z_{it} is rate of saving or rate of investment as percentage to GDP, X_{it} is a vector of control variables which include: fiscal indicator (i.e., a proxied by tax rate or the government balance). The fiscal policy of any country has the potential to affects the way the economy moves. By including fiscal indicator in the model the study accounts for the possibility that economic growth might get affected by fiscal policy, other than fiscal, the monetary policy also has implications on how the economy works, to counter this possibility a variable of fiscal monetary policy mix is also included which is proxied by the long term interest rate, likewise indicator for the openness of the economy is also of much importance (computed as the sum of export and import as a percentage of GDP), this variable was included to expand the model beyond the horizon of closed economy and μ_{it} is error term.

3.2.1.2 Model for Channels

The second set of empirical models is aimed to test the channels which are capable of diffusing the affect of debt accumulation which are disruptive for economic growth. In order to test the channel the variable of the channel under consideration is taken as a dependent variable. The study investigates the impact firstly on private investment and public investment, secondly, on total factor productivity, thirdly, interest rates and finally, saving rate.

3.2.1.2.1 Investment Channel

In order to assess if investment is a potential channel through which debt suppresses economic growth after reaching a threshold level, the investment channel is disaggregated into two streams i.e. private and public investment. There is rich literature on channels through which debt has affects on growth. However majority of the studies investigated investment channel primarily

(Clements et al., 2003; Schclarek, 2004; Pattilo et al., 2004; Kumar & Woo, 2010; Chechrita & Rother, 2012).

The channel of investment can be justified on basis of the concept of debt overhang hypothesis that whenever a country accumulates high debt, this leads towards expectations of imposition of higher taxes. The investors hesitate to make investments and their expectations regarding the future returns decline. Consequently, investment in the country is highly discouraged both at domestic and foreign level. This in turn slows down formation of capital stock. The other argument suggests that when a country's profile is not well maintained and depicts that it is under the burden of huge debt, the investors feel reluctant while investing in that country, this is due to the uncertainties about condition of the country's environment which is not conducive for investments. Both the arguments suggest when debt increases it leads towards deterioration in capital accumulation which further asserts suppression on growth (Patillo et al., 2004). The econometric model for private investment is as follows:

$$\text{Gfcf\_priv}_{it} = \alpha_0 + \alpha_1 \text{L gfcf\_priv}_{it} + \gamma_1 \text{debt}_{it} + \gamma_2 \text{debt\_sq}_{it} + \beta X_{it} + \mu_{it} \qquad (19)$$

Where, Gfcf_priv_{it} is abbreviated as gross fixed capital formation by the private sector (as a percentage of GDP) for country i at time t, L gfcf_priv_{it} is the variable of lagged gross fixed capital formation of private sector (as a percentage of GDP) for country i at time t, debt_{it} denotes gross government debt (percentage of GDP) for country i and time t, debt_sq_{it} is square of gross government debt (percentage of GDP) for country i and time t, X_{it} is a vector of control variables which includes public investment; economic growth rate; initial level of GDP per capita, tax rate, private credit to GDP ratio, long term interest rates, openness indicator and μ_{it} is error term

Turning towards the other strand of investment i.e. the public proxied by gross fixed capital formation by governmental sector, the following regression equation will be estimated**:**

$$\text{Gfcf\_gov}_{it} = \alpha_0 + \alpha_1 \text{Lgfcf\_gov}_{it} + \gamma_1 \text{debt}_{it} + \gamma_2 \text{debt\_sq}_{it} + \beta X_{it} + \mu_{it} \qquad (20)$$

Where, Gfcf_gov_{it} is gross fixed capital formation of government (percentage of GDP), Lgfcf_gov_{it} is lagged gross fixed capital formation of government (percentage of GDP), X_{it} is set

of other control variables which include initial level of GDP per capita, economic growth rate, private investment, openness indicators, government budget balance, LT interest rates, and μ_{it} is error term.

3.2.1.2.2 Total Factor Productivity Channel

The variable of TFP as a channel through which debt affects economy is very important. Like investment TFP has been examined in many studies as a channel which explains nonlinear behavior of growth in response to increasing debt (Pattilo et al., 2004; Schclarek, 2004; Kumar & Woo, 2010; Chechrita & Rother, 2012).

The justification of including total factor productivity implies that huge bulk of debt constrains growth by lowering the total factor productivity growth. The government will be less inclined to undertake reforms if it fears that the main beneficiaries of future profits will occur to foreign creditors. When the policies in a country are not conducive to investment environment this affects investment in that country. Moreover, growing uncertainties and upheavals emerging from debt overhang are likely to hinder incentives for improving technology (Patillo et al., 2004). In this way debt has its affects on economic growth through total factor productivity. The following regression equation will be used for analyzing total factor productivity as a channel:

$$\text{TFP}_{it} = \alpha_0 + \alpha_1 \text{ L. TFP }_{it} + \gamma_1 \text{ debt}_{it} + \gamma_2 \text{ debt\_sq }_{it} + \beta X_{it} + \mu_{it} \qquad (21)$$

Where, TFP_{it} is total factor productivity for country i and time t, which is computed following Schclarek (2004), L. TFP _{it} is lagged total factor productivity for country i at time t, X_{it} is set of explanatory variables which includes growth rate of population, the variable of old and young dependency ratio, the variable of lagged economic growth rate, indicator for openness, interest rates in long term, private credit to GDP ratio and μ_{it} is error term.

3.2.1.2.3 Interest Rate Channel

The third channel that the study investigates is interest rate channel. Although this channel is not analyzed in many studies but recent studies have investigated this channel. Long term interest rate is an indirect channel through which high public debt transmits its negative impulse into the economy (Gale & Orzag, 2003; Baldacci & Kumar, 2010). Following Gale and Orzag (2003)

and Baldacci and Kumar (2010) the study included interest rate as a channel for analysis through which debt affects growth. The following equations used for nominal and real interest rates are:

$$\text{LT\_nom\_i}_{it} = \alpha_0 + \alpha_1 \text{ ST\_real\_i}_{it} + \gamma_1 \text{ debt}_{it} + \gamma_2 \text{ debt\_sq}_{it} + \beta X_{it} + \mu_{it} \quad (22)$$

Where, LT_nom_i_{it} is the variable of nominal interest rate in long term for country i and time t, ST_real_i_{it} is the variable real interest rate in short term for country i and time t, X_{it} is a vector of control variables which includes lagged growth rate, rate of inflation, primary balance of government, indicator of openness, external balance, output gap and μ_{it} is error term

$$\text{LT\_real\_i}_{it} = \alpha_0 + \alpha_1 \text{ ST\_real\_i}_{it} + \gamma_1 \text{ debt}_{it} + \gamma_2 \text{ debt\_sq}_{it} + \beta X_{it} + \mu_{it} \quad (23)$$

Where, LT_real_i_{it} is real interest rate in long term for country i and time t, ST_real_i_{it} is short term real interest rate for country i and time t, X_{it} is set of other control variables which include primary balance of government, lagged economic growth rate, output gap; external balance and indicator for openness and μ_i is error term.

3.2.1.2.4 Saving Channel

The last channel that the study aims to investigate is saving channel. The channel of private saving is estimated through following regression equation:

$$\text{Saving\_priv}_{it} = \alpha_0 + \alpha_1 \text{ L saving\_priv}_{it} + \gamma_1 \text{ debt}_{it} + \gamma_2 \text{ debt\_sq}_{it} + \beta X_{it} + \mu_{it} \quad (24)$$

Where, Saving_priv_{it} is the variable of gross saving of private sector (as a percentage of GDP) for country i and time t, $\text{L saving\_priv}_{it}$ is lagged gross saving of private sector (percentage of GDP) for country i and time t, X_{it} is a vector of other control variables which includes GDP per capita at initial level, economic growth rate, tax rate, old and young people dependency ratio, interest rates in long term, growth rate of population, credit to GDP ratio, indicator for openness and μ_{it} is error term.

The other explanatory variables introduced in equation (24) are the variables which are important in explaining the saving rate. Other than the lagged term of private saving and the gross government debt, the equation includes GDP per capita, to demonstrate for demographic changes the variable of age dependency ratios are included, the level of taxation (proxied by government

revenue) which also is very important determinant for saving is also included in the model, to account for financial systems the variable of domestic private credit to GDP is included.

3.2.2 The Panel Data Framework

The study uses panel data on four South Asian Countries i.e. Bangladesh, India, Pakistan and Sri Lanka over the period of 1991 to 2013. The other South Asian countries were excluded from the panel due to the insufficiency of the data. The panel data is usually preferred over time series data or cross-sectional data because the panel data estimation takes heterogeneity into account and gives cross-section specific effects. Another advantage of using panel data is that it gives more information about the data, shows greater variation, more efficiency and more degree of freedom. Another advantage of using panel data is that it enables the researcher to study the impact and behavior of some complicated behavioral models. One more benefit of using panel data is that it minimizes the bias that might result if we aggregate individuals (Gujrati, 2003).

3.2.3 The Fixed Effect Least-Square Dummy Variable Model

There are three possible ways to estimate a model that possess panel data characteristics. The first method of estimation is pooled OLS model, in which cross-sectional nature and characteristic of time series in data is ignored and the model is estimated as one grand model. The drawback of using this method of estimation is that it will not give cross-section and period specific effects. The second method for estimation of panel data is fixed effect least square dummy variable model for estimation. In this type of model all observations are pooled together but each cross-sectional unit has its own intercept. This means that cross-section specific characteristics of a unit can be discriminated and studied while using this model for estimation. The last model that can be used for estimation while using a panel data is the random effects model. In this model the cross-section specific characteristics are assumed to be the part of random term. The study uses a set of panel data that comprises four cross-section and time period starting from 1991 till 2013. The number of time series data is larger than the number of cross-sectional units so fixed effect model is the most preferable one among the three models discussed. To this end the study employed fixed effect model for estimation.

One drawback of using fixed effect model is that it drops out time invariant variables during estimation. A method to estimate the time invariant variables is provided by Chang and Wall (2005). The study suggested that to estimate a time invariant variable an additional regression of estimated country effects on time invariant variables in the model is required. The time invariant variable in this study is initial level of gross domestic product per capita. The equation is as follows:

$$\alpha_{0i} = \alpha_1 + \alpha_2 \ln GDPPC_i + e_i \quad (25)$$

Where, α_{0i} is country individual effect and α_2 is coefficient for log of initial level of GDP per capita.

3.3 Data

The study uses data for South Asian countries (Bangladesh, India, Pakistan, and Sri Lanka) over the period of 1991 to 2013. Due to the unavailability of data for all South Asian countries the study focuses on only four countries. The main sources of data are "International Financial Statistics Yearbook" published by International Monetary Fund, "World Development Indicators", published by the World Bank, "Key Indicators of Asia and Pacific" published by Asian Development Bank and some official government data sources were used. The detail description of variables included and their sources is given in Appendix-I and Appendix-II.

4. Results

The study employs fixed effect model for estimation. The reason behind the selection of using fixed effect model rather than random effect model is that, the number of cross-sections is less than the number of years under the consideration. There are only four cross-sections (i.e. Bangladesh, India, Pakistan and Sri Lanka) and time period is from 1990 to 2013. A problem in estimating the model is that initial level of Gross Domestic Product per capita is time invariant series. Chang and Wall (2005) suggests a very convenient method to estimate the variables which are time invariant by using individual effects. The study suggests estimating the model using fixed effect method for estimation excluding the time invariant variable and then estimating an additional regression of country pair effects on the time variant variables. Initial GDP per capita is estimated in the similar way.

4.1 Basic Estimation Model

The primary objective of the study is to empirically test if accumulation of debt is sustainable till certain point beyond which debt impedes the pace of economic growth. This is achieved by estimating basic equation that has GDP per capita growth as dependent variable and debt, investment or saving, and set of explanatory variables as regressors. The model is estimated first by including total investment (proxied by gross fixed capital formation) and then by including total savings as explanatory variable in the model.

4.1.1 Basic Estimation Model with Aggregate Investment and Saving

The basic model is first estimated by including variable of total investment and total savings as explanatory variables. The models are estimated using fixed effect model for estimation. The results are presented in table 4.1

Table 4.1: Basic Estimation Model with Investment and Saving

Variables	Model 1 GDPPCG (Total Investment As Explanatory Variable)	Model 2 GDPPCG (Total Saving As Explanatory Variable)
Debt	0.0331** (0.0147)	0.0467* (0.0050)
Debt_sq	-0.0006* (0.0001)	-0.0010* (0.0001)
Ln(GDP/cap)	1.7741 (2.5235)	4.0275 (2.0338)
Gfcf	0.2454* (0.0222)	-----
Total_sav	-----	0.2239* (0.0491)
Pop	- 0.5917* (0.1230)	-0.5877* (0.0836)
Govbal	0.2834* (0.0633)	0.1608* (0.0527)
Lt_int	- 0.0668* (0.0207)	-0.0775* (0.0119)
Open	0.0089 (0.0124)	0.0096 (0.0216)
R sq	0.55	0.58

Note: *, ** and *** shows that coefficient is significant at 1%, 5% and 10% level of significance. The values in the parenthesis are standard errors.

The result signifies that debt (gross government debt) and economic growth (GDP per capita growth) are positively related and debt has a significant impact on economic growth. The squared term of debt depicts affirmation of non-linear association among the variable of debt and economic growth. By non-linear association it means that debt increases economic growth till a certain point but above that it starts adversely affecting the economic growth. The existence of non-linear dependency of economic growth on debt is pointed out by negative sign of debt square variable. Moreover, the variable of debt and debt square both turned out to be significant for both the models (i.e. with total investment and total saving). The justification of this non-linear relationship from theoretical point of view is that how debt affects economic growth depends on the ways the accumulated debt is used. If the debt is used for productive purposes mainly investments in infrastructure and increasing the bulk of capital, it is very likely that repercussion of debt on growth of economy turns out to be positive. Even if debt turns out to be catalyzing economic growth, there is a certain point beyond which debt starts affecting the economic growth negatively. This usually happens as a result of high government debt. Whenever it becomes difficult for the government to pay off the accumulated debt, the debt ends up slowing down the economic growth. The results show that debt in South Asian countries (i.e. Bangladesh, India, Pakistan and Sri Lanka) has a non-linear impact on economic growth. Similar results are obtained by Chechrita and Rother (2012) for 12 Euro countries. Saddiqui and Malik (2002) found a non-linear association between debt and economic growth in South Asia.

The results also intimate that total investment (gross fixed capital formation) and total saving are highly significant in their respective basic model that relates economic growth to debt. Both, the variables have expected signs showing that investment and saving affect economic growth positively. So, if the debt is used for investment and saving purposes it is expected to affect economic growth positively. These findings are similar with Chechrita and Rother (2012). The variable of population growth turns out to be highly significant in both the models and has a negative effect on growth. Population growth can be both beneficial and detrimental to economic growth depending on which side of economy it affects (Tsen & Furuoka, 2005). If growing population does not add anything to the economy it will have a negative impact on growth. South Asian countries are highly populated and the growing population is increasing poverty and piling up more and more burden.

The results indicate that government balance has a highly significant and positive impact on economic growth in both the models. The government accumulates debt whenever it falls short on its expenditure. Lack of resources is what leads towards debt accumulation either from internal or external sources. So, if the government balance is positive then it will affect economic growth positively. The results depict that long term interest rate has a negative and meaningful influence on growth. The higher the long term interest rates will be the lower will be economic growth. The negative relationship is obvious because the higher interests would mean lesser savings, lesser investments, larger debt, and slower growth.

4.1.2 Basic Estimation Model with Disaggregate Investment and Saving

The basic estimation model is estimated using investment and saving variables at disaggregate level i.e. private and public sectors. The model 1 for this section represents results for estimation of basic growth model that includes public investment (proxied by gross fixed capital formation of public sector as a percentage of GDP) and private investment (proxed by gross fixed capital formation of private sector as a percentage of GDP) as explanatory variables. The model 2 shows estimation results for basic estimation equation with disaggregated savings. The savings are disaggregated into public and private saving as a percentage of GDP. The results for both the models are obtained by fixed effect model for estimation. The results for these models are presented in table 4.2.

The results for model 1 show that when we include disaggregated investment as an explanatory variables and test for the non-linearity, the results remain unchanged. The variable of debt turns out to be significant and has a positive sign. The variable of debt square also turns out to be significant and has the desired sign. The negative sign of square term of debt shows that debt has a non-linear link with economic growth. This implies that debt has a positive influence on economic growth till certain level but after reaching that level debt adversely affects economic growth. The variable of public and private investment also comes out to be significant for growth. This means that investment at any level public or private accelerates growth of the economy. The variable of population turns out to be significant as well. The negative sign of the coefficient for population growth implies that if the population grows it will badly affect economy. Government balance also has an important but positive effect on economic growth. If

the government balance is positive it will also increase the economic growth. The variable of long term interest rate also turned out to be significant and has a negative impact on economic growth.

Table 4.2 Basic Estimation Model with Disaggregate Investment and Saving

Variables	Model 1 GDPPCG (Disaggregate Investment As Explanatory Variable)	Model 2 GDPPCG (Disaggregate Saving As Explanatory Variable)
Debt	0.0272** (0.0109)	0.0325*** (0.0177)
Debt_sq	-0.0006* (0.0001)	-0.0008* (8.89)
Ln(GDP/cap)	1.8807 (2.8164)	4.5667*** (1.9433)
Gfcf_priv	0.3063* (0.0323)	-----
Gfcf_pub	0.1469* (0.0495)	-----
Priv_sav	-----	0.2311* (0.0491)
Pub_sav	-----	0.3891** (0.1945)
Pop	-0.5299* (0.0932)	-0.5778* (0.1233)
Govbal	0.3134* (0.0636)	0.0889 (0.1074)
Lt_int	-0.0494* (0.0126)	-0.0720* (0.0134)
Open	-0.0073 (0.0183)	0.0075 (0.0192)
R_sq	0.58	0.59

Note: *, ** and *** show that coefficient of the variable is significant at 1%, 5% and 10% level of significance. The values in the parenthesis are standard errors.

The model 2 is replication of basic model by including public saving and private savings as explanatory variables. The results show that variable of debt is significant at 10% level. This means that debt is slightly less significant in model 2. However, the sign of the debt variable remains the same. The variable of debt square turns out to be significant in the model hence the non-linear trend in economic growth as an aftermath of stacking debt is validated once again. The variable of log of initial GDP level also turned out to be significant at low level of significance. The results show that private and public savings has a positive and vital influence

on economic growth. Population growth and long term interest rates have same results as for model 1.

4.2 Estimation of Channels

The second objective of the study is to investigate the channels that are mediums through which debt regulates the trend in economic growth. The main channels in the study are investment proxied by the variable of gross fixed capital formation, which is further disaggregated to investment in private sector (measured by gross fixed capital formation of private sector) and public investment (measured by gross fixed capital formation of government). The second channel is total factor productivity, third channel is interest rate which is segregated to real interest rate in long term and nominal interest rate in long term, last channel is saving.

4.2.1 Investment Channel

The very first channel that the study tries to explore is perhaps the most important channel through which debt has its impact on economic growth. The study decomposes the investment channel into two strands, private investment channel (proxied by gross fixed capital formation of private sector as a percentage of GDP) and public investment channel (proxied by gross fixed capital formation of public sector as a percentage of GDP). The results of the two channels are presented in table 4.3.

The results display that the debt significantly induces both private and public investment. The non-linear term of debt has a negative and significant sign for private and public investment models. This means that the non-linear impact of debt on growth operates through both private and public investment. This result can be supported by two arguments, when debt grows large, investor's expectations of returns lessens. People expect imposition of higher taxes. In this way new domestic investment is discouraged. The second argument suggests that the higher debt means greater uncertainty about economic conditions of a country which discourages foreign investment. So, the investment channel turns out to be significant in this analysis. The results are in line with Pattillo et al. (2004), and Chechrita and Rother (2012). The lagged variable of private and public investment is also significant and positive. This is obvious because theoretically the present trend of any variable is influenced by its trend in past. So, the results

show that both private and public investments have a strong relationship with its own lagged variable.

Table 4.3 Investment Channel

Explanatory/ Dependent Variables	Model 1 Private Investment	Model 2 Public Investment
Debt	0.1107* (0.0395)	0.1261* (0.0385)
Debt_sq	-0.0011* (0.0004)	-0.0017* (0.0003)
L gfcf_priv	0.3140* (0.1191)	------
Gfcf_pub	-0.7128* (0.0585)	------
Gfcf_priv	------	-0.7978* (0.0599)
Ln(GDP/cap)	0.1669 (3.6624)	-2.2982 (4.7145)
Gdppcg	0.1726*** (0.1020)	0.1861*** (0.1047)
Dom_cred	0.0659 (0.0445)	------
Lt_int	0.0806 (0.0739)	0.0175 (0.0681)
Open	0.0747** (0.0357)	0.1855* (0.0212)
Govbal	------	-0.1755 (0.1356)
Rev	0.0858 (0.1116)	------
L gfcf_pub	------	0.4624* (0.0823)
R sq	0.92	0.83

Note: *, ** and *** show that coefficient of the variable is significant at 1%, 5% and 10% level of significance. The values in the parenthesis are standard errors.

The variable of public investment turned out to be significant and negative for private investment. This can be justified as more public investment will be the share of private investment will decrease. This is often referred to as a public investment crowding out the private investment. Similarly, the variable of private investment shows a significant negative relationship with public investment. Openness has a positive and significant impact on both public and private investment. The more open an economy is, greater will be the investment opportunities. Sinha (2002) found that growth is positively related to openness and investment in

Asia. The value of R square is 0.92 and 0.83 for private and public investment channel respectively, which shows model is a good fit.

4.2.2 Total Factor Productivity Channel

The second channel that the study investigates is total factor productivity. TFP is also an important channel that has been tested in many studies to detect the source of non-linear relationship between debt and economic growth. The results for this channel are given in table 4.4.

Table 4.4 TFP Channel

Explanatory/Dependant Variable	TFP
Debt	0.1525** (0.0617)
Debt_sq	-0.0017*** (0.0010)
L. tfp	0.0403 (0.1241)
Gdppcg(-1)	0.209969 (0.6136)
Pop	0.9821 (4.9375)
Dep_old	1.1523 (1.0044)
Dep_young	-0.3320* (0.0606)
Dom_cred	0.11171 (0.1589)
Lt_int	-0.3394 (0.2515)
Open	-0.0009 (0.1049)
R sq	0.45

Note: *, ** and *** show that coefficient of the variable is significant at 1%, 5% and 10% level of significance. The values in the parenthesis are standard errors.

The results show that debt variable is significant at 5% level and debt square is significant at 10% level. The variables have expected signs i.e. debt has a positive sign and debt square possess a negative sign. This supports the hypothesis that TFP is a significant channel through which debt nonlinearly affects growth. The results can be supported by the argument that governments are reluctant to undertake costly reforms when it perceives the only beneficiaries will accrue to foreign creditors. Without reforms there will be no change in productivity. Poor

policies discourage investments and rise in productivity. Another argument is that the uncertainties hinder incentives to improve technology. So, the results suggest that TFP is a significant channel through which debt has a non-linear impact on economic growth. However, TFP is comparatively less significant channel as than investment. Chechrita and Rother (2012) found TFP as a significant channel through which debt has its impact in 12 Euro countries. Patillo et al. (2004) found that TFP is a significant channel through which debt inversely controls growth in developing countries. Schclarek (2004) found no robust connection between debt indicators and TFP for developing countries.

No other variable in the model turns out to be significantly affecting TFP other than dependency ratio of young. This variable is included in the model to account for demographic changes. The negative sign shows that the larger younger population dependency will affect the total factor productivity negatively. This is true especially in the context of developing nations. South Asian countries have many developmental issues including unemployment, poverty, income inequality and slow economic growth. In these countries higher dependency ratio of young people would act as a liability.

4.2.3 Interest Rate Channel

The third candidate for being a channel through which debt has its non-linear impact on economic growth is interest rate channel. The interest rate channel has not been explored in many studies. Gale and Orzag (2003) and Baldacci and Kumar (2010), mentions that public debt can affect capital accumulation through its adverse affect on long term interest rate. Though long term interest rate is an indirect channel but it can be taken into consideration as a channel through which debt has its impact on economic growth. However, Chechrita and Rother (2012) investigated this channel for Euro region. The interest rate channel is segregated into nominal long term interest rate and real long term interest rate. The results for this channel are given in table 4.5.

The results for model 1 show that none of the debt variable turned out to be significant. This implies that nominal long term interest rate fails to be an important channel through which debt has its impact on economic growth. Moreover, the signs of debt variables came out to be negative for both debt and debt square. Chechrita and Rother (2012) employed this channel for

investigation and found similar results. The variable of output gap has a significant negative impact on long term nominal interest rate. The farther away is an economy from its potential the lesser will be the long term nominal interest rate. The variable of short term real interest rate also came out to be highly significant and has a positive relationship with long term nominal interest rate.

Table 4.5 Interest Rate Channel

Explanatory/ Dependant Variable	Model 1 Lt Nominal Interest Rate	Model 2 Lt Real Interest Rate
Debt	-0.0474 (0.0685)	0.0040** (0.0020)
Debt_sq	-0.0003 (0.0011)	-3.04E-05 (3.41E-05)
Infl	0.0452 (0.0449)	------
Govpbal	-0.0139 (0.1631)	0.0040 (0.0036)
Gdppcg(-1)	0.0521 (0.1169)	-0.0037*** (0.0022)
Out_gap	-0.0491* (0.0062)	0.0046* (0.0011)
Cab	0.0035 (0.1434)	0.0114 (0.0090)
Open	0.0460 (0.0356)	0.0023 (0.0020)
St_real	0.0227* (0.0049)	1.0493* (0.0002)
R sq	0.38	0.99

Note: *, ** and *** show that coefficient of the variable is significant at 1%, 5% and 10% level of significance.
The values in the parenthesis are standard errors.

The results for model 2 suggest that debt variable is significant and has a positive relationship. The variable of debt square turned to have the expected sign but insignificant. The lagged GDP came out to be significant at 10 percent, suggesting that the GDP per capita of past year has a negative impact on the value of long term real interest rate. Like nominal long term interest rate, the real long term interest rate too has a significant link with output gap.

4.3.4 Saving Channel

The last channel that is analyzed in this study is saving channel. Saving channel considered only private saving as a possible channel through which debt has its impact on economic growth. Chechrita and Rother(2012) found that private saving is a significant channel in Euro area

through which debt has a non-linear impact on economic growth. The results are presented in table 4.6.

The results demonstrate that private saving is not a significant channel through which debt has its influence on economic growth. This is clearly visible as none of the debt variable is significant. Schclarek (2004) found mixed results for private saving channel for industrialized and developing countries. The study found that for developing countries private saving fails to be a significant channel. However, for industrialized countries the private saving is a significant channel. Chehrita and Rother (2012) found private saving as a significant channel for European countries.

Table 4.6 Saving Channel

Explanatory /Dependant Variable	Private Saving
Debt	-0.0032 (0.0355)
Debt_sq	0.0001 (0.0005)
L. priv_sav	0.5475* (0.0763)
Ln(GDP/cap)	1.3788 (3.0437)
Gdppcg	0.0056 (0.1114)
Pop	0.3920 (2.5945)
Rev	0.0623 (0.1708)
Dom_cred	0.1596* (0.0390)
Dep_old	-0.3330 (0.7080)
Dep_young	0.0183 (0.0437)
Lt_int	-0.0154 (0.1259)
Open	-0.0023 (0.0132)
R sq	0.88

Note: *, ** and*** show that coefficient of the variable is significant at 1%, 5% and 10% level of significance. The values in the parenthesis are standard errors.

5. Conclusion

This study has dual objective. The first objective of this study was to examine the non-linear association among debt and economic growth in South Asian countries. The second objective of the study was to test the channels through which debt has its non-linear impact on economic growth in South Asian countries. The study explored four channels empirically i.e. investment, total factor productivity, interest rate and saving channel. The study employed panel data for this analysis. The data for four South Asian countries i.e. Bangladesh, India, Pakistan and Sri Lanka was used over the time period starting from 1991 to 2013. The empirical model used in the study has its theoretical background in conditional convergence equation which is augmented to include debt variable in it.

The results of the study showed that there is a nonlinear association between debt and economic growth when we introduce investment or saving in the basic model. The existence of this nonlinear relationship remained unaffected when the variable of saving and investment were included in the basic model at disaggregate level. However, the most important and significant channel through which debt affects economic growth in South Asian countries is private public investment. The channel of TFP also came out to be significant. The channels of interest rate and saving failed to be significant channels.

The conclusion drawn from the study has some policy implications. The results imply that in order to stop the debt from becoming deleterious to economic growth the resources must be used efficiently. This means that government should use the accumulated debt in productive streams and must spend these funds efficiently. The debt has its impact on economic growth through the channel of investment which implies that debt must be reduced so that reduction in debt leads to increase in investment which crowd out when huge bulk of debt is accumulated. Reliance on debt should be discouraged, so that the economy may flourish. The need for accumulating debt arises when the government falls short on its resources to finance its expenditure. The government should stimulate the revenue generation and should reduce its huge current expenditures. Reducing debt accumulation alone will not rectify the problem unless the supplementary macroeconomic policies are made sound. So, there is a dire need to improve macroeconomic policies. The governments should mobilize domestic resources instead of taking

borrowings. Making the economy more open to the world and by eliminating the losses incurred due to loss in competitiveness would boost the financial resources. By removing political constraints, macroeconomic imbalances, improving governance, reducing dependency on foreign aids and eliminating structural distortions, the problem of debt can be resisted.

There are certain limitations of this study that are worth pointing out. These limitations give scope for further research. Followings are the limitations:

- The study did not include human capital in its empirical model. By including human capital better results can be obtained and a deeper analysis can be made.
- Due to inadequacy of the data for remaining South Asian countries the study included some countries. The availability of the data for all South Asian countries would increase the cross-sections in the panel and a better analysis can be made.

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Appendix - I

Variable	Description	Source
Debt	Gross government debt (% of GDP)	IFS
Gov_bal	Government budget balance(% of GDP)	IFS
Gov_primary_bal	Government budget primary balance(excl. interest payments: % of GDP)	IFS
Gov_balance	Gov. balance(% of GDP)	IFS
Gov_rev_ca	Gov. revenue(% of GDP)	IFS
PotetialGDP	Potential Gross domestic product	IFS
Pop.growth	Total population-growth rate	ADB
Openness	Calculated as sum of exports and imports (% of GDP)	WDI
Gov_cab	Current account balance(% GDP)	IFS
Gfcf_total	Gross fixed capital formation: total economy(% of GDP)	WDI
Gfcf_gov	Gross fixed capital formation : general government (% of GDP)	WDI
Gfcf_priv	Gross fixed capital formation : private sector (% of GDP)	WDI
Saving_total	Gross national saving: total economy(% GDP)	WDI
Saving_public	Gross saving: general government(% GDP)	WDI
Saving_priv	Gross saving: private sector(% GDP)	WDI
Interest rate	Nominal long term interest rates	ADB
Inflation (GDP defl.)	Annual rate of change in GDP deflator	IFS
Output_gap	Gap between actual and potential GDP	IFS
Old_dep_ratio	Age dependency ratio, old(% of population over 65 in working age population)	WDI
Young_dep_ratio	Age dependency ratio,young(% of population under 15 in working age population)	WDI
Credit_priv	Domestic credit to private sector(% of GDP)	WDI
TFP	Calculated following Schclarek (2004)	

Appendix - II

Data Sources and Definitions

The data was mainly taken from "International Financial Statistics Yearbook" published by International Monetary Fund, "World Development Indicators, published by the World Bank, "Key Indicators of Asia and Pacific, published by Asian Development Bank and some official databases. The official databases included "Handbook of Statistics 2010, Pakistan", "Annual Report" publishes by Reserve Bank of India, "Sri Lanka-Selected Issues and Statistical Appendix" published by IMF and database of Bangladesh Bank. Below is the list of the sources and definitions of the various variables used in this study.

1. Gross Government Debt (percentage of GDP): "Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable. Thus, all liabilities in the GFSM 2001 system are debt, except for equity and investment fund shares and financial derivatives and employee stock options. Debt can be valued at current market, nominal, or face values (GFSM 2001, paragraph 7.110)" (World Bank).
   Source: IFS and data for Bangladesh was utilized from Islam and Biswas (2005).
2. Gross Domestic Product Per Capita Growth: "Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2005 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources."(World Bank)
   Source: WDI
3. Initial GDP Per Capita (current LCU): the GDP per capita (current LCU) in year 1990.
   Source: WDI
4. Gross Fixed Capital Formation (percentage of GDP): Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.
   Source: WDI

5. Gross Fixed Capital Formation, Private Sector (percentage of GDP): Private investment covers gross outlays by the private sector (including private nonprofit agencies) on additions to its fixed domestic assets.
   Source: WDI
6. Gross Fixed Capital Formation, Public Sector (percentage of GDP): The gross fixed capital formation public sector was computed by subtracting gross fixed capital formation private sector from gross fixed capital formation total.
7. Government Balance (percentage of GDP): the government balance was computed by subtracting general government total expenditure from general government total revenue.
   Source: IMF
8. Government Revenue (percentage of GDP): Revenue consists of taxes, social contributions, grants receivable, and other revenue. Revenue increases government's net worth, which is the difference between its assets and liabilities (GFSM 2001, paragraph 4.20). Note: Transactions that merely change the composition of the balance sheet do not change the net worth position, for example, proceeds from sales of nonfinancial and financial assets or incurrence of liabilities.
   Source: IFS
9. Current Account Balance (percentage of GDP): Current account is all transactions other than those in financial and capital items. The major classifications are goods and services, income and current transfers. The focus of the BOP is on transactions (between an economy and the rest of the world) in goods, services, and income.
   Source: IFS
10. Government Primary Balance (percentage of GDP): the series was obtained by excluding interest payments from government expenditure and then subtracting obtained value from government revenue.
11. Potential GDP: Potential gross domestic product (GDP) is defined in the OECD's Economic Outlook publication as the level of output that an economy can produce at a constant inflation rate. Although an economy can temporarily produce more than its potential level of output, that comes at the cost of rising inflation. Potential output depends on the capital stock, the potential labor force (which depends on demographic factors and on participation rates), the non-accelerating inflation rate of unemployment (NAIRU), and the level of labor efficiency. The variable of potential GDP is measured as estimated real GDP.
    Source: IMF
12. Openness: openness is measured as a sum of exports of goods and services as percentage of GDP and imports of goods and services as a percentage of GDP.

Source: WDI

13. Output Gap: output gap is measured as difference between actual output and potential output.
14. Inflation GDP Deflator (annual percent): "Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency."(World Bank)

    Source: WDI
15. Age Dependency Ratio Old (percentage of population over 65 in working age population): "Age dependency ratio, old, is the ratio of older dependents--people older than 64--to the working-age population--those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population."(World Bank)

    Source: WDI
16. Age Dependency Ratio Young (percentage of population under 15 in working age population): "Age dependency ratio, young, is the ratio of younger dependents--people younger than 15--to the working-age population--those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population."(World Bank)

    Source: WDI
17. Domestic Credit to private sector(percentage of GDP): "Domestic credit to private sector by banks refers to financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of non equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises."(World Bank)

    Source: WDI
18. Gross domestic Savings (percentage of GDP): "Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption). Data are in constant local currency."(World Bank)

    Source: WDI
19. Gross Public Savings (percentage of GDP): the data for public savings has been collected from official databases. The data for public savings in Pakistan was collected from "Handbook of Statistics 2010, Pakistan", data on public savings in India was collected from "Annual Report" publishes by Reserve Bank of India, data for public savings in Sri Lanka was obtained from "Sri Lanka-Selected Issues and Statistical Appendix" published by IMF and data for Bangladesh was obtained from database of Bangladesh Bank.

20. Gross Private Savings (percentage of GDP): gross private savings were obtained by subtracting public savings from gross domestic savings.
21. Long Term Interest Rate: the variable of long term interest rate was proxied by 12 months interest rate per annum.

    Source: ADB
22. Short Term Interest Rate: the variable of short term interest rate was proxied by 6 months interest rate per annum.

    Source: ADB
23. Total Factor Productivity: the variable of total factor productivity was obtained following the study of Schclarek (2004). According to this study TFP can be computed as

    $$\text{Productivity} = \text{growth} - 0.3^{*} \text{ capital growth}$$

    Where growth is per capita GDP growth rate and capital growth is per capita capital stock growth. The series of capital stock was computed following perpetual inventory method, using 5 percent depreciation rate.