

Analysing Public Debt Asymmetries: Effect of Taxation and Government Spending on Public Debt in India between 2002-2013

Raghav Mehra , Shivani Mehta

Student, Amity School Of Economics , Amity University, Uttar Pradesh, India
Assistant Professor- I, Amity School of Economics, Amity University Uttar Pradesh, India
Corresponding Author: Raghav Mehra

Abstract: The study aims to estimate the impact of fiscal policy on public debt for the period 2002 to 2013 in India. The study adopts a multiple linear regression model to analyse the impact of the independent variables, represented by government spending and tax revenue on the dependent variable represented by public debt for the above mentioned period. The model is subject to a test of hypotheses and the results are computed and analysed. The model suggests that increasing tax revenue and government expenditure will reduce the debt to GDP ratio as both parameters happen to be inversely related with public debt. It also suggests the importance of expenditure being channelized effectively and productively, with the support of relevant economic literature to prove the theoretical validity of the model.

Date of Submission: 09-04-2018

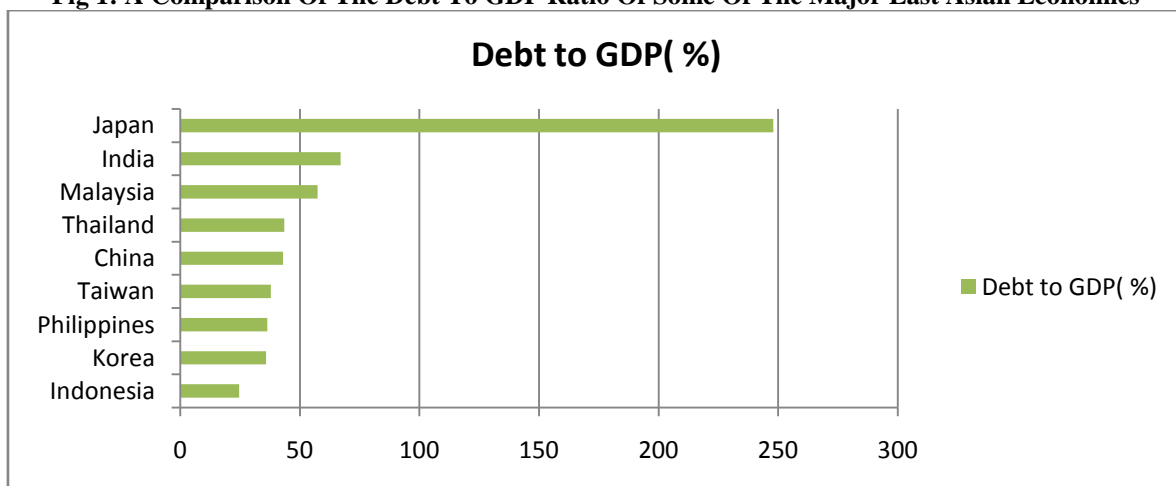
Date of acceptance: 23-04-2018

I. AN INTRODUCTION

In recent years, India has shown steady growth as a developing nation. However, despite the setbacks brought about by the demonetisation of Indian notes and the implementation of the good and services tax, there exists an economic indicator that threatens the credibility of the Indian economy, for investors worldwide. This is the country's debt to GDP ratio. Governments across the world borrow to spend on subsidies ,infrastructure and other such social sectors. The repayment of these obligations reflects the credit worthiness of the economy.

According to the data provided by the IMF , India's general government deficit which includes the borrowing of states and centre combined, is amongst the highest in the G-20 countries. This happens to be a drawback for India's credit rating upgrade despite it being the fastest emerging economy in the world. At about 67% of the total gross domestic product, India's public debt is higher than most Asian economies and only second to Japan, a concerning issue for both the RBI and rating agencies. (Karnik. M, quartz India, 2017)

Fig 1: A Comparison Of The Debt To GDP Ratio Of Some Of The Major East Asian Economies



Source: IMF Data.

Finance capital has become increasingly intolerant of what is perceived as public debt, after the experience of economies such as Greece, Spain and Portugal. It is sovereign default that threatens investor's

solvency making public debt it a pressing concern for an economy's future stability. This is because international investors are continuously exposed to government bonds and in those countries governments are seen incapable of meeting their debt serving commitments.

However over the last decade as India's GDP increased, the debt to GDP ratio declined by a small margin. Moreover a deutsche bank report stated that India was likely to witness an improvement in its debt to GDP ratio over the medium term brought about by a high economic growth rate and modest fiscal consolidation(business line, the Hindu). This forms the crux of the paper around which the research has been based. The paper studies and determines a statistically significant relationship between government debt and the parameters of government spending and tax revenue such that this relationship will serve to be useful in reducing the outstanding debt through appropriate fiscal measures by the government.

The next section studies the trends in public debt for the mentioned study period- 2002 - 2013.It also shows the trends of components of government debt namely internal and external debt followed by which it discusses the reasons for such high levels of government debt to GDP ratio, after careful review of relevant economic and financial literature.

II. A LOOK INTO THE TRENDS OF INDIA'S ASYMMETRIC PUBLIC DEBT BETWEEN 2002 - 2013

Public debt in India is categorized as internal and external debt. The former largely consists of fixed dated securities and treasury bills or coupon borrowings issued through auction. The latter however is used for financing specific projects for the governments and forms a small proportion of the overall government debt of India. Internal debt is generally created due to funds raised by the government through bonds sold to the public. The external debt on the other hand arises from multilateral agencies such as the Asian Development Bank, international development association or the international bank for reconstruction and development bank. The following table shows the overall public debt and its respective components for the study period 2002 - 2013.

Table 1: Tabulated Data For Internal And External Debt For India 2002-2013

Year	Debt To GDP Ratio	Internal Debt	External Debt
2002	82.9	62.6	20.3
2003	84.2	66.4	17.8
2004	83.3	66	17.3
2005	80.9	65.1	15.8
2006	77.1	60.3	16.8
2007	74	56.5	17.5
2008	74.5	56.5	18
2009	72.5	52.2	20.3
2010	69.6	49.3	18.2
2011	69.1	51.4	18.2
2012	68.5	47.9	21.2
2013	68.6	46.1	22.4

Source : Trading Economics Data

As seen above the internal debt constitutes a major portion of the total debt and decreases due to which the total debt has shown a decreasing trend. External debt on the other hand remains more or less constant over the span of 10 years, decreasing by only 3-5 percentage points in the first five years and increasing thereafter.

Fiscal policy instruments will only be effective and all sections of the society will only benefit if policy makers consider the existence of the black economy which is almost 50% of GDP and results from the shortage of resources. (Bhadani.P , 2016)

It is difficult to comprehend the Indian economy without considering the black economy. Fiscal policy faces two problems due to the presence of the black economy. First is that the government is unable to collect enough tax revenue, resulting in less revenue receipts leading to higher borrowing by it to fulfil its social obligations. Second the allotted money is not entirely used for development. If measures are taken to reduce the size of the black economy then the continuous rise in the fiscal deficit which is leading to higher borrowing by the central government can be curtailed and the government would be able to increase its revenue collection.

The existing levels of debt to GDP ratios affect India's rating in the S&P's in its report which suggested that an upward push on the ratings could only be brought about if the government's reforms show an improvement in its general fiscal outturns. Along with that the level of general government debt to GDP should also fall below 60%. Under the current fiscal responsibility and budget management (FRBM) act, the government has been aiming to increase revenue and reducing fiscal deficit.

The difference between nominal GDP growth, interest rate and primary deficit (which is government borrowing excluding interest payments) is a vital determinant for a fall or rise in the debt stock. Debt stock and the debt to GDP ratio is reduced with a higher difference between the nominal GDP and interest rate as it increases the ability of the government to service its debt. A lower primary deficit or primary surplus, on the other hand, also helps bring down debt to GDP ratio. As per the economic survey for 2016-17, India is supposedly to have favorable debt asymmetries for the next decade with its interest rate being 7-7.5% (with a differential of 4-6.5%) and nominal GDP growth expected to be in the range of 11-14. (livemint.com)

However it is important to note that a primary deficit remains a liability for India. Which signifies that India's central and state governments are not collecting enough revenue to cover their existent costs, which is even excluding the interest on its debt obligations. A major reason of this being the existence of the black economy as explained earlier.

The following chapter illustrates the empirical methodology adopted for the formulation of our model to analyse the effects of government expenditure and tax revenue on public debt in India's experience.

III. EMPIRICAL METHODOLOGY AND DATA ANALYSIS

The statistical analysis of this study is based on the assessment and evaluation of the multiple regression model for estimating the effect of the independent variables on the dependent variable public debt in India using the Microsoft Excel Software Program. This chapter details the definition of the variables under study, establishing the null hypotheses, the collection of data and the limitations faced during the study.

The data collected was processed through the MS-excel software for regression analysis and the results were tabulated and inferred as shown ahead in this section. The statistics obtained allow us to generalize our multiple linear regression model and test the validity of our hypotheses. To improve the accuracy of the data autocorrelation was removed by taking the logarithmic values of the dependent and explanatory variables.

A. DEFINING THE DEPENDENT AND INDEPENDENT VARIABLES

This multiple linear regression model considers two explanatory variables namely government expenditure and tax revenue and their effect is measured on government debt, the dependent variable.

The dependent variable (y) - Public debt in India

Public debt comprises of both internal and external debt. The concept of public debt in India refers to a part of the total borrowings by the central government in the form of treasury bills, special bearer bonds, special loans and securities issued by the reserve bank of India. It also comprises the outstanding external debt. Most of the debt in India is held in the form of long term interest bearing securities such as rural development bonds, national savings certificates, capital development bonds. (Mukherjee. S, economics for C.A Professional Education Course-1)

Our study for the sake of simplicity considers the total public debt as a percentage of the GDP that it considers the total debt to GDP ratio. This ratio is a significant macroeconomic indicator of the ability of an economy to pay back its outstanding debt, hence a measure of the economy's macroeconomic stability. A high debt to GDP ratio may lead creditors seek higher interest rates while lending as it makes it more difficult for countries to pay off their external debts.

First independent variable (X_1) - Government Expenditure

Government expenditure refers to the expenditure which the government incurs for its own maintenance and to provide various benefits to the society and to the economy. It is the expenditure incurred by the government for the satisfaction of the collective needs of the people and for promoting their economic and social welfare. Hence an increase in the expenditure directly contributes in the growth and development of the economy.

An economy experiences a fiscal deficit when its expenses are in excess of its receipts. This deficit generates a debt as the government begins to borrow to pay off its existing obligations. Therefore public expenditure is a crucial determinant of public debt.

In India public expenditure can be classified as planned and non planned expenditure. These are further classified as revenue and capital expenditures which maybe either developmental and non developmental.

Second independent variable (X_2) - Tax Revenue

Tax revenue refers to the income generated by the government from the imposition of taxes. It forms a part of the receipt budget which makes it in turn, as a part of the annual financial statement of the union budget. It incorporates revenue from both direct and indirect taxes. Direct taxes are those which are levied on the income and property of individuals such as income tax, capital gains tax, wealth tax, corporation tax, property

tax. On the other hand indirect taxes are those which are levied on expenditure such as sales tax , excise duties , customs duty. The data collected for our model takes into account the tax revenue generated as a proportion of the GDP for that year.

The above discussed form the dependent and explanatory variables of our model all taken as a percentage of the total GDP of that year for the study period 2002 to 2013.

B. ESTABLISHING THE HYPOTHESES

The study is based on the following hypotheses. The objective of this study is to prove through contradiction that the null hypothesis is false and the alternate hypotheses is true.

Null Hypotheses

(H₀)₁ - There is no significant statistical relationship between the variables of public debt and government expenditure at a level of significance (α) of 0.05.

(H₀)₂ - There is no significant statistical relationship between the variables of public debt and tax revenue at a level of significance (α) of 0.05.

Alternative Hypotheses

(H₁)₁ - There is a significant statistical relationship between the variables of public debt and government expenditure at a level of significance (α) of 0.05.

(H₁)₂ - There is a significant statistical relationship between the variables of public debt and tax revenue at a level of significance (α) of 0.05.

C. COLLECTION OF DATA

The data collected is secondary in nature and is collected for India, for the study period pertaining to 2002 to 2013. The data represents a trend of a gradually declining public debt to GDP ratio over the span of 12 years with a gradual increase in both government expenditure and tax revenue as a proportion of the GDP.

Table 2 : Data Collected For The Dependent And Explanatory Variables For The Period 2002-13

Year	Debt To GDP % (Y)	Expenditure To GDP % (X ₁)	Tax To GDP % (X ₂)
2002	82.9	11.57	8.794
2003	84.2	11.13	9.231
2004	83.3	10.64	9.7
2005	80.9	10.54	10.224
2006	77.1	10.05	11.371
2007	74	10.01	12.266
2008	74.5	10.64	11.088
2009	72.5	11.59	9.943
2010	69.6	11.13	10.507
2011	69.1	11.08	10.177
2012	68.5	10.68	10.837
2013	68.6	10.3	11.002

Source : Trading Economics Data

However the above data is further manipulated for higher accuracy by removing autocorrelation. This is done by taking the logarithmic values of the dependent and independent variables.

D. FORMULATION OF THE MULTIPLE LINEAR REGRESSION MODEL

Econometric theory postulates that unlike mathematical models that assume exact relationship between the dependent and independent variables in the non stochastic form, econometrics considers other parameters which also affect the variations in the dependent variable represented by the error term. The error term is thus a measure of unexplained variation. Hence the generalized form of the multiple regression equation in stochastic form is:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni} + u_i$$

Taking estimates on both sides we obtain:

$$\hat{Y}_i = E(Y_i) = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + \dots + \hat{\beta}_n X_{ni} + E(u_i)$$

As per the assumption of a linear stochastic regression model $E(u_i) = 0$ we have the linear regression model in the non stochastic form as follows:

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + \dots + \hat{\beta}_n X_{ni}$$

$$Y_i = \hat{Y}_i + u_i$$

Where

$I = 1, 2, 3, \dots, N$

$X_{1i}, X_{2i}, \dots, X_{ni}$ represent the explanatory variables

$\beta_1, \beta_2, \dots, \beta_n$ Are coefficients of the explanatory variables and β_0 is the intercept

$\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2, \dots, \hat{\beta}_n$ are estimates of the above.

u_i represents the error term associated with each i .

As defined in the previous section we have we have taken two explanatory variables so $n = 2$ so the above equation in its estimated form reduces to:

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i}$$

For a sample size of $n = 12$ observations such that $i = 1, 2, 3, \dots, 12$.

The following table shows the statistics obtained upon regression analysis. The important parameters that need to be considered are the values of the multiple regression coefficient (multiple r) which is a measure of the goodness of fit test and the r -square that gives us the percentage of variability in Y that is explained by changes in the explanatory variables X_1 and X_2 .

Table 4: Table Showing The Regression Statistics

Regression Statistics	
Multiple R	0.800676549
R Square	0.641082936
Adjusted R Square	0.561323588
Standard Error	0.0230576
Observations	12

Source: Prepared By Author Using MS- Excel Software

The output for the test for ANOVA has been tabulated to show the difference between the explained and unexplained variation as a proportion of the total variation.

Table 5: Table Showing The Analysis Of Variance (ANOVA)

	Df	SS	MS	F	Significance F
Regression	2	0.00854655	0.004273275	8.037715385	0.009941994
Residual	9	0.004784876	0.000531653		
Total	11	0.013331426			

Source: Prepared By Author Using MS- Excel Software

The values of the coefficients of β_0, β_1 and β_2 at a 0.05 level of significance (95% confidence interval) were obtained with their respective p -values to show their significance and further validate our assumed hypotheses. The results have been tabulated ahead with the help of which we can generate our estimated regression equation in non stochastic form.

Table 5: Table Showing Statistics For Coefficients Of Explanatory Variables X_1 And X_2

	Coefficients	Standard Error	T Stat	P-Value	Lower 95%	Upper 95%
Intercept	4.68567858	0.82536125	5.67712444	0.00030297	2.8185817	6.552775463
X_1	-1.58158253	0.55020042	-2.8745570	0.01833996	-2.8262223	-0.3369427
X_2	-1.15786348	0.29148513	-3.9722899	0.00324338	-1.8172486	-0.49847829

Source: Prepared By Author Using MS- Excel Software

From the above , rounding off values of coefficients up to three places of decimal we have:

$$\begin{aligned} \beta_0 &= 4.686 \\ \beta_1 &= -1.582 \\ \beta_2 &= -1.158 \end{aligned}$$

Hence the multiple regression function in its estimate and non stochastic form that forms the working model of this study is as follows :

$$\hat{Y}_i = 4.686 - 1.582X_{1i} - 1.158X_{2i}$$

E. TEST OF HYPOTHESES

The first hypotheses : At a given p-value of 0.01 for the t- statistic value of -2.875 there is a statistically significant negative relationship at the level $\alpha = 0.05$ between public debt to GDP ratio and government expenditure to GDP ratio. Hence the null hypotheses stands rejected that is $(H_0)_1$ is rejected and $(H_1)_1$ is accepted.

It is shown that an appreciation in the government expenditure reduces the public debt by 1.582 times the change in government expenditure. Hence the model refutes the common notion and assumption that public debt is reduced only when the government curbs its expenses. Hence public debt and government expenditure are inversely related parameters. This is supported by and consistent with both economic and financial literature which argues that is not necessary to decrease expenditure to curb debt and the fact that they may be negatively correlated. The reality of this performance is seen in the study period (2002-2013) which shows they are negatively correlated .

The second hypotheses: At a given p-value of 0.003 for the t-statistic value of -3.972 there is a statistically significant negative relationship at the level $\alpha = 0.05$ between public debt to GDP ratio and tax revenue to GDP ratio. Hence the null hypotheses stands rejected that is $(H_0)_2$ is rejected and $(H_1)_2$ is accepted.

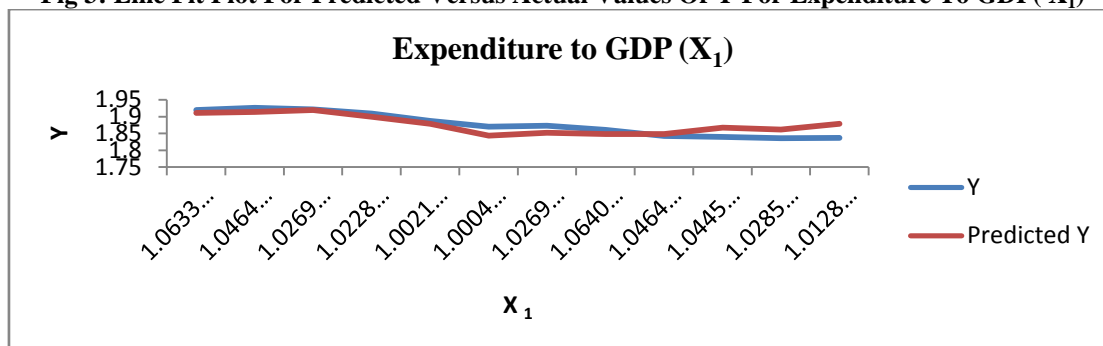
It is shown that an appreciation in the total tax revenue from both direct and indirect taxation reduces the public debt by 1.158 times the change in total tax revenue. This is supportive of a logical deduction(that the government needs to generate more revenue to pay off its outstanding obligations) and is also consistent with the economic and financial literature. The reality of this performance is seen in the study period (2002-2013) which shows that they are negatively correlated.

The details of the above arguments with support of reasoning and relevant literature will be discussed in the subsequent chapter.

F. INFERENCE

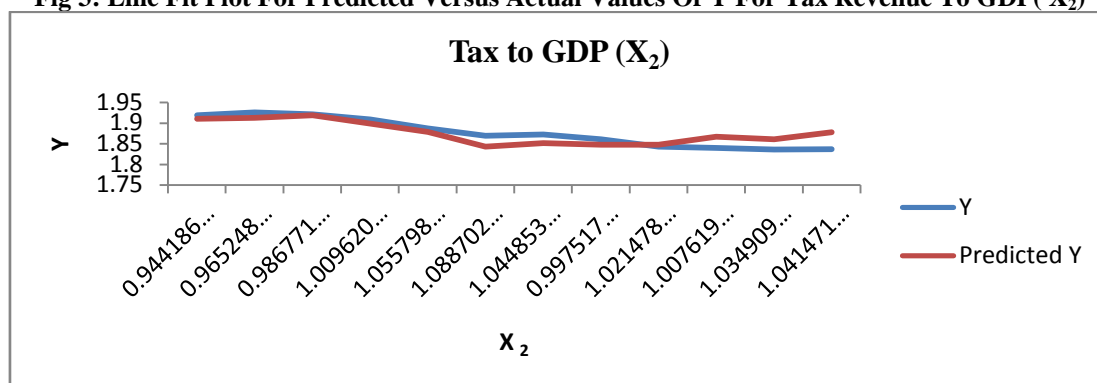
The summary of the regression output shows that our model has a coefficient of multiple correlation equal to 0.8 indicating a strong relationship between the dependent and explanatory variables. Further the r-square value of 0.64 indicates that the explanatory variables account for 64% of the variations in the dependent variable that is expenditure to GDP and tax to GDP ratios account for about 64% of the changes in debt to GDP ratio as far as the explained variation is concerned for India. This means there is a high degree of goodness of fit between the estimated regression function and the stochastic regression function. The F-statistic reached a value of 8.03 while the probability of its significance almost 0 shows that our model is statistically significant. The line fit plots showing the predicted versus the actual values of have been illustrated for both explanatory variables .

Fig 3: Line Fit Plot For Predicted Versus Actual Values Of Y For Expenditure To GDP(X_1)



Source: Prepared By Author Using MS- Excel Software

Fig 3: Line Fit Plot For Predicted Versus Actual Values Of Y For Tax Revenue To GDP(X₂)



Source: Prepared By Author Using MS- Excel Software

The above model is instrumental in forecasting the future values of public debt and take policy initiatives to reduce the alarming levels of debt that is a pressing issue for the RBI today.

G. LIMITATIONS OF THE STUDY

The major limitations of the study were that the period of study had to be extended to a span of 12 years to formulate the model. Moreover the data for other variables that account for unexplained variations on the dependent variables could not be determined.

In the following chapter we discuss and apply basic Keynesian macroeconomics to show how increasing expenditure and tax revenue, as determined by our model, can bring about a reduction in public debt and we substantiate our argument with relevant economic literature.

IV. REMOVING THE ASYMMETRIES OF DEBT: A NON TECHNICAL VIEW

In the previous chapter our data analysis concluded and provided a working model of increasing government expenditure and tax revenue to bring about a reduction in public debt. This is supported by the logical reasoning associated with the application of Keynesian macroeconomics to our model. According to Keynes for an open economy,

$$Y = C + I + G + NX$$

$$Y = (a + cY_d) + I + G + NX$$

$$Y = [a + c(Y - T)] + I + G + NX$$

- Where Y = National Income (In Terms Of GDP Output)
- Y_d= Net Disposable Income
- A = Autonomous Consumption, C = Marginal Propensity to Consume
- T = Tax Revenue
- C = Consumption Expenditure
- I = Investment Expenditure
- G= Government Expenditure
- NX = Income From Net Exports of Goods and Services

From the above it is essential to increase the GDP or the national output(income) of the economy, which in turn decreases the debt to GDP ratio. If the overall tax revenue is increased as our model suggests then that will decrease the consumption expenditure which in turn reduces the GDP output. To compensate the decrease in GDP with increasing tax revenue a simultaneous increase in government expenditure is required. This has two impacts on the economy. First it brings the economy to the original level of output or higher as the impact of increasing government expenditure is greater in reducing debt than tax revenue. Second it provides the government sufficient resources to pay off its outstanding obligations, a direct consequence of increasing tax revenue.

"Nobody spends someone else's money as wisely as he spends his own"
-Milton Friedman

To increase government expenditure by itself is not a sufficient condition but increasing productive expenditure is a necessary condition to control the fluctuating levels of the asymmetric debt to GDP over the years. In India the problem lies in the inefficiency of government spending. If the government reduced its spending to curb its growing levels of debt, it will restrain the expansion of social overhead capital such as growth of infrastructure, crucial for developing countries such as India.

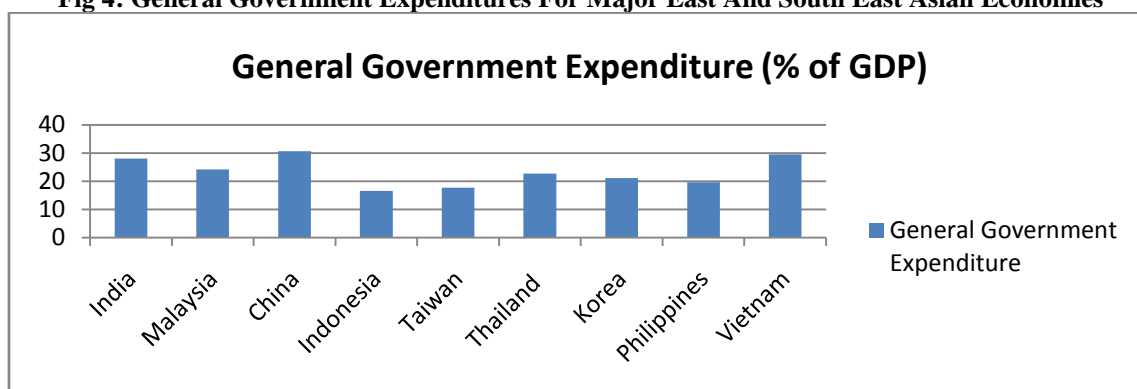
As per a working paper of 2016 ,empirical analysis in the case of India shows that the country is characterised by high growth rates accompanied by persistent government deficits. This shows that, while private capital formation remains crucial for the economy’s growth, the dynamics of the ratio public debt/GDP can be stabilised only if public spending is devoted to public investment to a significant extent. In the absence, or little relevance, of public investment, the effects of private investment on the debt ratio are not significant. Thus, contrary to the notion of public investment ‘crowding out’ private investment, the two must work together in the long run to stabilise the public debt trajectory. (Bhatt.A and Sardoni.C, 2016)

All those expenditures associated with the government that show an increase in the rate of capital accumulation(inclusive of both physical and human capital), that directly affect the economy's long run growth rate are considered productive expenditures. Unproductive expenditures are those that do not directly affect the growth and capital accumulation. An economy in the long run, can experience a stable ratio of the public debt to GDP despite persistent government primary deficits. A stable debt ratio is compatible with primary deficits if the latter are mainly devoted to financing productive expenditures that have a positive impact on the rate of growth as well as on private investment. (Bhatt. A. ibis)

In the above context, the distinction between productive and unproductive public expenditures is vital. These productive expenditures have an impact on capital accumulation either directly or through their effect on private investment. The growth of the productive capacity of an economy is contributed directly by them. Investment in infrastructure is a good example of this. Hence this supports our model in showing that productive expenditures must be increased in stabilising the debt to GDP ratio.

As far as major east and south east asian economies are concerned India's government expenditure is more higher than most of these countries as shown below.

Fig 4: General Government Expenditures For Major East And South East Asian Economies



Source: Prepared By Author Using MS- Excel Software. Data Collected From Livemint.Com

However in spite of these low expenditures, these countries have social welfare indicators that are higher than India. This indicates that the expenditure is wasteful and not well targeted. Most of this expenditure is in the form of subsidies to those people who can afford to pay. Moreover the debt servicing costs also constitute a large portion of the government's total annual spending.

Public debt can be considered to be bad if the government is unable to use it in a productive manner and simultaneously unable to raise sufficient tax revenue to meet its interest obligation. (Bhadani.P , 2016)

It is essential to note that the interest obligation of the government increases, as debt increases. If the borrowed funds are unable to recover the cost of borrowing as a result of unproductive expenditures or utilisation of funds raised from the public in the form of bonds. Therefore this also brings us to conclude that financing of deficit through debt should also be productive in nature to prevent creating any form of unnecessary burden of interest payment and repayment for the government.

V. CONCLUSIONS AND RECOMMENDATIONS

The study concludes by contradiction of the assumed null hypotheses that there exists a statistically significant and an inverse relationship between public debt and the explanatory variables of government expenditure and tax revenue. These two variables account for about 64% of the variation in the dependent variable. Hence both the tax revenue and productive expenditure of the government needs to increase as per the model to bring about a reduction in the public debt. It is also of vital importance that expenditure should increase only along productive lines which will directly bring about further growth in the economy and reduce the debt to GDP ratio, otherwise, it will result in the inefficient allocation of the resources of the government and widen its fiscal deficit.

On the basis of the above conclusions the author recommends the following:

- The borrowings of the government must be channelized in a way towards increasing investments and productivity.
- More efficient utilisation of the taxpayer's money through the expansion of social overhead capital such as increasing investments in infrastructure and education especially in a developing country like India.
- Reducing the non productive assets of banks which happens to be an issue of pressing concern for the banking industry in India.
- Disinvestment of dysfunctional public sector enterprises such as sick units or non- profitable industries. The sale proceeds from these are a part of the consolidated fund of India and can be used in reducing the public debt.
- Curbing the influence of the black economy that exists in India through which the government can collect sufficient tax. The goods and services tax introduced recently by the government is an important initiative towards this problem.

It is essential that government takes up appropriate measures to bring down and control the debt to GDP ratio as the current figures are a hindrance to India's credit rating upgrade by national and foreign rating agencies.

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Raghav Mehra "Analysing Public Debt Asymmetries : Effect of Taxation And Government Spending On Public Debt In India Between 2002- 2013 "IOSR Journal Of Humanities And Social Science (IOSR-JHSS). vol. 23 no. 04, 2018, pp. 85-94.