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THE CAUSAL RELATIONSHIP BETWEEN EXTERNAL DEBT AND ECONOMIC GROWTH IN INDIA: ERROR CORRECTION MECHANISM ESTIMATION

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Abstract: External debt is essential for economic growth but high levels of public debt adversely affect growth via debt overhang, crowding-out of domestic private investment and constraining countercyclical fiscal policy. This paper estimates the causal relationship between external public debt and economic growth in India along with other macroeconomic variables using annual time series data for 41 years from 1980 to 2020 and applying the error correction mechanism estimation method. The debt burden is segmented into two parts - external debt stock and external debt service and are measured as the percentage share to external debt to GDP and percentage share of total external debt service to total foreign exchange earnings. The estimated results show a significant positive impact of external debt stock on economic growth in the long run. There is no evidence of a debt overhang problem but evidence of external debt service potentially affecting growth by crowding out private investment. The effect of debt stock is less noteworthy as the negative effect of debt service exceeds the positive debt stock effect. The adverse effect of debt service both in long and short runs is significant The short-run disequilibrium is corrected at a reasonably good speed, providing the sanguinity of the external public debt in India.

Keywords: External debt, economic growth, debt overhang, crowding out, ECM estimation

INTRODUCTION

Almost all economies have public debt and external public debt plays an imperative role in determining economic growth. Public debt is a universal phenomenon found in all countries and has an important influence over the economy both in the short run and the long run (Kumar and Woo, 2015). The sources of public debt are internal and external public debt. The sources of internal public debts from which the government borrows include individuals, banks, business firms and others and the sources of external debt are the

foreign commercial banks, international financial institutions like IMF, World Bank, and other national governments, as debt owed to non-residents repayable in terms of foreign currency, food or service. The effect of external debt on investment and economic growth of the country has remained questionable and there has not been consensus on the impact of external debt on economic growth. External debt may be used to stimulate the economy but whenever a nation accumulates substantial debt, a reasonable proportion of public expenditure and foreign exchange earnings will be absorbed by debt servicing and repayment with heavy opportunity cost (Wijeweera *et al.* 2007). The conventional view is that public debt reflects deficit financing and hence stimulate aggregate demand and output in the short run, but crowds out capital and reduces output in the long run (Elmendorf and Mankiw, 1999) An excessive external debt constitutes an obstacle to sustainable economic growth and poverty reduction (Ajayi and Oke, 2012). Moreover, public debt, foreign debt, has an independent existence outside the budget and public finance.

Public debt influences the economy through several channels. High levels of public debt can adversely affect capital accumulation and growth via higher long-term interest rates, higher future distortionary taxation, inflation, and greater uncertainty about prospects and policies. In more extreme cases of a debt crisis, by triggering a banking or currency crisis, these effects can be magnified. High debt is also likely to constrain the scope for countercyclical fiscal policies, which may result in higher volatility and further lower growth. In the standard neoclassical growth theory, an increase in government debt leads to slower growth due to a fiscal deficit, a temporary decline in growth along the transition path to a new steady-state while in the endogenous growth, high government debt leads to a permanent decline in economic growth. Long historical data series shows that the difference in median growth rates of GDP between low debt (below 30 percent of GDP) and high debt (above 90 percent of GDP) groups of advanced economies is 2.6 percentage points and 2.1 percentage points in emerging economy groups (Reinhart and Rogoff, 2010). The difference in average growth rates between low and high debt advanced economies is even larger by 4.2 percentage points.

In developing country contexts, few available studies on the impact of external debt on economic growth are motivated by the debt overhang hypothesis, a situation where a country's debt service burden is so heavy that a large portion of output accrues to foreign lenders and consequently creates disincentives to invest (Krugman, 1988; Sachs, 1989). Even few available evidence on the public-debt-economic growth relationship in developing

countries are mixed. While studies like Imbs and Ranciere (2005) and Pattillo *et al.* (2011) find a nonlinear effect of external debt on growth i.e. a negative and significant impact on growth at high debt levels, typically over 60 percent of GDP and an insignificant impact at low debt levels, Cordella *et al.* (2010) find evidence of debt overhang for intermediate debt levels but an insignificant debt-growth relationship at very low and very high levels of debt. Despite the theoretical predictions and empirical evidence in advanced economies, there is little systematic analysis and evidence of the impact on GDP growth of high public debt. Specifically, little is known on the public debt effects on growth along with the other determinants of growth as well as issues such as reverse causality i.e. low growth can lead to large public debt (Kumar and Woo, 2015).

Therefore, this study attempts to examine the causal relationship between external public debt on economic growth in India along with other macroeconomic variables. This study uses annual time series data for 41 years from 1980 to 2020. The data are derived from the World Development Indicators of the World Bank. The macro variables considered are the GDP, gross capital formation, percentage share of external public debt to GDP and percentage share of total external public debt services to total foreign exchange earnings. Empirically, this study applies the error correction model to study the behaviour of the variables in India.

REVIEW OF LITERATURE

Shah and Pervin (2012) analyse the effect of external debt on economic growth in Bangladesh. during the period 1974 to 2010 applying the error correction model. To specify the debt overhang and crowding out effect of external public debt, the debt burden has been segmented into two parts - external debt stock and external debt service. The study shows a significant negative effect of external public debt service and a positive effect of external public debt stock on GDP in the long run. In the short run, the external public debt has a negative effect while the debt stock does not have any significant effect on the GDP. The study finds no evidence of debt overhang on GDP as there is no significant adverse effect of debt stock on GDP, but finds evidence of an adverse effect of debt service payment resulting in the crowding-out effect on economic growth. There is a dichotomy between debt stock and service payment, and hence the reconciliation of debt should be prudent to optimise growth.

Hadhek and Fatma (2014) examine the effects of debt on economic growth and the contribution of investment to the economic growth of 19 developing

countries covering the period 1990 to 2011 and applying dynamic panel data methods. The study hypothesises a negative effect of two measures viz. total external debt to GDP and external debt as a percentage of GNI ratio, on economic growth and negative interaction between these two debt measures and investment. The study finds external debt negatively affects economic growth and negative interaction between external debt and investment in these countries.

Kumar and Woo (2015) explore the long-run effects of high public debt on economic growth for a panel of advanced and emerging economies over the period 1970-2007. The study finds an inverse relationship between initial debt and subsequent growth. With a ten percent increase in the debt-GDP ratio, the annual growth of real GDP per capita decreases by 0.2 percentage points per year. The effect is much muted in developed countries. Only high levels of debt above 90 percent of GDP have a significant negative effect on growth. Patillo *et al.* (2011) show that the marginal impact of the net present value of external debt on economic growth becomes negative for debt ratios ranging from 5 to 50 percent of GDP.

Siddiqui and Malik (2001) examine the impact of rising external debt on economic growth in South Asian countries of Sri Lanka, Pakistan and India using various indicators of debt burden viz. debt-GDP, debt-exports and debt servicing-exports ratios. The study notes that the rate of debt accumulation and the increase in debt servicing have become the major factors affecting the growth rate of output in these economies after the 1980s. The study tests the non-linearity in the debt burden-growth relationship over the period 1975 to 1998 applying the panel data estimation methods. The panel estimates show the presence of a nonlinear relationship between economic growth and the indicators of debt burden. The negative impact of debt burden on the economic growth is statistically significant for Pakistan, whereas for the other two countries the significance of the ratios is below the critical levels.

Nwannebuike *et al.* (2016) aim to ascertain the impact of external debt on economic growth in Nigeria during the period 1980 to 2013 applying the error correction model. The study finds the external debt has a positive impact on the GDP in the short run, but a negative debt-GDP relationship in the long run. The external debt service payment also has a negative relationship with GDP. Thus, the external debt stock and debt service payment have a negative impact on the Nigerian economy.

Owusu-Nantwi and Erickson (2016) study the long term causal relationship between public debt and economic growth in Ghana using annual time series

data for the period 1970 to 2012 applying the vector error correction model. The estimated results show a positive and statistically significant long-run relationship between public debt and economic growth in Ghana. In the short run, a bidirectional Granger causality exists between public debt and economic growth.

In the Indian context, Mohanty and Mishra (2016) analyse the impact of public debt on economic growth using panel data for 14 major states in India for the period 1980-81 to 2013-14 applying the dynamic ordinary least square (DOLS) and fully-modified ordinary least square (FMOLS) methods. The study assesses the causal relationship between real public debt and gross state domestic product (GSDP), the proxy for real income, controlling for real institutional credit to the private sector and commercial consumption of electricity. After establishing the long-run relationship among the variables, the long-run estimates are drawn. The estimates from both methods suggest a positive and statistically significant impact of public debt and other variables on economic growth. The Dumitrescu-Hurlin pairwise causality test indicates the existence of bidirectional causality between public debt and economic growth.

Sasmal and Sasmal (2018) examines the impact of public expenditure on economic growth and the viability of fiscal policy when the deficit in the budget is financed by public borrowing. A number of alternative criteria have been used as indicators of solvency in fiscal balance. The study finds that the share of revenue expenditure of the government has significantly increased over time and the ratio of gross fiscal deficit to net national product has increased with an increase in the net national product causing a deterioration in the fiscal balance. The increase in total expenditure of the government has caused a rise in the ratio of revenue deficit to total spending. Interest payment on public debt has led to the increase of the ratio of gross fiscal deficit to income. If economic growth was to suffer, it will put an adverse impact on fiscal balance and the non-viability of fiscal policy in India at least in the short run.

Thus, the literature evidence on the external debt-economic growth relationship is mixed. From the evidence, the impact of external public debt on economic growth has been both positive and negative in developing countries, while it is negligible in advanced economies and that too only at very high levels of debt-GDP ratios, In the Indian context, it is observed that the public expansionary external debt policy is helpful for the economy in generating higher economic growth. Hence, it is pertinent and useful to understand the

nature of the causal relationship between external debt and economic growth in India for policy purposes.

DATA AND METHODOLOGY

To analyse the effect of external public debt on economic growth in India, this study uses time series data for 41 years for the period of 1980 to 2020. The data on GDP, gross capital formation, external public debt and foreign exchange earnings are derived from the World Development Indicators of the World Bank.

The neoclassical production function approach is used to explain the relationship of GDP growth with the debt burden. The production function considers debt burden as it affects the productivity of labour and accumulation of capital. Following Cunningham (1993), the aggregate production function can be specified as:

$$Y = f(K, L, ED) \tag{1}$$

As domestic debt and external debt affect the economy in different ways, to make the analysis more specific only external public debt is included in the production function.

ERROR CORRECTION MODEL

The econometric technique used in the empirical analysis is the Error Correction Model (ECM) methodology. To avoid any inconsistency in the coefficient estimation, the series is required to be stationary. Therefore, it is critical to check the presence of unit root and to identify the integration order of the series.

Stationarity Test: A time series is stationary if it has a time-invariant mean, time-invariant variance and covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed. The standard Augmented Dickey-Fuller (ADF) unit root test is used for potential non-stationary concerns. The regression to be estimated for the application of the ADF test is specified as:

$$\Delta y_t = \alpha + \beta t + \delta y_{t-1} + \Sigma_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t \tag{2}$$

where ε_t is the stochastic error term that is generated from a white noise process and is assumed to be independently and identically distributed with zero mean and constant variance. Sufficient lags of Δy_t must be included to ensure no

autocorrelation in the error term. The Schwarz Information Criterion (SIC) test is to be used to confirm that autocorrelation is not present. The null hypothesis is that the series has a unit root ($\delta=0$) meaning that the series is non-stationary against the alternative hypothesis of the series being stationary. If a unit root (non-stationarity) exists, then δ would not be statistically different from zero. If the p-value of the coefficient of y_{t-1} is less than 0.05 at 5 percent level of significance, the null hypothesis is rejected indicating that the series is stationary.

Cointegration Test: If an OLS regression is estimated with non-stationary data and residuals, then the regression is spurious. To overcome this problem, the two data series are to be stationary. If two variables are non-stationary i.e. I(1), then if the regression produces an I(0) error term, the equation is said to be cointegrated. For a long-run relationship, variables have to be cointegrated in the same order i.e. residual have to be stationary I(0). Although individually the variables are I(1), their linear combination is I(0) as their linear combination cancels out the stochastic trends. If the variables are not cointegrated in the long run, they do not have an equilibrium relationship and forecasting from that model is meaningless. To test for cointegration between two non-stationary time series, an OLS regression is to be run saving the residuals and then perform the ADF test on the saved residual to determine if the residual is stationary. The time series are said to be cointegrated if the residual is stationary. In effect, the non-stationary I(1) series have cancelled each other out to produce a stationary I(0) residual.

The Engel-Granger cointegration is analysed using the ADF test on residual ε obtained from the OLS regression:

$$\Delta\varepsilon_t = \tau_1 + \tau_2 t + \mu\varepsilon_{t-1} \tag{3}$$

This produces a t-statistic of τ. If the critical value for this model is greater than the calculated value, the null hypothesis of the non-stationary time series is to be rejected and the error term is stationary and the two variables are cointegrated.

Error Correction Mechanism: The ECM was first used by Sargam and later popularised by Engle and Granger to correct disequilibrium in the cointegrated series. If two variables are cointegrated i.e. move in the same direction, the short-run relationship may deviate from the long run relationship i.e. a disequilibrium may exist. To rectify the short run disequilibrium, an error correction term is to be included in the estimating model. According to the Granger representation theorem, if two variables are cointegrated, then the relationship between the two can be expressed as an error correction

mechanism (ECM), in which the error term from the OLS regression, lagged once, acts as the error correction term. In this case, the cointegration provides evidence of a long-run relationship between the variables and the ECM provides evidence of the short-run relationship. The error correction mechanism can be specified as:

$$\Delta y_t = \gamma_0 + \gamma_1 \Delta x_t + \lambda(\hat{\varepsilon}_{t-1}) + u_t \quad (4)$$

where λ is the error correction term coefficient, which theory suggests should be negative and whose value measures the speed of adjustment back to equilibrium following an exogenous shock. The error correction term $\hat{\varepsilon}_{t-1}$ which can be written as $(y_t - x_t)$ is the residual from the cointegrating relationship.

EMPIRICAL ANALYSIS

Following Iyoha (1999), the external debt burden is divided into debt stock burden and total debt service payments to capture the debt overhang and crowing out respectively. The total external debt stock and debt service payments are measured as a ratio to GDP and to total foreign exchange earnings respectively. The estimating empirical specification is:

$$GDP = \beta_0 + \beta_1 GCF + \beta_2\left(\frac{ED}{GGP}\right) + \beta_3\left(\frac{DS}{FEX}\right) + \varepsilon \quad (5)$$

Table 1 presents the definition, measurement and descriptive statistics of the variables used in the empirical estimation of the causal relationship between external debt and economic growth in India.

Unit Root Test: The results of the stationarity test presented in Table 1 shows the GDP and the debt service payments are measured as a ratio to GDP and EDS are stationary at levels while EDB and GCF are not stationary at levels. The ADF test for unit root at first difference shows that all the variables are stationary in their first difference.

Table 1
Augmented Dicky-Fuller Unit Root Test of Stationarity

Variable	*At level*		*At first difference*		*Integration order*
	Constant	*Constant + trend*	*Constant*	*Constant + trend*	
GDP	10.612*	4.311*	-5.235*	-4.907*	I(1)
GCF	1.234	-1.035	-5.88*	-6.375*	I(1)
EDB	-1.258	-2.228	-5.837*	-6.626*	I(1)
EDS	-2.486**	-1.395	-2.641*	-3.337*	I(1)

Note: *, ** Significant at 1, 5 percent levels.

OLS Estimates: Table 2 presents the OLS regression estimates of economic growth using White's heteroscedasticity-consistent variance and standard errors. The coefficients of gross capital formation (GCF) and the total external public external debt service to total foreign exchange earnings ratio are negative while the coefficient of share of external public debt to GDP ratio is significantly positive. For an increase in external debt, GDP increases by 0.23 percentage points while debt servicing decreases growth by 0.55 percentage points. Thus, the net effect of external debt on economic growth is negative.

Table 2
OLS Estimates of Economic Growth
Dependent variable: GDP

Variable	*Coefficient*	*Std. Err.*	*t-statistic*	*Prob.*
GCF	-35.621	1.162	-1.169	0.108
EDB	0.234**	0.042	3.501	0.005**
EDS	-0.573**	0.234	-3.650	0.003**
Constant	56.416***	2.213	-1.79	0.09***
R- square	0.696	Durbin-Watson statistic		4.671

Note: *,**, *** Significant at 1, 5, 10 percent levels.

Cointegration Test: The Durbin-Watson d statistics from the regression of the original model is used to test the cointegration of the variables. In this case, the d value is 0 for the null of no cointegration. The computed Durbin-Watson d value is 4.671, which is higher than the 5 percent critical value of 0.386. Therefore, the null is rejected and the variables are cointegrated. The Engel-Granger cointegration test is applied using the ADF test on residual ε obtained from the OLS regression. The estimated cointegration test results are reported in Table 3. The null hypothesis of no cointegration is rejected as all the test values are statistically significant.

Table 3
Augmented Dicky-Fuller Cointegration Test

At level		*At first difference*	
Constant	*Constant + trend*	*Constant*	*Constant + trend*
-3.417**	-3.373**	-4.032**	-3.707**

Note: *,** Significant at 1, 5 percent levels.

Error Correction Mechanism: Although the model is in equilibrium in long run, it may not be in equilibrium in the short run. To rectify the short run disequilibrium, the error correction term is included in the model:

$$\Delta GDP = \beta_0 + \beta_1 GCF + \beta_2 \Delta\left(\frac{ED}{GGP}\right) + \beta_3 \Delta\left(\frac{DS}{FEX}\right) + \lambda\left(\hat{\varepsilon}_{t-1}\right) + u_t \qquad (6)$$

The error correction term corrects the disequilibrium at a speed of λ. The coefficient of the error correction term λ is expected to be negative and significant to restore the equilibrium. The estimated results of the error correction model are presented in Table 4.

Table 4 ECM Estimates of Economic Growth

Dependent variable: ΔGDP

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
ΔGCF	-8.773*	2.671	-2.0123	0.055
ΔEDB	0.351	0.081	-0.623	0.539
ΔEDS	-0.615*	0.141	-5.896	0.008
$\hat{\varepsilon}_{t-1}$	-0.325*	0.128	-2.856	0.400
Constant	0.235	1.441	0.439	0.702
Adjusted R-square	0.4787	Durbin-Watson statistic		0.6925

Note: * Significant at 1 percent level.

The estimated ECM results are quite satisfactory especially as the speed of correction in short term disturbance towards the long-run stable relationship λ (-0.325) is negative and statistically significant. The ECM indicates that any divergence from the long-run relation in the current period should be adjusted by around 32 percent in the following period. This shows that the short-run disequilibrium is corrected by about 32 perent every year and eventually the long-run relationship would be restored in a short span of time. While an increase in external debt stock positively affects economic growth, debt servicing reduces economic growth. The growth-depressing effect of debt servicing outweighs the growth-promoting effect of debt stock resulting in the net negative effect of debt burden on growth. Further, the effect of the changes in the gross capital formation on growth is significantly negative. This implies the crowding-out effect of external debt, that external debt crowds out capital and reduce output growth in the long run. Thus, external debt impacts economic growth negatively in India.

CONCLUSION

This study examines the effect of external public debt on economic growth in India over a period of 41 years from 1980 to 2020. The study applies the

error correction mechanism method to estimate the long-run relationship between external debt stock and debt serving on GDP growth using the aggregate data derived from the World Bank statistics. To specify the debt overhang and crowding out effect of external public debt, the debt burden has been segmented into two parts, external debt stock and external debt service, and they are measured as the percentage share to external debt to GDP and percentage share of total external debt service to total foreign exchange earning respectively. The debt overhang and crowding-out effects of external public debt on economic growth are examined. The empirical results show a significant positive impact of debt stock only in the long run but no significant effect in the short run. This implies no evidence of a debt overhang problem in India. Debt overhang means some of the return from investment in the domestic economy will be taxed away by external creditors and the investors from both domestic and abroad get disincentive to invest and consequently growth is adversely affected. The obtained result of short-run insignificance is reasonable as capital formulation needs a long period of time to actuate productive activities. With the increases of debt stock more capital is accumulated which promotes growth in the long run. The capital stock increases as more debt are incurred, provided that at least part of the debt is used to finance investment. Further, external debt service potentially affects growth by crowding out private investment.

Public debt is acceptable for the budget deficit of the government, basically by the developing country for the development of the economy. The empirical results provide the relevance of the supportive role of debt stock to economic growth. But the effect of debt stock is less noteworthy as the negative effect of debt service exceeds the positive debt stock effect. The adverse effect of debt service both in long and short runs has been found to be significant from the empirical results. Beyond a certain threshold level, debt repayment capacity declines. As India has not yet reached the threshold level, an increase in debt stock increases the debt services payment. The short-run disequilibrium is corrected at a reasonably good speed in India. This provides the sanguinity about the prospect of debt in India.

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