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# External Debt and Economic Growth in India: Error Correction Model Estimation of the Causal Relationship

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**Abstract**

External debt is essential for economic growth; however, 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, respectively. 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 affects 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 the long and short run, 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. 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 and the long run (Kumar & 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 a consensus on the impact of external debt on economic growth. External debt may be used to stimulate the economy; however, when 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 stimulates aggregate demand and output in the short run, but crowds out capital and reduces output in the long run (Elmendorf & Mankiw, 1999). An excessive external debt constitutes an obstacle to sustainable economic growth and poverty reduction (Ajayi & 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

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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 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% of GDP) and high debt (above 90% of GDP) groups of advanced economies is 2.6 percentage points and 2.1 percentage points in emerging economy groups (Reinhart & Rogoff, 2010). The difference in average growth rates between low and high debt advanced economies is even larger (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 the 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 non-linear effect of external debt on growth, i.e. a negative and significant impact on growth at high debt levels, typically over 60% 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 & Woo, 2015).

Therefore, this study attempts to examine the causal relationship between external public debts 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, by 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 a negative interaction between these two debt measures and investment. The study finds that external debt negatively affects economic growth and a 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 10% 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% 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% of GDP.

Siddiqui and Malik (2001) examine the impact of rising external debt on economic growth in South-Asian countries like 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 non-linear 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 that 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, 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) examine 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 an increase in 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 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:

$$Y = f(K, L, ED) \quad (1)$$

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). 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 and 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:

$$\Delta y_t = \alpha + \beta t + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

Where, $\varepsilon_t$ 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 $\Delta y_t$ 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 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% 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. residuals 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 performing the ADF test on the saved residual to determine if the residual is stationary. The time series is 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:

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

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 show the GDP and the debt service payments, 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: * and **Significant at 1 and 5 per cent levels, respectively.

*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: *, **, and ***Significant at 1, 5, and 10% levels, respectively.

*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% 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: * and **Significant at 1 and 5% levels, respectively.

*Error Correction Model*: Although the model is in equilibrium in the 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:

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

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.* |
|---|---|---|---|---|
| **Δ**GCF | −8.773* | 2.671 | −2.0123 | 0.055 |
| **ΔED**B | 0.351 | 0.081 | −0.623 | 0.539 |
| ΔEDS | −0.615* | 0.141 | −5.896 | 0.008 |
| | −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% level.

The estimated ECM results are quite satisfactory, especially as the speed of correction in the 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% in the following period. This shows that the short-run disequilibrium is corrected by about 32% 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 is, external debt crowds out capital and reduces 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. They are measured as the percentage share to external debt to GDP and percentage share of total external debt service to total foreign exchange earnings, 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, both domestic and foreign, get disincentive to invest. 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 increase of debt stock, more capital is accumulated, which promotes growth in the long run. The capital stock increases as more debts 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.

Basically, public debt is acceptable for the budget deficit of the government of a developing country for the development of the economy. The empirical results

provide the relevance of the supportive role of debt stock to economic growth. However, 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 the long and short run, 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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