



## Crowding-in or crowding-out? The linkage between private investment and public debt of India using symmetric and asymmetric cointegration methodology

Shah Husain<sup>1</sup>

Mohammad Noor Alam<sup>2\*</sup>

Mohammed Wamique Hisam<sup>3</sup>

Laxman Ram Paliwal<sup>4</sup>

<sup>1</sup>Department of Humanities and Social Sciences, National Institute of Technology, Hamirpur, India.

Email: [shahhusain8@gmail.com](mailto:shahhusain8@gmail.com)

<sup>2</sup>Department of Accounting, College of Business Administration, University of Bahrain, Bahrain.

Email: [mohammedsg68@gmail.com](mailto:mohammedsg68@gmail.com)

<sup>3</sup>Department of Management, CCBA, Dhofar University, Salalah, Oman.

Email: [mhisam@du.edu.om](mailto:mhisam@du.edu.om)

<sup>4</sup>Department of Commerce, Swami Shradhdhanand College, University of Delhi, Delhi, India.

Email: [laxman\\_paliwal@yahoo.co.in](mailto:laxman_paliwal@yahoo.co.in)

### Licensed:

This work is licensed under a Creative Commons Attribution 4.0 License.

### Keywords:

Crowding

Domestic credit

GDP

Interest rates

NARDL approach

Private investment

Public debt.

### JEL Classification:

A10; E60; E69.

**Received:** 10 January 2023

**Revised:** 3 May 2023

**Accepted:** 11 May 2023

**Published:** 22 May 2023

(\* Corresponding Author)

**Funding:** This study received no specific financial support.

**Competing Interests:** The authors declare that they have no competing interests.

## 1. Introduction

The ratio of public debt to GDP (Gross Domestic Product) in India has increased persistently over the past several decades and has gone up from approximately 49 percent in 1980-81 to more than 69 percent in 2017-18. The increasing high debt-to-GDP ratio of the Indian Government shows that public debt, especially domestic debt, has grown to be a substantial source of financial resource mobilisation to meet its growing expenditure needs. The accumulation of public debt may increase policy uncertainty and impact economic growth by influencing macroeconomic factors such as interest rates, inflation, and investment (Islam & Hasan, 2007). Surging public debt raises concern about the potential crowding out of the private investment.

It has long been contested among academics and decision-makers whether public debt crowds out private investment, but some studies have found compelling evidence that it does. (Pradhan, Ratha, and Sarma (1990), Kulkarni and Balderas (1998), Mitra (2006), Dash (2016)).

Figure 1 illustrates the trends in India's total debt as a percentage of Gross Domestic Product (GDP) of India.

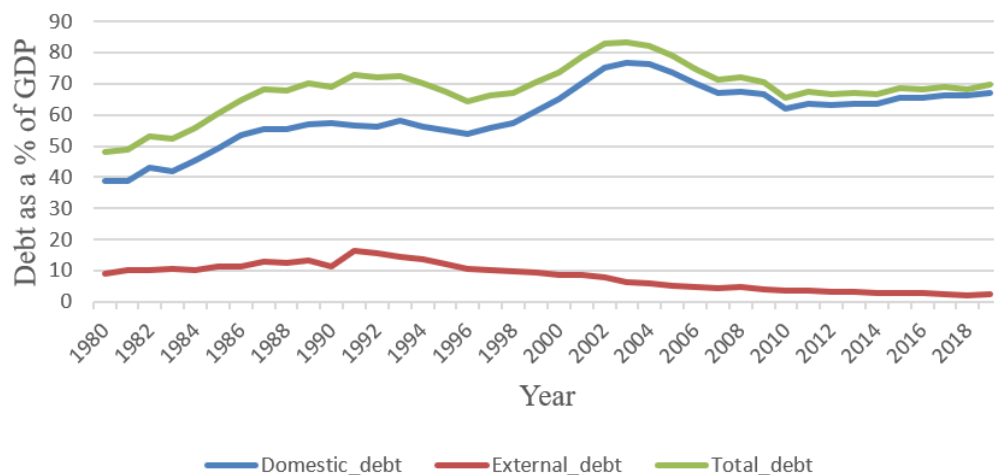


Figure 1. Trends in Indian public debt.

On the other hand, some other studies have suggested that an increase in public debt may not necessarily be destructive but rather act as a complementary to private investment depending upon how the Government has used the raised fund (Serven (1999), Chakraborty (2007), Bahal, Raissi, and Tulin (2018), Karun, Vinod, and Chakraborty (2020)). When government fund used to boost public services and infrastructure, it can increase marginal productivity and draw in additional private investment. Although a large body of literature analyses the impact of public debt on private investment, the empirical findings still need to be conclusive, and research on developing countries is limited. Most of the earlier studies in the Indian context have focused either on the issue of fiscal management or on understanding the nexus between public debt and economic growth.

With this motivation, the study assesses the impact of public debt on private investment in the Indian context. The study especially attempts to address two main issues. Firstly, to ascertain whether public debt crowds out or crowds-in private investment. Secondly, to check whether the relation between public debt and private investment is symmetric or asymmetric. we have employed a nonlinear distributed lag model as suggested by Shin, Yu, and Greenwood-Nimmo (2014) To assess the asymmetry in the private investment function. The findings of the present study show that private investment has an asymmetric response due to the changes in public debt in the long run. The long-run asymmetries show that positive changes in debt do not crowd out private investment, while negative changes in debt crowd in private investment more than positive changes.

## 2. Review of Literature

It is generally contended that an increase in government spending crowds out private investment. However, some empirical findings on the issue have led some scholars to believe that the effect of public debt on private investment is not necessarily deleterious (Andersen, 1986; Keran, 1969). The lack of unanimity among scholars regarding the impact of increased public debt on private investment has fuelled a controversy on the crowding-out issue, which has taken place on two fronts – theoretical and empirical. Theoretically, there are distinct views/ strands of literature on the crowding-out effect of public expenditure. Classical economists contend that government spends on crowds out private investment. The impact of increasing government spending on private investment spending depends on how the fiscal imbalance is financed. The Government can finance the increased expenditure through money creation or borrowing from the public, i.e., bond financing or increased taxation. The first method of financing is monetary. The latter two are purely fiscal measures and do not involve changes in the current stock of money supply. It simply implies transferring already available resources from the private sector to the public sector. Classical economists believed this would crowd out private investment unless accompanied by an appropriate monetary measure. In the classical setting, there is always full employment in the economy. So, any government intervention in the form of increased spending would only alter the composition of total output, thereby impacting relative prices.

Since the economy is already working at a full employment level, Government's effort would bid up the price of resources and discourage the private sector from investing and spending. Neoclassicism takes a strict action against financial crowding-out. Klien (1968), advocated utilizing fiscal stimulus to aid in the revival of the economy. With the help of the fiscal multiplier theory and the liquidity preference theory of interest rate, Keynes maintained that government spending does not crowd out private investment. The liquidity preference theory ensures that government spending would increase the velocity, implying efficient utilization of existing

money stock. The multiplier demonstrated that the induced increase in income due to government spending would result in higher savings and taxes, which would be sufficient to cover the deficit. But Keynes himself noted few caveats to this multiplier mechanism. He noted that the influence of government expenditures on business psychology would determine the effect on private investment, "with confused psychology which often prevails, the Government program may, through its effect on 'confidence,' increase liquidity preference or diminishing the marginal efficiency of the capital, which, again, may retard other investment unless measures are taken to offset it. Secondly, he warned that as income increases with the rise in employment, the marginal propensity to consume would decline, which, in turn, will weaken the multiplier effect. The monetarists have severely attacked the Keynesian view. Monetarists like classical and neo-classical believed that tax-financed or bond-financed government expenditure crowds out private investment spending.

Crowding out is a phenomenon that is not all or nothing. Crowding out is the displacement of private economic activity by public economic activity. It could be complete or partial. It varies in degrees and it has limited effects. For instance, Friedman emphasized "the necessity to distinguish between initial and subsequent effects of fiscal policy. According to Friedman, an "expansionary" fiscal action might first be reflected in a rise in output, however, funding the deficit would unleash contractionary factors that might ultimately cancel out the initial stimulative benefit. (Buiter, 1977). Proposed a comprehensive taxonomy of crowding-out. He offered four categories of crowding-out based on degrees of crowding-out, short-run or impact vs. long-run effects, indirect or system-wide and direct effect. Indirect crowding-out results from competing demands for scarce goods. The appropriation of resources by the Government bids their prices up. This phenomenon has also been termed financial crowding-out. When public expenditure replaces private spending unit for unit, this is known as direct or actual crowding-out. Again, the impact of crowding out can also depend on the specific content of government spending. Aschauer (1989), argued that public investment in infrastructure positively impacts private sector productivity and output growth, both directly and indirectly." The availability of public capital to support private sector production, along with the ability to distribute goods and services across the domestic and worldwide market, have a direct impact on the expansion of the private sector's output. An increase in the stock of public capital enhances the return on private capital, which in turn serves to drive the rate of expansion of the private sector capital. This indirect effect results from the complementarity between private and public capital in private sector productive activity. The empirical findings of Blejer and Khan (1984), Greene and Villanueva (1991), Canning and Pedroni (2008), and Fic and Portes (2013) further substantiated (Aschauer, 1989) argument. Pradhan et al. (1990), Kulkarni and Balderas (1998) and various other studies did not find evidence that corroborates the complementarity between public infrastructure investment and private sector productivity and output growth. This complementary relation depends upon the economic structure of a country. Erden and Holcombe (2005) maintained that although public infrastructure acts as complementary to private sector investment in developing countries, the scenario is the opposite in the case of developed countries.

Serven (1999) in his study, he examines the interactions between public and private investment in India and presents evidence of crowding out of private capital in the short run and crowding in of private capital as a result of infrastructure investment in the long run. Mitra (2006) has conducted structural VAR model on data from 1969–2005 on three variables of public Investment, Private Investment, and output and concluded that public investment "crowds out" private investment. Chakraborty (2007) analysed the real (direct) and financial crowding out effect of public investment on private Investment in India from 1971 to 2003. The study also considered the heterogeneous effect of public investment by analysing the differential impact of public infrastructure and non-infrastructure investment on private corporate investment and found no evidence of real (direct) crowding-out effect of public investment on private investment; rather, the findings indicated a complementary relation between the two in general and the public infrastructure investment and private corporate investment. Further, the study indicated that although private investment is interest-sensitive, the fiscal deficit has no impact on the real interest rate. Thereby, the study found no evidence of financial crowding-out.

Bahal et al. (2018) used the Structural-Vector Error Correction model (SVEM) in three variables (public investment, private investment, and output) from 1950 to 2012 to examine whether the economic liberalization implemented in the 1990s had an impact on the relationship between public investment and private investment in India. When the sample was limited to post-the 1980s to account for the economic liberalization, it was discovered that public investment does crowd out private investment over the full sample period 1950-2012. Dash (2016) also examined the impact of public investment on private Investment in India during 1970–2013 and result suggested strong evidence of crowding out the effect of public investment on private investment. But the crowding-out effect is only partial, which tends to increase over long-term horizons of 4 to 5 years. He further found that the crowding-out effect has lessened in the post-liberalization period. Besides, the study suggested that not all components of public investment are dampening; the public infrastructure investment is, in fact, complementary to private investment. Mallick (2016) also analysed the heterogenous impact of infrastructure and non-infrastructure components of public investment on private investment and income using SVAR and an 'impulse response function. The non-infrastructure component of public investment is mostly to blame for the evidence of the crowding-out effect of public expenditure on private investment seen in all studies undertaken from an Indian perspective. However, the effect of public

infrastructure investment on income is larger than that of non-infrastructure public investment. Based on this finding, the study suggested that the Government should increase investment in the infrastructure component as it seems complementary to private investment. Karun et al. (2020) also found evidence which supports the crowding-in effect of public investment on private investment. They maintained that public infrastructure investment is a significant factor in determining private investment.

The present study differs from the previous studies and contributes to the existing literature in two ways. First, several studies have focused on the linear cointegration relationship between private investment and public debt, but there has yet to be a study that examined this hypothesis in the Nonlinear ARDL cointegration relationship. Therefore, this study used the NARDL approach (Shin et al., 2014) to examine the asymmetric effect of public debt on private Investment in India. Secondly, studies have not emphasized interest rates influencing Private Investment in India. Thus, to our knowledge, this is the first study that fulfils these two research gaps in the Indian context.

### 3. Data and Methodology

This study used annual time series data from 1980 to 2019. The dataset includes private investment as a percentage of GDP, public debt as a percentage of GDP, domestic credit to the private sector, and interest rates. Where Public debt is the main variable of interest that affect private investment, other variables are considered as control variables. All the data sources were taken from the handbook of India's statistics, Reserve Bank of India. The following mathematical model has been used to examine the nexus between private investment and public debt.

$$PI_t = \beta_0 + \beta_1 PD_t + X_t + u_t \quad (1)$$

Where  $PI_t$  is private Investment,  $PD_t$  is the measurement of public debt in India,  $X_t$  is a set of control variables that include domestic credit to the private sector, and interest rate and  $u_t$  is the error term.

#### 3.1. Unit Root Test

The study used a unit root test to check the stationarity of the variables. In time-series data, it is essential to test the stationarity of the variables before making an estimation. In the unit root, we employed ADF (Augmented –Dickey fuller) and PP (Phillips Perron) tests. In the case of both ADF and PP-tests, the null hypothesis assumes that the variables are non-stationary.

#### 3.2. Nonlinear ARDL Model

For conducting cointegration tests in empirical studies to analyse the long-term relationship of variables in a bivariate or multivariate framework, methods of Engle and Granger (1987) and Johansen and Juselius (1990) These methods are better when variables are integrated with different orders. Further, Pesaran, Shin, and Smith (2001) introduced a new technique, commonly recognized as the Auto-regressive distributed lag (ARDL) model and this model can be used when all variables are not integrated in the same order of integration. The ARDL model also has the advantage of simultaneously assessing long-run and short-run parameters in a model (Khan, Adil, & Husain, 2021). Further, the linear ARDL model of cointegration was developed into a nonlinear ARDL model suggested by Shin et al. (2014). The Nonlinear ARDL (NARDL) model allows the possibility of asymmetric effects of positive and negative changes in independent variables on the dependent variable. The NARDL estimation also offers the cumulative dynamic multiplier graphs that are useful to identify the patterns of adjustment following both positive and negative shocks to independent variables. For this study, we have been used the asymmetric cointegration technique applying the NARDL model suggested by Shin et al. (2014) to explain the negative and positive effects of public debt on private Investment in India. The asymmetric ARDL model for Equation 1 can be written as follows:

$$y_t = \beta_1 x_t^+ + \beta_2 x_t^- + e_t \quad (2)$$

Where,  $y_t$  is the dependent variable,  $x_t^+$  and  $x_t^-$  are the partial sum of upward and downward changes in  $K \times 1$  vector of  $x_t$ ,  $e_t$  is the error term, whereas  $\beta_1$  &  $\beta_2$  denote the asymmetric effect of regression in the long-run,  $x_t$  is equivalent as:

$$x_t = x_0 + x_t^+ + x_t^- \quad (3)$$

These positive and negative changes in the above equation ( $x_t^+$  &  $x_t^-$ ) are defined as:

$$x_t^+ = \sum_{i=1}^t \Delta x_t^+ = \sum_{i=1}^t \max(\Delta x_i, 0) \quad (4)$$

$$x_t^- = \sum_{i=1}^t \Delta x_t^- = \sum_{i=1}^t \min(\Delta x_i, 0) \quad (5)$$

The following variables are being constructed, applying the methodology given by Shin et al. (2014) to examine the asymmetric effect of variables (debt-to-GDP ratio, Domestic credit to private sector and interest rate) on Private Investment.

$$PD_t^+ = \sum_{i=1}^t \Delta PD_t^+ = \sum_{i=1}^t \max(\Delta PD_i, 0) \quad (6)$$

$$PD_t^- = \sum_{i=1}^t \Delta PD_t^- = \sum_{i=1}^t \min(\Delta PD_i, 0) \quad (7)$$

$$INT_t^+ = \sum_{i=1}^t \Delta INT_t^+ = \sum_{i=1}^t \max(\Delta INT_i, 0) \quad (8)$$

$$INT_t^- = \sum_{i=1}^t \Delta INT_t^- = \sum_{i=1}^t \min(\Delta INT_i, 0) \tag{9}$$

$$DC_t^+ = \sum_{i=1}^t \Delta DC_t^+ = \sum_{i=1}^t \min(\Delta DC_i, 0) \tag{10}$$

$$DC_t^- = \sum_{i=1}^t \Delta DC_t^- = \sum_{i=1}^t \min(\Delta DC_i, 0) \tag{11}$$

$PD_t^+$  &  $PD_t^-$ ,  $INT_t^+$  &  $INT_t^-$ ,  $DC_t^+$  &  $DC_t^-$  are the positive and negative variables of public debt, interest rate and domestic credit to the private sector, respectively, respectively, shown in Equations 6, 7, 8, 9, 10, 11.

After generating the asymmetric parameters of different chosen variables, used NARDL model (Shin et al., 2014). The NARDL model of our data series is as follows:

$$\begin{aligned} \Delta PI_t = & \alpha_0 + \theta_1 PI_{t-1} + \theta_2 PD_{t-1}^+ + \theta_3 PD_{t-1}^- + \theta_4 INT_{t-1}^+ + \theta_5 INT_{t-1}^- + \theta_6 DC_t^+ + \theta_7 DC_t^- + \sum_{i=1}^k \alpha_{1i} \Delta PI_{t-i} \\ & + \sum_{i=0}^k \alpha_{2i} \Delta PD_{t-i}^+ + \sum_{i=0}^k \alpha_{3i} \Delta PD_{t-i}^- + \sum_{i=0}^k \alpha_{4i} \Delta INT_{t-i}^+ + \sum_{i=0}^k \alpha_{5i} \Delta INT_{t-i}^- \\ & + \sum_{i=0}^k \alpha_{6i} \Delta DC_{t-i}^+ + \sum_{i=0}^k \alpha_{7i} \Delta DC_{t-i}^- + E_t \end{aligned} \tag{12}$$

Where in Equation 12, the coefficients without summation show long-run asymmetric effects and the coefficients with summation show short-run effects; k is the optimal lag length for each variable and is decided by the Akaike information criterion. The cointegration relationship is applied to the null hypothesis ( $H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = 0$ ). The evidence of asymmetries can be tested through the Wald test with the null of symmetry, that is ( $\theta_2 = \theta_3, \theta_4 = \theta_5, \theta_6 = \theta_7$ ), rejection of the null hypothesis indicates the presence of nonlinearity or asymmetry in the data set. Additionally, the error correction process can be studied, revealing the speed of adjustment, if long-run relations are present. This study also estimated the dynamic multiplier effects of public debt, interest rate and domestic credit to the private sector on private investment.

#### 4. Empirical Discussion

To avoid misleading results, we employ the stationary test for the variables used in the study and after that the augmented Dickey-Fuller (ADF) and Phillips- Perron (PP) unit root tests were applied to ensure that the variables are integrated at I (2), which is required to check in the bounds testing procedure. The results of the unit root tests provided in Table 1, shows private investment, domestic credit to the private sector, interest rate, domestic debt and external debts are I(1), while total public debt is I (1), which implies that none of these variables are I (2). The tests show that all variables are incorporated into order 1, and the results of the ADF and PP unit root tests support this conclusion.

Before employing the NARDL test, the study also applied ARDL bound test and found the results of the cointegration test reported in Table 2, shows that cointegration exists for all the measure of public debt except external debt. The results of the diagnostic tests suggest that the estimation has no serial correlation and no heteroscedasticity issue found.

Table 1. Stationary test results.

Variables	ADF test		PP test (Phillips- Perron)	
	Level	First difference	Level	First difference
PI	- 1.26	-7.56*	- 1.24	- 7.44*
DPD	-1.69	-3.38*	- 2.13	-3.67**
EPD	-0.22	-7.05*	-0.18	- 6.98*
TPD	-2.73***	- 3.92*	- 2.61***	- 3.96*
INT	-0.52	-6.15*	-0.33	-0.94
DC	-0.65	-3.34**	-0.46	-5.40

Note: \*, \*\*, \*\*\* denote statistically significant at 1%, 5%, and 10% level respectively. Whereas PI means private investment, DPD means domestic public debt, EPD means External public debt, TPD means Total public debt, INT means Interest rate and DC means Domestic credit

Table 2. ARDL cointegration bound test results.

	Domestic debt	External debt	Total debt
Bound test (F-statistics)	5.57*	2.57***	4.68**
Diagnostic test			
R-square	0.54	0.42	0.51
Adjusted R-square	0.35	0.18	0.30
Heteroscedasticity test	0.33	0.24	0.20
Serial correlation Lagrange Multiplier test	0.34	0.60	0.61

Note: \*, \*\*, \*\*\* Denote statistically significant at 1%, 5%, and 10% level respectively.

However, the long-run coefficient of all the measures of debt, interest rate and domestic credit to the private sector are shown in Table 3. According to the long-run projections, total governmental debt and



domestic debt both significantly increase private investment by 0.26 and 0.31, respectively, although the impact of external debt on this sector is negligible. For models of domestic and total public debt, the coefficient of interest rate has a negative impact on private investment; however, for models of external debt, the negative impact is significant. Moreover, the coefficient of domestic credit to the private sector has insignificant effects on private investment. These symmetric cointegration results may lead to inappropriate inferences due to the apparent misspecification involved in the symmetric model, so asymmetric estimation is required to get effective conclusions.

NARDL results are represented in Table 4. The findings show the long-run asymmetries for all the measures of public debt (domestic, external, and total debt). Long-term changes in public debt have an asymmetric impact on private investment. Private investment increases by 0.64, 0.88 and 0.39 percent due to the one percent positive shocks in domestic debt, external debt, and total public debt. On the contrary, the negative shocks in public debt (domestic, external, and total debt) increase private investment by 2.41, 1.32 and 1.86 percent points, respectively. The one percent points out positive shocks in domestic debt, external debt, and total governmental debt cause an increase in private investment of 0.64, 0.88, and 0.39 percent, respectively. On the other hand, domestic, overseas, and total public debt negative shocks raise private investment by 2.41, 1.32, and 1.86 percentage, respectively. Hence, Private investment responds more strongly to negative than to positive shocks, suggesting that private investment rises sharply when there is less public debt. The positive shocks in interest rate crowd out private investment by 3.97, 4.05 and 2.94 percent for all measures of public debt while negative shocks in interest rate increase private Investment in Table 4. The results of change in the public debt have positive effects on private investment in short-run and long run in India, which are in line with Mallick (2016) and Karun et al. (2020), who found evidence of the crowding-out effect of public investment on private investment in India. The results of the present study are different from Serven (1999), Mitra (2006) and Chakraborty (2007), which suggest crowd-out effects in India.

Table 3. Long-run coefficients with private investment as a dependent variable.

Variables	Domestic debt	External debt	Total debt
Debt	0.31**	1.96***	0.26**
INT	-1.18**	3.63***	-1.79**
DC	-0.35	-0.01	-0.23

Note: \*\*, \*\*\* Denote statistically significant at 5%, and 10% level respectively.

Table 4. NARDL model long-run coefficients.

Long-run estimation	Domestic debt	External debt	Total debt
Variables			
Debt <sup>+</sup>	0.64*	0.88**	0.39*
Debt <sup>-</sup>	2.41**	1.32**	1.86*
INT <sup>+</sup>	-3.97	-4.05	-2.94***
INT <sup>-</sup>	0.65	0.73	0.48
DC <sup>+</sup>	-1.24*	0.15	-0.56*
DC <sup>-</sup>	0.21	-0.005	-0.34
Long-run asymmetries			
Debt	7.45*	14.63*	18.27*
INT	2.14	3.63***	3.49***
DC	1.50	0.025	2.69
Diagnostic test			
R-squared	0.77	0.72	0.79
Adjusted R-squared	0.50	0.71	0.55
Heteroscedasticity test	0.11	0.10	0.28
Portmanteau test	0.05	0.18	0.06
Ramsey RESET test	0.55	0.89	0.03

Note: \*, \*\*, \*\*\*denote statistically significant at 1%, 5% and 10%level of significance respectively.

### 5. Conclusion and Policy Recommendations

The present study examined the link between private investment and public debt using symmetric and asymmetric cointegration methodology. The results of the symmetric cointegration model show that a long-run relationship exists between private investment and the measure of public debt, except external debt. These symmetric cointegration results may lead to inappropriate inferences due to the apparent misspecification involved in the symmetric model, so the present study applies asymmetric estimation to get effective conclusions. The results demonstrate that changes in long-term governmental debt have an asymmetric impact on private investments. The long-run asymmetries show that positive changes in debt do not crowd out private investment, while negative changes in debt crowd in private investment more than positive changes. According to this study's findings, private investment is crowded out by increasing government spending through borrowing, which is contrary to what traditional economists assume. This study on

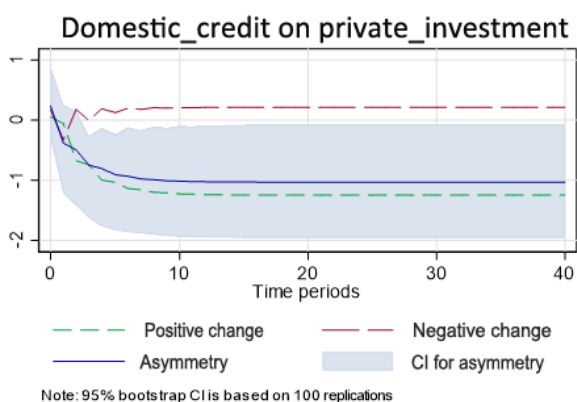
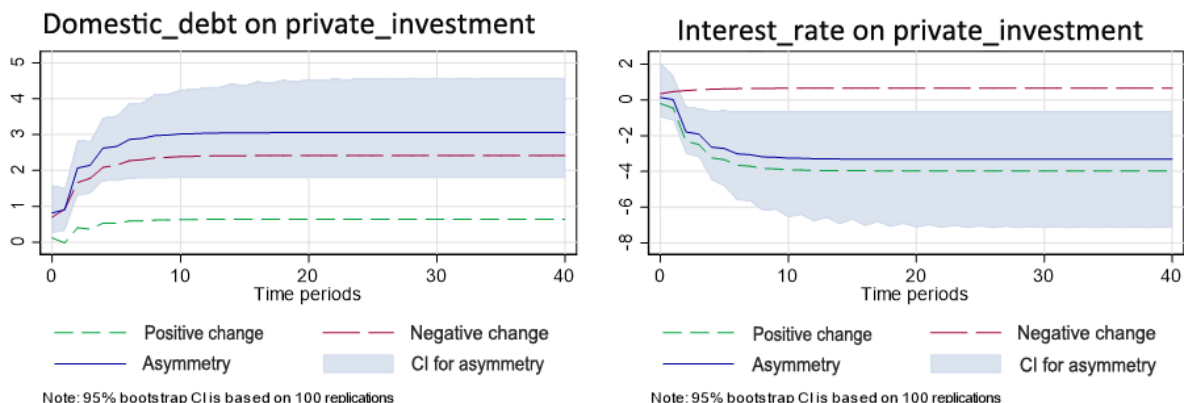
asymmetric public debt-investment links may have important policy implications. A decrease in borrowing may result in a long-term increase in private investment since long-run asymmetries show that negative shocks to debt have a greater crowding effect in India. Therefore, a reduction in government debt could be a suitable path to stimulate economic growth.

## References

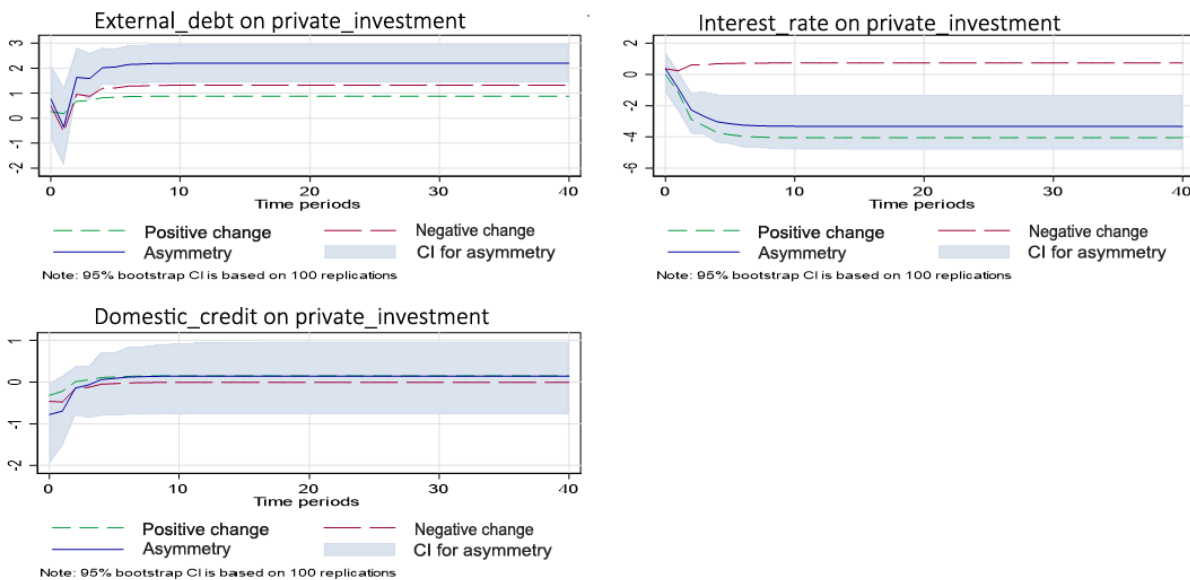
- Andersen, L. C. (1986). Monetary and fiscal actions: A test of their relative importance in economic stabilization. *Review, Federal Reserve Bank of St. Louis*, 50(Nov), 11-23.
- Aschauer, D. A. (1989). Public investment and productivity growth in the group of seven. *Economic Perspectives*, 13(5), 17-25.
- Bahal, G., Raissi, M., & Tulin, V. (2018). Crowding-out or crowding-in? Public and private investment in India. *World Development*, 109, 323-333.
- Blejer, M. I., & Khan, M. S. (1984). Government policy and private investment in developing countries. *IMF Staff Papers*, 31(2), 379-403.
- Buiter, W. H. (1977). 'Crowding out' and the effectiveness of fiscal policy. *Journal of Public Economics*, 7(3), 309-328.
- Canning, D., & Pedroni, P. (2008). Infrastructure, long-run economic growth and causality tests for cointegrated panels. *The Manchester School*, 76(5), 504-527.
- Chakraborty, L. S. (2007). *Fiscal deficit, capital formation, and crowding out in India: Evidence from an asymmetric VAR model (No. 518)*. Retrieved from Working papers//The Levy Economics Institute.
- Dash, P. (2016). The impact of public investment on private investment: Evidence from India. *Vikalpa*, 41(4), 288-307.
- Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, 55(2), 251-276.
- Erden, L., & Holcombe, R. G. (2005). The effects of public investment on private investment in developing economies. *Public Finance Review*, 33(5), 575-602.
- Fig, T., & Portes, J. (2013). *Macroeconomic impacts of infrastructure spending*. Retrieved from In Report to Trade Union Congress.
- Greene, J., & Villanueva, D. (1991). Private investment in developing countries: An empirical analysis. *IMF Staff Papers*, 38(1), 33-58.
- Islam, M. F., & Hasan, M. S. (2007). The macroeconomic effects of government debt on capital formation in the United States: An empirical investigation. *The Manchester School*, 75(5), 598-616. <https://doi.org/10.1111/j.1467-9957.2007.01032.x>
- Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210. <https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x>
- Karun, H., Vinod, H., & Chakraborty, L. S. (2020). Did public investment crowd out private investment in India? *Economic and Political Weekly*, 55(30), 21.
- Keran, M. W. (1969). Monetary and fiscal influences on economic activity- the historical evidence. *Federal Reserve Bank of St. Louis Review*, 51(Nov), 5-24.
- Khan, M. A., Adil, M. H., & Husain, S. (2021). The impact of economic uncertainty, stock market uncertainty and monetary uncertainty on money demand in India. *International Journal of Emerging Markets*(ahead-of-print).
- Klien, L. R. (1968). *The Keynesian revolution*. London: The Mcmillan Company.
- Kulkarni, G., & Balderas, J. (1998). An empirical study of the crowding out hypothesis: A case of Mexico. *Prajnan*, 27, 263-279.
- Mallick, J. (2016). *Effects of government investment shocks on private investment and income in India (No. 315)*. Retrieved from Working Paper.
- Mitra, P. (2006). Has government investment crowded out private investment in India? *American Economic Review*, 96(2), 337-341.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Pradhan, B. K., Ratha, D. K., & Sarma, A. (1990). Complementarity between public and private investment in India. *Journal of Development Economics*, 33(1), 101-116.
- Serven, L. (1999). *Does public capital crowd out private capital? Evidence from India*: Retrieved from Policy Research Working Paper Series No. 1613, The World Bank.
- Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modeling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In R. Sickles & W. Horrace (Eds.), *Festschrift in Honor of Peter Schmidt*. In (pp. 281-314). New York: Springer.

## Appendix

Appendix showing the impact of domestic debt, external debt and total debt on private investment of India.

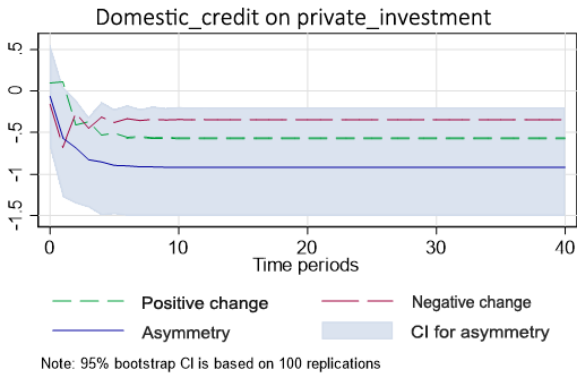
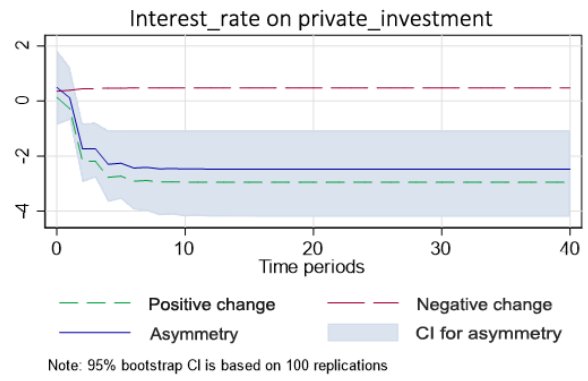
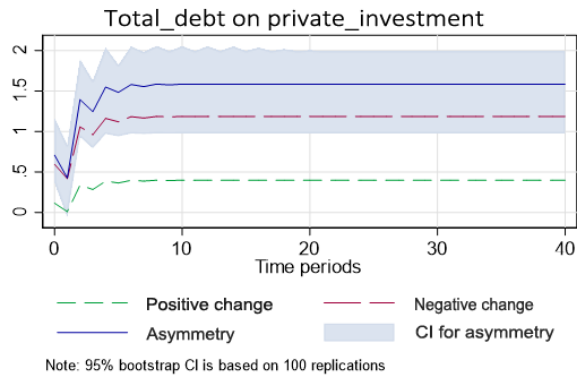


Panel A. In the case of domestic debt.



Panel B. In The case of external debt.





Panel C. In the case of total debt.