



## LONG-RUN RELATIONSHIPS AND CAUSALITY TESTS BETWEEN MILITARY EXPENDITURE AND ECONOMIC GROWTH IN INDIA

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### ABSTRACT

*Economists recognize that the public expenditure has an impact on economic growth. The rising level of military spending over other classes of public expenditure like economic and social services has raised a serious concern among scholars and have been at the core of recent development literature and thinking. In this study, we focus on to reexamine the effects of military spending on economic growth in India using annual data from the period of 1980 to 2011. The analysis is carried out within a multivariate setting that includes real GDP, real government military expenditure, population and real export.. In this paper, the autoregressive distributive lags (ARDL) cointegration approach is used to reexamine the long-run relationships among the variables. We then employ the Granger causality test to identify the direction of causality. The results for ARDL tests indicate that there is a significant relationship between military expenditure and economic growth in the short run, while the long run results suggest otherwise. While the estimated granger causality outcomes, revealed a unidirectional relationship between GDP and military spending.*

**Keywords:** Military expenditure, Economic growth, ARDL, Granger causality, India.

### Contribution/ Originality

There are many studies that tried to examine the relationship between military expenditure and economic growth. However, most of these studies used cross-sectional and panel data, this suggest that empirical study on the subject matter for case specific country is scanty. Hence it is crucial to investigate from a country perspective. This study therefore used time-series data to avoid the implausibility of pooling data across countries. Another contribution of this paper is that to circumvent the problem of sufficiently long time-series data in the developing countries it employed ARDL model that enables researcher to overcome the problem of small sample size.

### 1. INTRODUCTION

The relationship between military expenditure and economic growth is one of the major themes in current development literature and thinking. There is clear evidence that a substantial amount of fiscal budgetary provisions of many developing countries go to defense and security and in most often exceeds allocation to economic and social services. For instance, in 2008 about

12.18% of central government expenditure of lower and middle income countries was spent on military sector (WDI (World Development Indicator- World Bank), 2011). This has raised serious concern among scholars and policy makers about the role of military expenditure on economy wide growth. Many are of the view that the magnitude of expenditure in defense may have serious implication on the rate of growth and development of the developing economies.

Theoretically it is indeed the case that the level of fiscal allocation to different sectors has a varied effect on the economy. A Large investment in defense sector may lead a nation to bequeath less physical capital in other more productive sectors. For example, Deger and Sen (1995) argue that spending in military and security disproportionately impedes economic efficiency, though providing peace and stability is necessary for economic progress. There is no doubt reallocation of resources from education, health and other social services to military may affect economic activities. However, Benoit (1978) provides evidence that military spending actually accelerates economic growth in less developed countries (LDCs). Since then, many studies have been carried out to reexamine the effect of defense expenditure on economic performances. For instance, Yildirim *et al.* (2005) investigate the effects of military expenditure on economic growth in Middle Eastern countries, using panel data analysis. They found no evidence of any relationship between the two variables. These variations in the results of the findings and others are perhaps due to differences in the methods used and the reliability of the existing data (Blasko *et al.*, 2007). Thus, the results are mostly controversial and for these reasons a detailed analysis on the defense-growth nexus are still important for well-informed policy decisions.

The purpose of this paper is to reexamine the effect of military spending on economic growth for India over the period of 1980–2011 using a more rigorous econometric technique and to control for other factors such as exports and population. The remainder of the paper is organized as follows. The following section discusses the relationship between defense and economic growth. Section 3 provides the methodology. Section 4 is discusses the results of the analysis. Section 5 is the conclusion section.

## 2. THE DEFENSE-GROWTH NEXUS

The debate on the relationship between government defense expenditure and economic growth is still unsettled among development economists. There are three different views on the defense-growth nexus. The first view is that the defense expenditure is important in accelerating economic growth through its effect aggregate demand, expansion of markets for suppliers, technology development and security benefits. The proponents of this view argued that, countries can benefit from spill-over effects of investment in research and development (R&D), in the military industries. However, the impact R&D on growth is well established in the economic growth literature. Furthermore, defense spending can deliver other public goods in terms of social infrastructure, such as airports, roads, and communication networks by producing goods with a “dual-use” nature. More notably, defense expenditures can increase internal and external security by funding the production of an optimal level of military production. A more secure environment would attract domestic and foreign investments, thus improve the standard of

living. Moreover, technology transfers from the inflow of foreign capital can speed up economic growth in the process (Benoit, 1973; 1978; Atesoglu and Mueller, 1990; Mueller and Atesoglu, 1993; MacNair *et al.*, 1995; Ward, 1995).

The second view is that the military expenditure hampers overall growth through its crowding out effect on private investments (Deger and Smith, 1983; Lim, 1983; Faini *et al.*, 1984; Lebovic and Ishaq, 1987; Rasler and Thompson, 1988; Mintz and Huang, 1990; Scheetz, 1991). For instance, the typical “guns versus butter” trade-off elucidates how an increase in military spending can use up economic resources that could otherwise be channeled to other sectors of the economy. Generally, government expenditures, including military spending, have to be financed through tax payer’s money. Therefore, excessive expenditure in the military sector would then have to involve limiting economic resources for planned investment in other areas, because each increment of the defense budget brings a heavier tax burden, a bigger government budget deficit, or both, leading to lower savings and investments.

Finally, the third group provides evidence that there is no sufficient relationship between military spending and economic growth. According to them, military expenditure doesn’t have any impact on the economy wide growth as the spillover effect being emphasized by the proponents of the military spending is ambiguous and the idea that it crowd out private investments is not very clear (Adams *et al.* (1991), Alexander (1990), Biswas and Ram (1986), Deger (1986), Deger and Smith (1983), Heo and DeRouen (1998), Frederiksen and Looney (1983), Mintz and Huang (1990; 1991), Landau (1986; 1993), Mintz and Stevenson (1995), Park (1993), Ram (1995), Stewart (1993), Ward *et al.* (1993). Therefore, the inconsistency in the theoretical and empirical evidence on the relationship between defense spending and economic growth are attributed to individual country specific effects and the techniques employed.

Most studies on the defense-growth relationship utilized cross-sectional data. However, sample variations and differences in the model specifications and time periods usually lead to a diversity of interpretations. Furthermore, since different parts of the world do not share the same natural environments and socioeconomic structures, the impacts of military spending across countries cannot be easily generalized. These facts provide a justification for case studies on specific countries by using time-series data. The results of the estimated parameters from a country-specific model will then provide higher explanatory power, even with a small sample size (Ram, 1995). For these reasons, we investigate only one country to identify its unique correlation between defense expenditure and economic growth.

**Table-1.** India military expenditure as a percentage of GDP (1988-2012).

Year	1988-1992	1993-1997	1998-2002	2003-2007	2008-2012
	3.479115	2.827158	2.728214	2.678161	2.550593
	3.426785	2.668349	2.955817	2.828317	2.892945
	3.138794	2.575965	2.948453	2.753584	2.704189
	2.908553	2.473091	2.92464	2.526366	2.580517
	2.711269	2.645648	2.826923	2.342047	2.432983
<b>Average</b>	3.095192	2.736403	2.777568	2.510104	2.491788

Source: (SIPRI, 2013).

Although the use of individual-country data necessarily includes limited data observations, one can counter this limitation by creating a model that is more appropriate for the economic and political nature of the particular country.

As shown in Table I, average military expenditure as a share of GDP was 3.095192% between 1988 and 1992, this percentage regularly has decreased between 1993 and 1997 to 2.736403%. However, in average, the military expenditure as a share of GDP slightly increased between 1998 and 2002 from 2.736403 to 2.777568. It means that India besides its rapid economic growth has begun to raise its the military power and provide resource to this sector to stimulate economic growth. Surprisingly, for the following years military expenditure has been decreased from 2003 and 2012.

### 3. METHODOLOGY

#### 3.1. Data

The four variables used in this study, namely real gross domestic product, real military expenditure, real export and population, using time-series data for over the period 1980–2011. The data are collected from various sources. For example, the data of gross domestic product (GDP) and population are collected from World Development Indicator (WID), and the data for military expenditures are obtained from Stockholm International Peace Research Institute (SIPRI).

#### 3.2. Model Specification and Estimation

Moreover, we begin the empirical analysis with an investigation of the unit root test for the variables. We assumed that, the data we have used in this estimation are stationary. If the results of stationarity are violated, this might lead to spurious results. In examining the time-series data properties, there are several models to test the stationarity, but the most important one are the Augmented Dickey–Fuller (ADF) ((Dickey and Fuller, 1979), and the Phillips–Peron (PP) (Phillips and Perron, 1988) unit root tests.

To analyze time series data with different order I(1) and I(0) together, Pesaran *et al.* (2001) suggested that, the Autoregressive distributed lag approach (ARDL) to test for co-integration as an alternative way to the co-integration model for Engle and Granger (1987). This study uses ARDL model to investigate the long and short run relationship between military expenditure and GDP in the case of India. The ARDL bound testing approach for co-integration can be written:

$$\Delta \text{GDP}_t = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta \text{GDP}_{t-i} + \sum_{i=0}^p b_i \Delta \text{ME}_{t-i} + \sum_{i=0}^p c_i \Delta \text{POP}_{t-i} + \sum_{i=0}^p d_i \Delta \text{EX}_{t-i} + \delta_1 \text{GDP}_{t-1} + \delta_2 \text{ME}_{t-1} + \delta_3 \text{POP}_{t-1} + \delta_4 \text{EX}_{t-1} + \mu_t \quad (1)$$

Here,  $\Delta$  is the first difference operator,  $\Delta \text{GDP}_t$  denotes the natural log of real GDP,  $\Delta \text{ME}$  represents the natural log of real government military expenditure,  $\Delta \text{POP}$  is the natural log of population while  $\Delta \text{EX}$  stands the natural log of real export, and  $\mu_t$  is the error term.

The  $F$  test is used to determine whether the long-run relationship exists between the variables through testing the significance of the lagged levels of the variables. When, the long-run relationship exists, then, the  $F$  test shows which variable should be normalized.

The null and alternative hypotheses are as follows:

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0 \text{ (There is no long-run relationship)}$$

Against the alternative hypothesis

$$H_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0 \text{ (There is a long-run relationship exists)}$$

The  $F$  test has not a standard distribution which depends on; (1) whether the variables in the ARDL model are  $I(0)$  or  $I(1)$ ; (2) the number of independent variables; (3) whether the ARDL model contains an intercept and a trend; and (4) the sample size of the variables. The rejection of the null depends on  $F$ -test and the critical bound tabulated value for small sample size by Narayan (2005).

The long run relationship among the variables exists if the calculated value of  $F$ -statistic is greater than the upper critical bound (UCB) value. Conversely, if the calculated value of  $F$ -statistic is smaller than the lower critical bound (LCB) value, the long run relationship does not exist, and if the computed value of  $F$ -statistic lies in between the range of LCB and UCB then the long run relationship is inconclusive (Mintz and Huang, 1990; Hassan and Kalim, 2012). The Akaike Information Criterion (AIC) is used for the optimal lag selection. According to Narayan (2005) the maximum lags for small sample size are two lags.

**Table-2.** Augmented Dickey-Fuller and Phillip-Perron unit root test results India.

	ADF		Philip-Perron		
	intercept	Intercept and trend	Level and intercept	Intercept and trend	and trend
$\text{GDP}_t$	-1.715171	-2.459618	-1.861813	-1.590107	
$\text{ME}_t$	-4.968409 *	-6.015342*	-4.932968*	-10.71829*	
$\text{POP}_t$	-4.222475*	-8.006610*	-6.617158*	0.624630	
$\text{EX}_t$	2.213301	-0.632022	1.652774	-0.691812	
1 <sup>ST</sup> Difference					
$\text{GDP}_t$	-4.621860*	-4.794549*	-4.394975*	-4.667337*	
$\text{ME}_t$	-8.239342*	-8.108106*	-18.99220*	-18.53070*	
$\text{POP}_t$	-3.522087 **	0.189614	0.051997	-3.039105	
$\text{X}_t$	-3.492851**	-4.759500*	-3.455245 **	-4.745225*	

\* Denotes significant at 1%, \*\* Denotes significant at 5%, \*\*\* Denotes significant at 10%.

#### 4. RESULTS AND DISCUSSION

We provide the summary of the of stationarity test results of the ADF and PP tests in table 2. Both tests revealed that GDP has a unit root at level, but it becomes stationary at first difference, which implies that GDP is I (1). Nevertheless, other two variables were found to be significant at the level, and thus it indicates that the variables are I (0). As the results point out, the variables are I(0), or I(1), therefore, implying that we can confidently apply ARDL approach which capable of handling both stationary at level I(0) and first difference I(1) (Narayan, 2005)

In Table 3, we represent the long run co-integration test analysis, and an existence of long run relationship which has been found among the model's variables. Results illustrate that the computed F-statistics is 7.6366. The relevant critical value bounds at ten percent level (with unrestricted intercept, and no trend) are 5.333 and 7.063 and for the lower and upper bounds respectively. Subsequently, the computed F-statistics is higher than the critical value of the upper bound, the null hypothesis of no long run co-integration relationship among the variables can be simply rejected. Having established that, the existence of the long run associated between real GDP per capita, real government military expenditure, real export and population. The model can be used to estimate the long run and short run parameters.

**Table-3.** ARDL Bounds Test for Co-integration

<b>Lag structure:</b>		<b>2,2,0,1</b>				
F-statistics	1% Critical value		5% Critical value		10% Critical value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
7.6366*	5.333	7.063	3.710	5.018	3.008	4.150
K=3 , N=30						

The critical value according to Narayan (2005) (Case III: Unrestricted intercept and on trend)

\*, (\*\*), (\*\*\*) Significant at 1 %, 5% and 10% respectively.

Table 4 demonstrates the selected long and short run ARDL model, based on Akaike Information Criterion (AIC). The results show positive and significant relationship between real gross domestic product ( $GDP_t$ ) and real government military expenditure ( $ME_t$ ) in the short run, it's statistically significant at 1%. The results revealed that improvement in government military expenditure is associated with improvement in gross domestic product, and any increase in the military sector will lead to increase the economic growth in India. A positive and significant relationship between military spending and economic growth has been reported in the literature similar to Frederiksen and Looney (1983); Sezgin (1997); Chletsos and Kollias (1995); Aizenman and Glick (2003); who found positive relationship between military expenditure and economic growth for developing countries. These results agreed and corroborated with the findings of the study Biswas and Ram (1986); Alexander (1995) who also report similar results.

**Table-4.** Short and Long Run Model (Dependent variable: LGDP)

variables	Short Run		Long Run	
	Coefficient	T-Ratio [Prob]	Coefficient	T-Ratio [Prob]
Constant	11.3483	1.2849 [.211]	92.8648	1.1353 [.268]
ME <sub>t</sub>	.41713	3.0419* [.005]	-1.1945	-4.8257 [.634]
POP <sub>t</sub>	-.45114	-1.0204 [.317]	-3.6917	-1.4656 [.156]
X <sub>t</sub>	.41919	4.5813* [.000]	.5750E-9	1.4304 [.166]
ECT <sub>t-1</sub>	-.12220	-6.5650 [.518]	n/a	

\*, (\*\*), (\*\*\*) denotes Significant at 1%, 5% and 10% respectively. Lag lengths are 2,2,0,1 selected based on Schwarz Bayesian criterion (SBC).

The results of Granger causality test (as shown in table 5) reveal that there is a bidirectional relationship between defense expenditure and GDP, this correlation are running from GDP per capita to the military expenditure, and from military spending to the economic growth. This is showing that GDP is very important to the military sector in India and efforts need to be geared towards improving the GDP per capita to increase the defense spending and development in India.

**Table-5.** Granger Causality Test

Null Hypothesis	F-Statistic(Prob.)
LGDP does not Granger Cause LME	2.39828** (0.0929)
LME does not Granger Cause GDP	5.39098* (0.0056)

\*, (\*\*), (\*\*\*) denotes Significant at 1%, 5% and 10% respectively. The number of lags is 3.

## 5. CONCLUSION

The relationship between military expenditure and economic growth has been debated quite extensively in economic literature, and the results of such studies are far from uniform across countries and regions. The three main conclusions are drawn as described in section 2. The diversity in findings and lack of consensus are attributed mainly to different methods or approaches employed for the analysis of the studies. This article is an attempt to reinvestigate the issue using India data. India is one of the fastest growing economies in the world and also one of the highest spending countries in terms of military expenditure in the world (Stockholm Peace Research Institute (SIPRI), 2013). This article applies both autoregressive distributed lag (ARDL) approach and granger causality tests to reexamine the effect of military spending on economic growth for India over the period of 1980– 2011.

The findings of the results revealed that a 1% increase in military spending in the short run generating 0.41% increase in economic growth. The short run results indicate that there is a positive and significant relationship between military expenditure and economic growth, while, in the long run, the correlations are inconclusive. On the other hand, the estimated granger causality results revealed a unidirectional relationship running from GDP to military spending. The study concludes that, in India, the military spending is productive in the short-run, while it does not significantly affect economic growth in the long-run. This does not mean that society will necessarily benefit from the reallocation to military spending nor

does it mean that military spending is the best way to achieve economic growth. There is no sufficient evidence that the economy currently being hindered by its present defense burden. However, the recent increase in military expenditure and downturn cyclical fluctuations has led the defense expenditure close to its optimal level. Thus, further increases are likely to be at the cost of economic growth in the long run.

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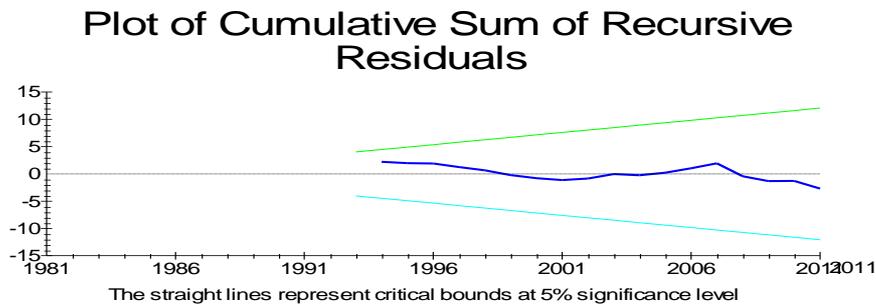
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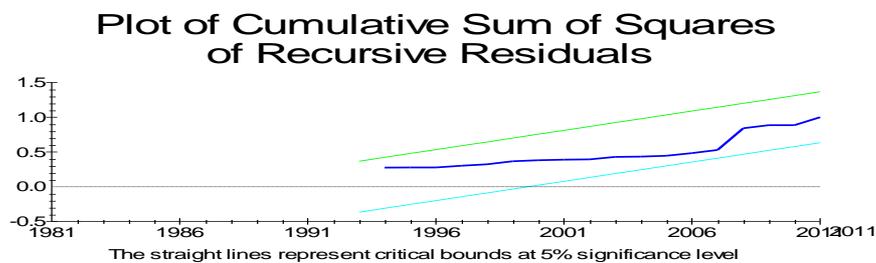
### Appendix 1 (CUSUM TEST)

Figure-1.



### Appendix 2 (CUSUM Square TEST)

Figure-2.



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