Does Defence Spending Stimulate Economic Growth in India?

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Does Defence Spending Stimulate Economic Growth in India?

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Abstract: The aim of present is to reinvestigate the effect of defence spending on economic growth using Zivot and Andrews (1992) and Lee and Strazicich, (2003) structural unit root tests and ARDL bounds testing approach to cointegration in augmented version of Keynesian model for Indian economy. Our analysis confirmed long run relationship between the variables and, results indicated positive effect of defence spending on economic growth (also negative impact after a threshold point). Investment and trade openness stimulate economic growth while economic growth is inversely affected by interest rate. Granger causality analysis showed bidirectional causal relationship between defence spending and economic growth as probed by variance decomposition approach.

Keywords: Defence Spending, Economic Growth, Cointegration

JEL Codes: C12, C32, O16

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I. Introduction

A positive relationship between defence spending and economic growth may be finding in the developing countries which may be due to the fact that military spending provides peaceful environment for investment and production activities to domestic and foreign investors. Further, it contributes to economic growth by engaging resources, particularly population, in research and development activities, providing technical skills, educational training and generating a necessary infrastructure for sustained level of economic development [see Benoit (1978), Babin (1986), Atesoglu and Mueller (1990), Stewart (1991), Mueller and Atesoglu (1993), Sezgin (2001), Halicioglu, (2003, 2004) and latter on Wijeweera and Webb (2009) etc]. However, a negative relationship between defence spending and economic growth might occur due to the fact that it crowd-outs private investment by distorting resource allocation and diverting resources from productive ventures to unproductive activities [Mintz and Huang (1990), Ward and Davis (1992), Atesoglu (2002), Klein (2004), Kentor and Kick (2008) and Shahbaz et al. (2011) etc].

There are, broadly, two groups of empirical research in the defense economics literature. The first group consists of those studies which used single regression equations in order to test the effect of military spending on economic growth. This single equation framework based models were based on either Neoclassical or Keynesian approaches. Neoclassical approach based studies includes such as Feder (1982), Ram (1986), Biswas and Ram (1986), Alexander (1990), Sezgin (1997) and Murdoch et al. (1997). Examples of Keynesian approach based studies include Smith (1980), Lim (1983), Faini et al. (1984), and Chletsos and Kollias (1995). The basic difference among these approaches is that the

Neoclassical models are particularly based on the supply-side (i.e. modernization positive externalities from infrastructure, technological spin-offs) whereas the Keynesian models are based on the demand-side (i.e., crowding-out of investment, exports, education, health). The Neoclassical or supply-side models include the work of Feder (1982), Ram (1986) and Biswas and Ram (1986), which is referred to as the Feder–Ram model while Keynesian or demand-side models are based on the work of Smith (1980).

To overcome the problem of single equation by concentrating on the demand or supply-side only, models were developed in simultaneous equation framework with a Keynesian aggregate demand and supply-side function, in the form of a growth equation derived from aggregate production function. Those studies which use simultaneous equation models by incorporating both the demand and supply sides factors to investigate the effect of military spending on economic growth, forms the second group of empirical studies. These models are known as Deger-type models as these are based on the work of Deger and Smith (1983) and Deger (1986). However, from the empirical point of view, it appears that there is no clear-cut agreement among the researchers about the nature and extent of the growth effects of military spending. For instance, Halicioglu (2003, 2004) found positive impact of defence spending on real output for Turkish economy and same inference was drawn by Atesoglu, (2009) for US economy while Shahbaz et al. (2011) reported inverse effect of military spending on economic growth in case of Pakistan. Above discussion shows that defence literature provides inconclusive results on the relationship between military spending and economic growth in case country studies and is the main motivation for researchers to probe the relationship between military spending and economic growth in case of India.

The current study is a valuable contribution to existing literature for four main reasons. Firstly, the study probes the effect of military spending on economic growth using extended Keynesian model by incorporating trade openness as an exogenous variable for the period of 1971-2010 in case of India. Secondly, ARDL bounds testing approach is applied to examine cointegration among the variables which is not used in the existing literature on military spending and economic growth in case of India. Thirdly, the study uses two unit root tests containing information about structural breaks in the series in which one test uses endogenously determined one structural breaks and second test incorporates endogenously determined two structural breaks. Forth, we analyzed the nonlinearity in the defence spending and economic growth relationship and we also estimated the turning point after which effect of more defence spending becomes negative on economic growth in Indian economy.

I.I. Indian Context

Defence sector in developing countries like India is one of those sectors where major proportion of budget allocation is allocated every year. According to SIPRI Yearbook 2009, India's military spending in 2008 was US$ 24,716 million, in constant 2005 price which ranks among the top 10 in the world. For example, in 1988 India's total military spending was in 3.82% of GDP US$ which has increased to 2.97% of GDP in 2009. This implies that India spends a huge chunk of her income on military sector which might use scarce resources and crowd out growth-leading spending such as health and education expenditures and also might stimulate economic growth by spin-off effects. In particular since the trade-off takes place first and primarily at the government budgetary level, military spending may crowd-out other types of government spending which has direct and bigger productivity effects. Thus, there is a potential problem and trade-off between military security and human security. In addition, national security and protection of property rights are the sine qua non of economic development and without them no institutions can transform a poor country into a developed one.

Another point is worth mentioning; this is derived from the recent literature on the success of ‘large’ economies in achieving high rates of growth in the era of globalization. Alesina et al. (2008) claimed that “there are economies of scale in the production of public goods. The per capita cost of many public goods is lower in larger countries, where taxpayers pay for them”. For example defence in case of a larger country (both in terms of population and national product) is less subjective to foreign aggression. Thus, safety is a public good that increases with country size. Also, and related to the size of government argument above, smaller countries may have to spend proportionately more for defence than larger countries given economies of scale in defence spending. This shows that a large country may derive economies of scale from defence spending which protects itself and provides security. This may be one explanatory factor behind the recent growth successes of large developing countries (often termed BRICS, Brazil, Russia, India, China, and South Africa). Yet, India seems to have suffered a lot due to high military spending which have been a substantial part of overall government spending that in turn has depleted resources from government spending on health, education and infrastructure. Though, expenditure on the defence sector is treated as unproductive expenditure yet it is argued that it provides a number of opportunities of employment in India and hence contributes to growth process. However, from the policy perspective, it is very need to determine the channels by which defense spending affects economic growth process as the effect of defence spending on economic growth can be either positive or negative. Therefore, it opens new channels for the policy makers to apply different strategies to boost economic growth and development of the country in question.

Military expenditure would have both positive and negative effects on economic growth in developing countries. Those effects could be direct and indirect. For example, military expenditure might stimulate India's economic growth directly by the spin-off from defence to other sectors in the economy. India's military expenditure also might reduce economic growth indirectly by depressing the savings ratio. Some major problems of India's economic development such as a low savings ratio, severe deficits in balance of payment and lack of public expenditures on health might be deteriorated by the high military spending. So the third hypothesis is that India's military spending has a net negative effect on economic growth by taking both direct and indirect effects together.

The rest of study is organized as following: Section-II contains the review of literature on relationship between defence spending and economic growth. Modeling framework and data is explained in Section-III while Section-IV explains the estimation strategy. The empirical evidence on relationship between defence spending and economic growth is discussed in Section-V and conclusions and policy implications are drawn in final Section.

II. Literature Review

There are number of studies trying to find an answer whether a rise in defence spending enhances growth process or not. We can classify these studies into those that find positive benefits and therefore support the Keynesian point of view, those that find negative benefits refuting the Keynesians and those that conclude there are insignificant linkages between defence spending and economic growth. The following is a short summary of some of the empirical defence literature that has emerged since the beginning of the last decade. Initially, Benoit (1978) analyzed the correlation for 44 less developed economies by concluding that defence spending has positive impact on economic growth. Latter on, Babin (1986) by using data from 88 developing countries probed relationship between both the variables and reported that military stability is an important precondition for economic advancement. Atesoglu and Mueller (1990) used a two sector Feder-Ram's model for the US economy. They noted a positive effect from defence sector to civilian sector.

Similarly, Stewart (1991) investigated Keynesian demand function to a group of LDCs. From empirical analysis, Stewart reported that defence and non-defence expenditures are positively linked with economic growth, however, the effect of non-defence spending is stronger. Ward et al. (1991) applied a three sector model developed by Feder-Ram with seperate externality and productivity effects for India. Their analysis revealed that defence spending has positive effect on economic growth. Apart from that, Mueller and Atesoglu

(1993) investigated the relationship between military spending and economic growth by incorporating technological change into a two sector Feder-Ram model for the US economy and noted a positive effect from defence spending to economic growth. In case of Turkey and Greece, Sezgin (2001) ran a regression to test the effect of military spending on economic growth. Their results showed that defence spending boosts the pace of economic growth both in long-and-short runs. Later on, Halicioglu, (2003, 2004) used Atesoglu (2002) model to analyze the impact of military spending on aggregate output and agreed with findings by Sezgin (2001) in case of Turkey. For Sri Lankan economy, Wijeweera and Webb, (2009) used Keynesian model to investigate relationship between military spending and economic growth in the presence of non-military expenditures and real interest. Their results indicated a positive effect of military spending on economic growth. Finally, Gupta et al. (2010) re-investigated the relationship between military expenditures and aggregate output for US economy. They applied factor augmented vector autoregressive (FAVAR) model and reported positive impact of military spending on aggregate output. In case of North Cyprus, Feridun et al. (2011) reported positive effect of defence expenditures on economic growth.

In cross-country studies, Bose et al. (2003) chose a panel of thirty developing countries to test the association between defence spending and economic growth and found positive and significant effect from military expenditures to economic growth. Similarly, Yildirm et al. (2005) explored the relationship between military spending and economic growth for OECD countries using dynamic panel data approach. Their empirical analysis indicated that military spending stimulates aggregate output. Narayan and Singh (2007) investigated said issue for Fiji Islands by incorporating exports as a new variable in production function within multivariate framework. They found that defence spending has positive impact on economic growth through exports-enhancing effect. A positive and significant effect of defence spending on economic growth was found by Ando (2008) using data for 109 countries, including 30 OECD countries.

On contrary, defence literature also provides studies which reported inverse impact of military spending on economic growth. For instance, Mintz and Huang (1990) used three equation models for the US economy and noted that a rise in defense spending is inversely linked with economic growth through investment-declining effect[1]. Ward and Davis (1992) re-investigated the relationship between defence spending and economic growth by using three sectors' Feder-Ram model in case of United States. Their empirical exercise revealed an inverse effect of military spending on economic growth through productivity-declining effect. Moreover, Atesoglu (2002) probed the role of military spending in economic performance of US economy by applying models developed by Romer, (2000) and Taylor, (2000). The empirical analysis found that a reduction in military spending improves the economic performance of United States in long run as well as in short run. In case of South Africa, Birdi and Dunne, (2002) investigated the relationship between military spending and economic growth using model developed by Feder-Ram and reported that a rise in military spending impedes the economic performance for short span of time with significant feedback affect.

In case of Peru, Klein (2004) conducted a study to investigate the impact of defence spending on economic growth and reported inverse effect of military spending on the pace of economic growth. Karagol and Palaz, (2004) re-examined the association between defence spending and economic growth for Turkish economy by using Johansen multivariate approach to cointegration. Their empirical evidence confirmed long run relationship between the variables and noted that a rise in military spending retards economic growth[2]. Kentor and Kick (2008) explored a new dimension of military spending, military expenditures per soldier, which captures the capital intensiveness of a country's military organization on economic growth. The cross-national panel regression analysis indicated that rise in military spending per soldier inhibits the growth of per capita GDP and this effect is the most pronounced in least developed economies. Apart from that Smith and Tuttle (2008) probed the relationship between military spending and economic growth for US economy by applying Atesoglu (2002) model and found the absence of positive impact of military spending on economic growth. Tang (2008) tested the effect of military spending on economic growth in case of Malaysia and reported the inverse impact of rise in military spending on economic growth. In case of Pakistan, Shahbaz et al. (2011) reinvestigated the validation of Keynesian hypothesis regarding the relationship between military spending and economic growth. Their empirical evidence indicated that a rise in military spending retards the pace of economic growth. The granger causality analysis further confirmed that military spending inversely granger-caused economic growth.

In cross-country case studies, Cappelen et al. (1984) examined the effect of military expenditures on economic growth including manufacturing output and investment as exogenous variables in OECD countries. They found positive association between military spending and manufacturing sector output while inverse relation was reported between military spending and investment. Moreover, they concluded that overall effect of military spending is negative on economic growth for three sub-groups[3]. Galvin (2003) applied 2SLS and 3SLS to investigate demand and supply side models for 64 LDCs. Results indicated that defence spending has negative effect on economic growth by declining public savings[4]. Abu-Bader and Abu-Quarn (2003) investigated the relationship between military spending, government non-military expenditures and economic growth for Egypt, Israel and Syria. Their analysis reported that military spending impedes economic growth. Moreover, Pieroni (2009) investigated the relationship between military spending and economic growth using cross-country data. Results showed that a rise in defence spending is retarding economic growth. Furthermore, Pieroni (2009) argued that relationship between military spending and economic growth may be non-linear and provide different results as compared to traditional approaches in defense literature. In a very recent study Wijeweera and Webb (2011) used a panel co-integration approach to examine the relationship between military spending and economic growth in the five South Asian countries (namely India, Pakistan, Nepal, Sri Lanka and Bangladesh) for the period of 1988–2007. Wijeweera and Webb (2011) found that a 1% increase in military spending increases real GDP by only 0.04% and hence they concluded that the substantial amount of public expenditure that is currently used for military purposes in these countries has a negligible impact upon economic growth.

III. Modeling, Methodological Framework and Data Collection

The development of empirical research lead us to use Feder (1983) military spending model to test the relationship between military spending and economic growth in the presence of investment, interest rate and trade openness. Feder's model was used by Ram (1986, 1995), Biswas and Ram (1986) and latter on, Ward et al. (1991) and Yildrin et al. (2005) investigated the effect of military spending on economic growth using Feder (1983) model. Romer (2000), Taylor (2000) and Atesoglu (2002, 2009) have examined the association between both the variables by replacing IS-LM and AD-AS models. We have transformed the series into natural logarithm. Simple linear specification provides inefficient and unreliable empirical results due to sharpness in time series in developing economies like India (Karagol, 2006). In such situation, use of log-linear specification is better option for time series analysis which directly produces elasticity. Also, log-linear specification provides better and unbiased empirical evidence (Sezgin, 2004). In the light of above discussion, our empirical equation is modeled as follows:

$$\ln G_t = \alpha_1 + \alpha_2 M_t + \alpha_3 K_t + \alpha_4 R_t + \alpha_5 T_t + \mu_t \qquad (1)$$

Where G_t is real GDP per capita proxy for economic growth, M_t is for per capita military spending, K_t indicates investment per capita, R_t is real interest rate, T_t is showing trade openness per capita and μ_t is residual term is assumed to be normally distributed.

II.I: Unit root tests

Traditional unit root tests such as ADF (Dicky and Fuller, 1979), P-P (Philip and Perron, 1988) and DF-GLS (Elliot et al. 1996) are used to find out integrating order of the variables. However, these tests are argued to give misleading results when data series exhibits socks. Therefore, attempts have been made to develop test of unit root which incorporates presence of structural breaks in the null of the unit root hypothesis. The Perron's (1989) unit root test in this regard is the first attempt. The Perron (1989) unit root test assumes that the structural break date is uncorrelated with the data and known ex ante by economic information: for example, the 1973 oil price shock. However, according to Christiano (1992), the Perron (1989)'s assumption of exogenous breaks has been criticized and considered inappropriate. Due to problems associated with "pre-testing", Perron's methodology invalidates the distribution theory of conventional testing and will tend to over reject the null of unit root. Instead, Zivot and Andrews (1992, hereafter ZA) treat the selection of the break points as the outcome of an estimation procedure. They transform Perron (1989)'s test into an unconditional unit root test which allows endogenously determined break points in the intercept and/or the trend function.

Following Perron (1989)'s notation, ZA test the null of unit root against the alternative of a one-time structural break with three models: Model A allows a one-time change in the level of the series, Model B permits a one-time change in the slope of the trend function of the series and Model C admits both changes. The regression equations corresponding to these three models are as following.

Model A: $\Delta y = \mu + \beta t + \alpha y_{t-1} + \theta DU_t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t$ (2)

Model B: $\Delta y = \mu + \beta t + \alpha y_{t-1} + \gamma DT_t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t$ (3)

Model C: $\Delta y = \mu + \beta t + \alpha y_{t-1} + \theta DU_t + \gamma DT_t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t$ (4)

where *DUt* and *DTt* are break dummy variables for a mean shift and a trend shift, respectively. The shift occurs at each possible break point $T_B (1 < T_B < T)$. Formally:

$$DU_t = \begin{cases} 1, if, t > T_B \\ 0, otherwise \end{cases} \quad and \quad DT_t = \begin{cases} t - T_B, if, t > T_B \\ 0, otherwise \end{cases}$$

where k is the number of lags determined for each possible break point by one of information criteria. The null hypothesis is $\alpha = 0$, which implies that the series exhibits a unit root with a drift and excludes any structural break points. The alternative hypothesis is $\alpha < 0$, which implies that the series is a trend-stationary with an unknown one-time break. So Equations (1), (2) and (3) are sequentially estimated and T_B is chosen so as to minimize the one sided t-statistics for testing $\hat{\alpha} = 0$

Since some variables exhibit multiple break points, some test has been developed to incorporate multiple structural breaks in the data series. Lee and Strazicich (2003, 2004) test of unit root allows us to test for at most two endogenous break and uses the Lagrange Multiplier (LM) test statistics. Let us consider the following data generating process (DGP):

$$y = \delta Z_t + e_{t,}\ e_t = \beta e_{t-1} + \varepsilon_t \qquad (5)$$

where Z_t is a vector of exogenous variables, δ is a vector of parameters and ε_t is a white noise process, such that $\varepsilon_t \sim NIID(0, \sigma^2)$. First we will consider the case when there is evidence of one structural break. The crash model that allows shift in level only is described by $Z_t = [1, t, D_t]$, and the break model that allows for changes in both level and trend is described as $Z_t = [1, t, D_t DT_t]'$, where D_t and DT_t are two dummies defined as:

$$D_t = 1, if \ \ t \geq T_B + 1$$

$$= 0, otherwise$$

and

$$DT_t = t - T_B, if \ \ t \geq T_B + 1 \qquad = 0, otherwise$$

where T_B is the time period of the break date. Next, let us consider the framework that allows for two structural breaks. The crash model that considers two shifts in level only is described by $Z_t = [1, t, D_{1t}, D_{2t}]$, and the break model that allows for two changes in both level and trend is described as $Z_t = [1, t, D_{1t} DT_{1t} D_{2t} DT_{2t}]$, where D_{jt} and DT_{jt} for j = 1, 2 are appropriate dummies defined as above, viz.,

$$D_{jt} = 1, if \ \ t \geq T_{Bj} + 1$$

$$= 0, otherwise$$

and

$$DT_{tj} = t - T_{Bj}, if \ \ t \geq T_{Bj} + 1$$

$= 0, otherwise$

where T_{Bj} is the j[th] break date. The main advantage of (Lee and Strazicich, 2003, 2004) approach to unit root test is that it allows for breaks under the null (β = 1) and alternative (β < 1) in the DGP given in equation (2). This method uses the following regression to obtain the LM unit root test statistics

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta \tilde{S}_{t-j} + u_t \qquad (6)$$

where $\tilde{S}_t = y_t - \tilde{\Psi}_t - Z_t \tilde{\delta}, t = 2,...,T; \tilde{\delta}$ denotes the regression coefficient of Δy_t on ΔZ_t and $\tilde{\Psi}_t = y_t - Z_1 \tilde{\delta}$, y_1 and Z_1 being first observations of y_t and Z_t respectively. The lagged term $\Delta \tilde{S}_{t-j}$ are included to correct for likely serial correlation in errors. Using the above equation, the null hypothesis of unit root test $(\phi = 0)$ is tested by the LM t-statistics. The location of the structural break or structural breaks is determined by selecting all possible breaks for the minimum t-statistic as follows:

$$\ln f\tilde{\tau}(\bar{\lambda}_i) = \ln_{\lambda} f\tilde{\tau}(\lambda), \text{ where } \lambda = T_B / T .$$

The search is carried out over the trimming region (0.15*T*, 0.85*T*), where *T* is sample size and T_B denotes date of structural break. We determined the breaks where the endogenous two-break LM t-test statistic is at a minimum. The critical values are tabulated in Lee and Strazicich (2003, 2004) for the two-break and one-break cases respectively. To select the lag length (k) we use the 't-sig' approach[5] proposed by Hall (1994). This involves starting with a predetermined upper bound *k*. If the last included lag is significant, *k* is chosen. However, if k is insignificant[6], it is reduced by one lag until the last lag becomes significant. If no lags are significant k is set equal to zero. In the present study we have estimated a model which allows for endogenous determined structural breaks in intercept and trend jointly and we call this model as model CC.

II.II ARDL cointegration approach

For cointegration analysis the autoregressive distributed lag (ARDL) bounds testing approach developed by Pesaran et al. (2001) is utilized between the variables in equation-1 because of its numerous advantages over traditional techniques of cointegration. For example, first, it can be applied irrespective of whether the variables are integrated of order *I(0)* or integrated of order *I(1)*; secondly, it has better properties for small sample data sets; thirdly, a dynamic error correction model (ECM) can be derived from the ARDL model through a simple linear transformation (Banerrjee and Newman, 1993) which integrates the short-run dynamics with the long-run equilibrium without losing information about long-run. In our study we estimated following unrestricted error correction method (UECM) in ARDL framework:

$$\begin{aligned}\Delta \ln G_t &= \alpha_\circ + \alpha_t t + \alpha_G \ln G_{t-1} + \alpha_M \ln M_{t-1} + \alpha_K \ln K_{t-1} + \alpha_R \ln R_{t-1} + \alpha_T \ln T_{t-1} + + \sum_{i=1}^{p} \alpha_i \Delta \ln G_{t-i} \\ &+ \sum_{j=0}^{q} \alpha_j \Delta \ln M_{t-j} + \sum_{l=0}^{m} \alpha_k \Delta \ln K_{t-l} + \sum_{n=0}^{n} \alpha_l \Delta \ln R_{t-n} + \sum_{n=0}^{n} \alpha_m \Delta \ln T_{t-m} + \mu_i\end{aligned} \quad (7)$$

$$\begin{aligned}\Delta \ln M_t &= \beta_\circ + \beta_t t + \beta_G \ln G_{t-1} + \beta_M \ln M_{t-1} + \beta_K \ln K_{t-1} + \beta_R \ln R_{t-1} + \beta_T \ln T_{t-1} + + \sum_{i=1}^{p} \beta_i \Delta \ln M_{t-i} \\ &+ \sum_{j=0}^{q} \beta_j \Delta \ln G_{t-j} + \sum_{l=0}^{m} \beta_k \Delta \ln K_{t-l} + \sum_{n=0}^{n} \beta_l \Delta \ln R_{t-n} + \sum_{n=0}^{n} \beta_m \Delta \ln T_{t-m} + \mu_i\end{aligned} \quad (8)$$

$$\Delta \ln K_t = \delta_\circ + \delta_t t + \delta_G \ln G_{t-1} + \delta_M \ln M_{t-1} + \delta_K \ln K_{t-1} + \delta_R \ln R_{t-1} + \delta_T \ln T_{t-1} + \sum_{i=1}^{p} \delta_i \Delta \ln K_{t-i} + \sum_{j=0}^{q} \delta_j \Delta \ln G_{t-j} + \sum_{l=0}^{m} \delta_k \Delta \ln M_{t-l} + \sum_{n=0}^{n} \delta_l \Delta \ln R_{t-n} + \sum_{n=0}^{n} \delta_m \Delta \ln T_{t-m} + \mu_i \quad (9)$$

$$\Delta \ln R_t = \vartheta_\circ + \vartheta_t t + \vartheta_G \ln G_{t-1} + \vartheta_M \ln M_{t-1} + \vartheta_K \ln K_{t-1} + \vartheta_R \ln R_{t-1} + \vartheta_T \ln T_{t-1} + \sum_{i=1}^{p} \vartheta_i \Delta \ln R_{t-i} + \sum_{j=0}^{q} \vartheta_j \Delta \ln G_{t-j} + \sum_{l=0}^{m} \vartheta_k \Delta \ln M_{t-l} + \sum_{n=0}^{n} \vartheta_l \Delta \ln K_{t-n} + \sum_{n=0}^{n} \vartheta_m \Delta \ln T_{t-m} + \mu_i \quad (10)$$

$$\Delta \ln T_t = \gamma_\circ + \gamma_t t + \gamma_G \ln G_{t-1} + \gamma_M \ln M_{t-1} + \gamma_K \ln K_{t-1} + \gamma_R \ln R_{t-1} + \gamma_T \ln T_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta \ln T_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta \ln G_{t-j} + \sum_{l=0}^{m} \gamma_k \Delta \ln M_{t-l} + \sum_{n=0}^{n} \gamma_l \Delta \ln K_{t-n} + \sum_{n=0}^{n} \gamma_m \Delta \ln R_{t-m} + \mu_i \quad (11)$$

Where $\alpha_\circ$ and α_T is the drift component and time trend, and μ is *i.i.d.* processes. In order to avoid problem of serial correlation in equation 7, 8, 9, 10 and 11 optimal lag length of the first differenced regression is selected by Akaike Information Criteria (AIC). Pesaran et al. (2001) tabulated two critical bounds (upper and lower critical bounds) to take the decision about the existence of long-run relationship among the variables. The null hypothesis of no cointegration in equations i.e. (7-11) $H_0: \alpha_G = \alpha_M = \alpha_K = \alpha_R = \alpha_T = 0$, $H_0: \beta_G = \beta_M = \beta_K = \beta_R = \beta_T = 0$, $H_0: \delta_G = \delta_M = \delta_K = \delta_R = \delta_T = 0$, $H_0: \vartheta_G = \vartheta_M = \vartheta_K = \vartheta_R = \vartheta_T = 0$ and $H_0: \gamma_G = \gamma_M = \gamma_K = \gamma_R = \gamma_T = 0$ against alternative hypothesis of cointegration i.e. $H_0: \alpha_G \neq \alpha_M \neq \alpha_K \neq \alpha_R \neq \alpha_T \neq 0$, $H_0: \beta_G \neq \beta_M \neq \beta_K \neq \beta_R \neq \beta_T \neq 0$, $H_0: \delta_G \neq \delta_M \neq \delta_K \neq \delta_R \neq \delta_T \neq 0$, $H_0: \vartheta_G \neq \vartheta_M \neq \vartheta_K \neq \vartheta_R \neq \vartheta_T \neq 0$ and $H_0: \gamma_G \neq \gamma_M \neq \gamma_K \neq \gamma_R \neq \gamma_T \neq 0$ is tested by comparing the calculated F-statistic with LCB (lower critical bound) and UCB (upper critical bound) tabulated by Pesaran et al. (2001). If calculated value of F-statistic is more than upper critical bound (UCB) then there is cointegration among the variables and if lower critical bound (LCB) is more than computed F-statistic then hypothesis of no cointegration may be accepted however, if calculated F-statistic is between lower and upper critical bounds then decision about cointegration is inconclusive.

Now we moved to detect the direction of causal relationship between economic growth, military spending, investment, real interest and trade openness by applying standard Granger causality test augmented with a lagged error-correction term. Engle-Granger (1987) suggested that if there is cointegration relationship among the test variables there will be Granger causality in at least from one direction provided that the variables are integrated of order one or I(1). Engle-Granger (1987) cautioned that if the Granger causality test is conducted at first difference through vector auto regression (VAR) method then it will be misleading in the presence of cointegration. Therefore, the inclusion of an additional variable to the VAR method such as the error correction term would help us to capture the long-run relationship. Therefore, error correction term is incorporated in the augmented version of Granger causality test and it is formulated in a bi-variate *p*th order vector error-correction model (VECM) which is as follows:

$$\begin{aligned}\Delta \ln G_t = {} & \alpha_{\circ 1} + \sum_{i=1}^{l} \alpha_{11} \Delta \ln G_{t-i} + \sum_{j=1}^{m} \alpha_{22} \Delta \ln M_{t-j} + \sum_{k=1}^{n} \alpha_{33} \Delta \ln K_{t-k} + \sum_{r=1}^{o} \alpha_{44} \Delta \ln R_{t-r} + \sum_{l=1}^{p} \alpha_{55} \Delta \ln T_{t-l} \\ & + \eta_1 ECM_{t-1} + \mu_{1i} \end{aligned} \quad (12)$$

$$\Delta \ln M_t = \beta_{\circ 1} + \sum_{i=1}^{l} \beta_{11} \Delta \ln M_{t-i} + \sum_{j=1}^{m} \beta_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \beta_{33} \Delta \ln K_{t-k} + \sum_{r=1}^{o} \beta_{44} \Delta \ln R_{t-r} + \sum_{l=1}^{p} \beta_{55} \Delta \ln T_{t-l} + \eta_2 ECM_{t-1} + \mu_{2i} \quad (13)$$

$$\Delta \ln K_t = \phi_{\circ 1} + \sum_{i=1}^{l} \phi_{11} \Delta \ln K_{t-i} + \sum_{j=1}^{m} \phi_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \phi_{33} \Delta M \ln_{t-k} + \sum_{r=1}^{o} \phi_{44} \Delta \ln R_{t-r} + \sum_{l=1}^{p} \phi_{55} \Delta \ln T_{t-l} + \eta_3 ECM_{t-1} + \mu_{3i} \quad (14)$$

$$\Delta \ln R_t = \varphi_{\circ 1} + \sum_{i=1}^{l} \varphi_{11} \Delta \ln IR_{t-i} + \sum_{j=1}^{m} \varphi_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \varphi_{33} \Delta \ln M_{t-k} + \sum_{r=1}^{o} \varphi_{44} \Delta \ln K_{t-r} + \sum_{l=1}^{p} \varphi_{55} \Delta \ln T_{t-l} + \eta_4 ECM_{t-1} + \mu_{4i} \quad (15)$$

$$\Delta \ln T_t = \rho_{\circ 1} + \sum_{i=1}^{l} \rho_{11} \Delta \ln T_{t-i} + \sum_{j=1}^{m} \rho_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \rho_{33} \Delta \ln M_{t-k} + \sum_{r=1}^{o} \rho_{44} \Delta \ln K_{t-r} + \sum_{l=1}^{p} \rho_{55} \Delta \ln Y_{t-l} + \eta_5 ECM_{t-1} + \mu_{5i} \quad (16)$$

Where Δ is the difference operator; ECM_{t-1} is the lagged error-correction term derived from the long-run cointegrating relationship and $\mu_{1i}, \mu_{2i}, \mu_{3i}, \mu_{4i}$ and μ_{5i} are *i.i.d* process with mean zero and finite covariance matrix. The presence of a significant relationship in first differences of the variables provides evidence on the direction of the short-run causation while a significant *t*-statistic pertaining to the error correction term (*ECM*) proposes the presence of significant long-run causation. It is important to mention that the causality has to be interpreted in the Granger sense.

To test the goodness of fit of the ARDL model we conducted the diagnostic test by examining the problem of serial correlation, functional form, normality of error term and heteroscedisticity and the stability of the ARDL model is tested by applying the cumulative sum of recursive residuals (**CUSUM**) and the cumulative sum of squares of recursive residuals (**$CUSUM_{SQ}$**).

The study covers the time period of 1971-2010. The data on real GDP per capita, military spending, investment, interest rate and trade openness has collected from World Development Indicators (WDI, CD-ROM, 2010).

IV. EMPIRICAL ESTIMATION

In defence literature, researchers extensively used traditional unit root tests, for instance, ADF by Dicky and Fuller (1981)**,** P-P by Philip and Perron (1988), DF-GLS by Elliot et al. (1996) and Ng-Perron by Ng-Perron (2001) etc to test the integrating orders of the macroeconomic variables. These tests provide spurious results due to their poor properties. It is pointed by Baum (2004) that empirical evidence on order of integration of the variable by ADF, P-P and DF-GLS is not reliable. These unit root tests do not have informations about structural break occurred in the series. In doing so, we have used Zivot-Andrews (1992) unit root test containing information about one structural break and Lee-Strazicich (2003) unit root test containing information about two structural breaks occurred in the series to test the order of integration of the variables. The results are reported in Table-1.

Table-1: Unit Root Estimation

ZA test-statistic					
Model	G	M	K	T	R
A	-2.115	0.618	-3.566	-4.002	-5.608***
B	-2.456	-0.279	-4.447**	-3.389	-3.389
C	-2.450	-0.271	-4.577	-4.366	-4.366
LS test					
CC	-6.6155***	-11.8770***	-8.6494***	-5.9746**	-5.0415

ZA test-Critical values: 1%: -5.43 5%: -4.80 for model when breaks occur in intercept only; Critical values: 1%: -4.93 5%: -4.42 for model when breaks occur in trend only; Critical values: 1%: -5.57 5%: -5.08 for model when breaks occur in intercept and trend both;. T_{B1} and T_{B2} are the dates of the structural breaks; *k* is the lag length; Critical values of test statistics when breaks occur intercept and trend jointly are reported in Lee-Strazicich (2003). Complete results of both tests will be available from the authors upon request. *** and ** denotes significance at 1% and 5% level of significance.

It is evident from Table-1 that ZA test-statistic suggests that R is stationary at I(0) while rest of variables are integrated at I(1). The empirical evidence by LS test statistic (which incorporate two structural breaks and has relatively more power because of being LM type test) suggests that all variable are stationary at I(1) except R is integrated at I(0). This shows that variables in the model are integrated at mixed order of integration. In such circumstances, we apply ARDL bounds testing approach to cointegration to test the existence of long run relationship between the variables. However, before proceeding to two steps ARDL procedure, it is necessary to select appropriate lag length of variables for which we used Akaike Information Criteria (AIC)[7].

Table-2: Bounds Testing to Cointegration

Estimated Models	$G_t = f(M_t, K_t, T_t, R_t)$	$M_t = f(G_t, K_t, T_t, R_t)$	$K_t = f(G_t, M_t, T_t, R_t)$	$T_t = f(G_t, M_t, K_t, R_t)$	$R_t = f(G_t, M_t, K_t, T_t)$
Optimal lag structure	(2, 2, 1,2 , 1)	(2, 1, 2, 1, 1)	(2, 2, 1, 2, 1)	(2, 1, 2, 1, 2)	(2, 2, 2, 1, 2)
F-statistics (Wald-Statistics)	7.1262**	5.424***	7.831**	1.146	0.7957
Significant level	Critical values (T = 40)#				
	Lower bounds, $I(0)$	Upper bounds, $I(1)$			
1 per cent	7.527	8.803			
5 per cent	5.387	6.437			
10 per cent	4.447	5.420			
R^2	0.8024	0.8537	0.8521	0.6696	0.5945
Adjusted- R^2	0.5678	0.6989	0.6764	0.2773	0.0539
F-statistics (Prob-value)	3.4209(0.0082)*	5.5142 (0.0004)	4.8518 (0.0012)	1.7069 (0.1422)	1.0998 (0.4322)
Durbin-Watson	1.7015	2.1367	1.9564	2.1534	2.0619

Note: The asterisk *, ** denote the significant at 1%, 5% level of significance. The optimal lag structure is determined by AIC. The probability values are given in parenthesis. # Critical values bounds computed by (Narayan, 2005) following unrestricted intercept and restricted trend.

The empirical evidence indicates that calculated F-statistics are i.e. $F_G = (G_t / M_t, K_t, T_t, R_t) =$ 7.1262, $F_M = (M_t / G_t, K_t, T_t, R_t) =$ 5.424 and $F_K = (K_t / M_t, G_t, T_t, R_t) =$ 7.831 is more than upper critical bound i.e. 6.437 and 5.420 at 5%, 10% and 5% level of significance respectively, reported by Narayan (2005). This indicates that there are three cointegrating vectors that confirm the existence of long run relationship between economic growth, defence spending, investment, interest rate and trade openness for the period 1971-2010 in Indian context. The existence of long run relationship between the variables helps us to find out partial impacts of military spending and other control variables on economic growth. Results are reported in Table 3.

Table-3: Long Run Results

Dependent Variable = $\ln G_t$				
Variable	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	6.5559	128.0949*	6.5153	168.2397*
$\ln M_t$	0.0440	4.9592*	0.0884	4.7863*
$\ln M_t^2$	...	...	-0.0020	-1.7465***
$\ln K_t$	0.1631	2.1200**	0.1406	2.5031**
$\ln T_t$	0.1036	4.2542*	0.0681	3.1850*
$\ln R_t$	-0.0659	-2.0886**	...	...
Diagnostic Tests				
Test	Statistics	Prob.	Statistics	Prob.
$R-Squared$	0.9948		0.9954	
$F-Statistics$	1601.319	(0.0001)	1786.714	(0.0000)
χ^2 *NORMAL*	0.6430	(0.7250)	0.2379	(0.8878)
χ^2 *SERIAL*	1.3933	(0.2633)	0.1544	(0.8575)
χ^2 *ARCH*	1.3091	(0.2885)	0.19700	(0.6599)
χ^2 *WHITE*	1.2480	(0.3094)	1.4002	0.2555
χ^2 *REMSAY*	0.0592	(0.8091)	2.2167	0.1463
Note: *, (**), *** indicate significant at 1%, (5%), 10% significance level respectively.				

Note: χ^2*NORMAL* refers to the Jarque–Bera statistic of the test for normal residuals, χ^2*SERIAL* is the Breusch–Godfrey LM test statistic for no first-order serial correlation, χ^2*WHITE* denotes White's test statistic to test for homoskedastic errors, and χ^2*ARCH* is Engle's test statistic is for no autoregressive conditional heteroskedasticity. χ^2*REMSAY* is model specification test.

It is evident from Table-3 that current economic growth is positively affected by military spending (M), investment (K) and trade openness (T) while negatively by interest rate (R). It is concluded that a 1 percent increase in M, K and T in current period will raise economic growth by 4.40, 16.31 and 10.36 percent in the long run. This implies that an increase in defence spending increases economic growth in India might be through spin-off effect or it may be due to the fact that defence expenditure provides peaceful environment for investment and production activities to domestic and foreign investors or it might be contributing to economic growth of India by engaging resources, particularly population, in research and development activities, providing technical skills, educational training and generating an infrastructure necessary for economic development or might be due to combination of all the factors.

Similarly, increase in the domestic investment and trade openness enhances economic growth by providing basic infrastructure facilities, competitive environment and broader market. Although, the effect of defence spending on economic growth is positive and it is statistically significant but linear impact is minimal. To test the more robustness of the results we included the squared term of M in the model. The results show that nonlinear relationship between military spending and economic growth is inverted-U shaped. The coefficients of linear and non-linear terms are 0.0884 and -0.0020 respectively. This shows that a rise in military spending stimulates economic growth initially and declines it as economy reaches to maturity while threshold point is 36.59. Moreover, lower portion of Table-3 reflects that long run model passes all diagnostic tests against serial correlation, autoregressive conditional heteroscedisticity, non-normality of residual term, white heteroscedisticity and misspecification of model[8].

To examine the short run impact of independent variables including lagged error term ECM version of OLS is used. The results of short run model are reported in Table-4. The coefficient of lagged error term or ECM_{t-1} indicates the speed of adjustment from short run towards long run equilibrium path with negative sign. It is suggested by Bannerjee et al. (1998) that significance of lagged error term further validates the established long run relationship between the variables. Our empirical exercise indicates that coefficient of ECM_{t-1} is -0.6109 and significant at 1 percent level of significance. It implies a 61.09 percent of disequilibrium from the current year's shock seems to converge back to the long run equilibrium in the next year.

Table-4: Short Run Results

Dependent Variable = $\Delta \ln G_t$			
Variable	Coefficient	Std. Error	T-Statistic
Constant	0.0081	0.0074	1.0858
$\Delta \ln M_t$	0.0287	0.0110	2.6104**
$\Delta \ln K_t$	0.0543	0.0649	0.8375
$\Delta \ln T_t$	0.0947	0.0509	1.8562***
$\Delta \ln R_t$	-0.0846	0.0363	-2.3315**
ECM_{t-1}	-0.6109	0.1811	-3.3732*
R-Squared = 0.4578 Adjusted R-Squared = 0.3757 Akaike info Criterion = -4.3838 Schwarz Criterion = -4.1278 F-Statistic = 5.5739* Durbin-Watson = 1.9303			
Diagnostic Tests		**Statistics**	
Breusch-Godfrey LM test		0.5529 (0.5808)	
ARCH LM test		0.0795 (0.7795)	
White Heteroscedisticity		0.3737 (0.8630)	
Ramsey RESET		0.8538 (0.3624)	
CUSUM		Stable**	
CUSUMsq		Stable**	
Note: *, ** and *** show significant at 1%, 5% and 10% level of significance.			

It is evident from Table 4 that in the short run economic growth is affected positively by defence spending, investment and trade openness and negatively by R hence it confirms out long run findings also. However, in this case positive impact of T is highest and then K and then comes the impact of M. This implies that in the short run T has the highest impact on the economic growth of Indian economy while in the long run impact of K is highest. This asserts that Indian policy makers might use policy of trade openness to boost economic growth particularly in the short run. However, long run policy of growth enhancement should be based on the development of investment sector. Hence, in budget allocations on priority might be given to investment sector over defence sector.

For the short run model, diagnostic tests also indicate that there is no evidence of serial correlation and error term is normally distributed. The autoregressive conditional heteroscedisticity and white heteroscedisticity are not found. Finally, short run model is well specified as confirmed by Ramsey RESET test. The stability of long run and short run estimates is tested by applying the cumulative sum (CUSUM) and the cumulative sum of squares ($CUSUM_{SQ}$) tests. The results of CUSUM and $CUSUM_{SQ}$ reveal that both short run and long run estimates are stable and reliable.

In the next step we analyzed the direction of causality using VECM (vector error correction method) framework. The presence of cointegrating among the variables leads us to perform the Granger causality test to provide a clearer picture for policymakers to formulate a comprehensive policy regarding defence and economic growth by understanding the direction of causality between the both variables. It is well documented that if there is long run relationship between the variables then there must be granger causality, at least from any direction. That's why after finding cointegration between the variables; we have used VECM granger causality to detect the direction of causality between defence spending and economic growth in the presence of investment, trade openness and interest rate. The detection of direction of causal relationship between the variables provides a clear picture for policymakers to formulate a comprehensive and sound economic policy to reduce military spending in sustaining economic growth. The results of our empirical exercise regarding causality are reported in Table-5. The causality relation can be divided into short- and long-runs causation as variables are cointegrated. The long run causality is indicated by the significance of coefficient of the one period lagged error-correction term i.e. ECM_{t-1} while short run causality can be detected by the joint significance of independent variables. The results show that military spending and economic growth granger-cause each other in short run as well in long run for the period of 1971-2010.

Table-5: Granger Causality Analysis

Dependant Variable	Types of Granger Causality					
	Short Run					Long Run
	$\sum \Delta \ln G_{t-i}$	$\sum \Delta \ln M_{t-i}$	$\sum \Delta \ln K_{t-i}$	$\sum \Delta \ln T_{t-i}$	$\sum \Delta \ln R_{t-i}$	ECM_{t-1}
$\Delta \ln G_t$	_____	5.6645* [0.0088]	1.3037 [0.2881]	5.9646* [0.0072]	3.2230*** [0.0556]	-0.6210 [-3.1424]*
$\Delta \ln M_t$	3.8637** [0.0334]	_____	3.4680** [0.0457]	4.7945** [0.0165]	3.0216*** [0.654]	-0.5002 [-2.2246]**
$\Delta \ln K_t$	0.4374 [0.6501]	0.6812 [0.5145]	_____	0.4941 [0.6155]	2.9290*** [0.0712]	-0.7408 [-3.5556]*
$\Delta \ln T_t$	0.7702 [0.4728]	3.0037*** [0.0664]	4.7156** [0.0175]	_____	2.8502*** [0.0753]	-0.0835 [-0.7646]
$\Delta \ln R_t$	1.1595 [0.3288]	0.3292 [0.7223]	0.1189 [0.8883]	4.7441** [0.0172]	_____	-0.0807 [-0.5415]
Note: *, ** and *** show significant at 1%, 5% and 10% level of significance.						

These findings are in line with the studies by Tahir (1995), Khilji and Mahmood (1997) and, Khan (2004) who reported bidirectional causality between the variables military spe2nding and economic growth in case of Pakistan. There is also bidirectional causality between economic growth and interest rate only long span of time but in short run, interest rate granger-causes economic growth. It is documented on basis of our findings that a rise in interest rate will granger-cause economic growth inversely through investment-declining effect while economic growth inversely granger causes interest rate through real money balances enhancing-effect. Further, we have evidence of bidirectional causal relationship between T and M, T and R, and unidirectional between T and K. This implies that defence expenditure provides peaceful environment for investment and production activities to foreign investors through trade openness and foreign investors provides advanced technology for investment in defence activities. Trade openness precedes interest rate and interest rate precedes trade openness i.e. trade openness decreases the rate of interest rate and low rate of interest is helpful in enhancing the trade openness. Further, trade openness is also found to be helpful in the encouraging domestic investment.

It is important to note that the F-test and t-test in VECM may be interpreted as within sample causality tests since they only indicate the Granger-exogenity or endogenity of the dependent variable within period under consideration (Tiwari and Tiwari 2010; Tiwari 2011). These tests do not provide information regarding the relative strength of the Granger causal chain amongst the variable beyond the period under study. Further, they do not provide the direction of the causal chain as they just show, in strict Granger sense, which variables precedes other (Tiwari 2009, 2011). In order to analyze the dynamic properties of the system the forecast error Variance Decompositions (VDs) and Impulse Response Functions (IRFs) are computed and results of VDs are reported in following Table-6 and IRFs are presented in appendix.

Table-6: Variance Decomposition Approach

Variance Decomposition of $\ln G_t$						
Period	S.E.	$\ln G_t$	$\ln M_t$	$\ln T_t$	$\ln K_t$	$\ln R_t$
1	0.0210	100.0000	0.0000	0.0000	0.0000	0.0000
3	0.0357	45.4692	32.4393	18.2033	3.7919	0.0961
5	0.0496	38.2672	44.5886	13.6716	2.2635	1.2088
7	0.0648	33.8986	50.4905	12.4739	1.3279	1.8090
9	0.0813	32.5298	53.9054	10.5752	0.8463	2.1431
11	0.1001	31.8213	56.6976	8.58170	0.5693	2.3299
13	0.1219	31.4170	58.8506	6.82891	0.4295	2.4738
15	0.1474	31.1962	60.4554	5.3965	0.3845	2.5672
16	0.1617	31.1367	61.1015	4.7842	0.3836	2.5938
17	0.1772	31.0980	61.6670	4.2333	0.3924	2.6090
18	0.1941	31.0729	62.1633	3.7396	0.4091	2.6149
19	0.2123	31.0568	62.5984	3.2990	0.4322	2.6133
20	0.2321	31.0470	62.9789	2.9077	0.4605	2.6057
Variance Decomposition of $\ln M_t$						
Period	S.E.	$\ln G_t$	$\ln M_t$	$\ln T_t$	$\ln K_t$	$\ln R_t$
1	2.8829	10.2713	89.7286	0.0000	0.0000	0.0000
3	4.8162	23.6196	71.0273	1.5344	2.0469	1.7716
5	6.4521	26.1107	68.6706	0.8613	2.5823	1.7749
7	8.1395	28.3478	67.1730	0.5608	2.2433	1.6749
9	10.0315	29.3421	66.7105	0.3840	1.9483	1.6148

11	12.1959	29.9264	66.3819	0.2616	1.8070	1.6228
13	14.6832	30.3380	66.1351	0.1815	1.7019	1.6433
15	17.5658	30.6396	65.9701	0.1304	1.5967	1.6629
16	19.1831	30.7519	65.9126	0.1126	1.5486	1.6741
17	20.9336	30.8435	65.8655	0.0989	1.5053	1.6865
18	22.8297	30.9189	65.8256	0.0887	1.4667	1.6999
19	24.8848	30.9815	65.7909	0.0813	1.4321	1.7140
20	27.1133	31.0340	65.7605	0.0764	1.4007	1.7281
Variance Decomposition of $\ln T_t$						
Period	S.E.	$\ln G_t$	$\ln M_t$	$\ln T_t$	$\ln K_t$	$\ln R_t$
1	0.0654	0.0039	6.0063	93.9896	0.0000	0.0000
3	0.1456	0.4091	2.0298	96.4629	0.6335	0.4646
5	0.1874	1.1624	1.2758	90.8497	5.1900	1.5219
7	0.2163	1.8117	1.6181	84.8926	9.9581	1.7192
9	0.2433	2.8364	3.3863	82.0113	10.3826	1.3832
11	0.2727	4.3482	5.9218	78.9863	9.5797	1.1636
13	0.3039	6.3258	9.3300	74.3904	8.8452	1.1084
15	0.3383	8.6987	13.9422	68.1692	7.9608	1.2288
16	0.3576	10.0056	16.6514	64.5759	7.4123	1.3546
17	0.3786	11.3733	19.5549	60.7407	6.8169	1.5139
18	0.4017	12.7838	22.5945	56.7251	6.2011	1.6953
19	0.4270	14.2159	25.7183	52.5917	5.5861	1.8877
20	0.4548	15.6471	28.8778	48.4057	4.9872	2.0820
Variance Decomposition of $\ln K_t$						
Period	S.E.	$\ln G_t$	$\ln M_t$	$\ln T_t$	$\ln K_t$	$\ln R_t$
1	0.0366	0.0145	8.0966	1.5735	90.3153	0.0000
3	0.0471	0.4822	14.0444	18.7983	62.6659	4.0090
5	0.0611	2.1267	10.5648	47.2791	37.6226	2.4066
7	0.0712	3.8899	9.2596	54.7952	30.1091	1.9460
9	0.0797	5.8119	11.1129	54.4129	27.0683	1.5938
11	0.0895	8.0684	15.1639	52.7703	22.6246	1.3726
13	0.1011	10.7062	19.8760	49.8224	18.2129	1.3823
14	0.1076	12.1309	22.4460	47.6926	16.2942	1.4360
15	0.1146	13.5883	25.1908	45.1654	14.5389	1.5164
16	0.1223	15.0471	28.0838	42.3371	12.9080	1.6237
17	0.1307	16.4812	31.0607	39.3185	11.3844	1.7550
18	0.1401	17.8706	34.0432	36.2119	9.9710	1.9031
19	0.1504	19.2010	36.9625	33.1004	8.6778	2.0581
20	0.1618	20.4612	39.7691	30.0474	7.5118	2.2104
Variance Decomposition of $\ln R_t$						
Period	S.E.	$\ln G_t$	$\ln M_t$	$\ln T_t$	$\ln K_t$	$\ln R_t$
1	0.0743	1.1459	1.9237	12.7084	1.0128	83.2090
3	0.1194	0.5317	3.4961	37.0096	1.0784	57.8840

5	0.1373	0.5482	2.8289	38.5509	1.9800	56.0919
7	0.1473	0.5287	3.0602	35.7505	3.6489	57.0115
9	0.1556	0.5418	3.8374	33.1039	3.6055	58.9112
11	0.1626	0.6067	4.5590	30.9948	3.3111	60.5281
13	0.1680	0.7115	5.2190	29.2038	3.1038	61.7617
15	0.1725	0.8332	5.9522	27.7158	2.9502	62.5483
16	0.1746	0.8993	6.3437	27.0967	2.8986	62.7615
17	0.1766	0.9694	6.7394	26.5635	2.8713	62.8562
18	0.1786	1.0436	7.1314	26.1200	2.8694	62.8353
19	0.1805	1.1216	7.5158	25.7703	2.8904	62.7017
20	0.1824	1.2025	7.8912	25.5166	2.9312	62.4583

It is evident from Table-6 that in 20th year 62.98% of the variation in economic growth (G) is accounted by M (military expenditure) and 31% is accounted by variation in economic growth by itself. At the 20th year horizon, 65% of the uncertainty in M is accounted by itself and 31 % is accounted by economic growth. At the same time 48.40% of the variation in trade openness (T) is accounted by itself, 15.65% percentage by economic growth and 28.88% by M and 20.46%, 39.78% and 30.04% variation in investment (K) in the 20th year is accounted by G, M and T respectively. Further, 62.46% variation in the interest rate (R) at the 20th year is accounted by itself and 25.55% is accounted by trade openness (T). Though, the results show of VECM analysis reveals that military spending and economic growth granger-cause each other in short run as well in long run however, causality is stronger from military spending and economic growth than otherwise.

V. CONCLUSIONS AND POLICY IMPLICATIONS

The allocation of resources for defence purpose in developing economies and its impact on their economic growth has been studied by number of studies however, conclusion has been remain inconclusive so far. For the estimation purpose, various approaches based on classical, neoclassical and Keynesian framework were used to explore the nature of relationship between defence spending and economic growth. The present study is an attempt to re-investigate the effect of military spending on economic growth using time series data over the period 1971-2010 in case of India. To test the stationary properties of the data we used unit root test which incorporates endogenously determined structural breaks in the series while ARDL bounds testing approach to cointegration is for relationship between military spending and economic growth.

Study finds from unit root analysis that the variables have mixed order of integration. Further, the empirical exercise confirms the evidence of cointegration between economic growth, defence spending, investment, trade openness and interest rate. Results report that economic growth is positively affected by defence spending, investment and trade openness while negatively by interest rate. Further, higher defence spending is found to be having negative impact on the economic growth rate of Indian economy after a threshold point.

Granger long run causality analysis reveals that any deviation from the cointegration will get corrected when economic growth, defence expenditure, and investment are the dependent variables as the error correction term is significant with negative sign when these variables are significant. This implies that if there is disequilibrium from the cointegration equation of the defence expenditure equation equilibrium will be stored with the speed of adjustment of 62.10% per annum. Short run Granger causality analysis reveals bidirectional causal relationship between military spending to economic growth, trade and defence spending and trade and interest rate and unidirectional causal relation between economic growth and interest rate and trade and investment. IRFs and VDs analysis also confirms the findings of short run analysis.

Based upon these results we expect a higher economic growth rate in India if more public resources are diverted from the civilian sectors to defence of the economy now however, these expenditures must be up to a limit as if expenditure on defence activities crosses this limit it will have negative effect. However, expenditure in the capital sector (i.e., investment) has positive impact on the economic growth of India in the long run. This implies that Indian government must allocate major proportion of her budget in investment sector followed by defence sector and sooner or later she should reduce the expenses on defence sector. Therefore, keeping these points in mind Indian policy makers should allocate their budget expenses.

Footnotes

1. Alexander (1990) used a four sector Feder-Ram model for nine developed countries and found no effect of defense spending on economic growth. Huang and Mintz (1990) estimate a three sector Feder-Ram model using ridge regression techniques to overcome multicolinearity problems using annual data for the US for period 1952-1988. Their empirical exercise indicated no any relationship between defence spending and economic growth was found.
2. Wilkins (2004) estimated pooled model explaining GDP growth as a function of labor, capital and defense spending for 85 countries. The defense spending has positive and significant effect for 39 countries while negative and significant for eight countries and insignificant on economic growth for the remaining 38 countries.
3. Chowdhury (1991) investigated the direction of causality between defence burden and economic growth for 55 LDCs. Results indicated a positive causal relation running from defence spending to economic growth for seven countries while negative causality for 15 countries and no causal relation was found for 30 countries, and bi-directional causality for three countries was found.

4. Guaresma and Reitschuler (2003) found that the partial correlation between defense spending and economic growth appears robust and significantly negative only for countries with a relatively low military expenditure ratio.
5. The'‘t-sig’ approach has been shown to produce test statistics which have better properties in terms of size and power than information-based methods such as the Akaike Information Criterion or Schwartz Bayesian Criterion (see for example, Hall 1994, Ng and Perron, 1995).
6. We used conventional level of significance that is 10% level of significance as a benchmark and fixed k_{max}= 12.
7. Results of lag length selection test are presented in the appendix in Table-1.
8. The long run estimates are stable because diagrams of CUSUM and $CUSUM_{SQ}$ are lying between critical bounds.

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Appendix

Table-1: Lag Order Selection

VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-34.68258	NA	5.88e-06	2.1450	2.3626	2.2217
1	177.8470	356.1307*	2.36e-10	-7.9917	-6.6855*	-7.5312*
2	204.3231	37.2096	2.36e-10*	-8.0715*	-5.6769	-7.2273
3	224.1853	22.5462	3.85e-10	-7.7937	-4.3107	-6.5658

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Figure-1: Impulse Response Function

Response to Cholesky One S.D. Innovations ± 2 S.E.