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DEFENCE EXPENDITURE AND CROWDING-IN EFFECT IN INDIA: A VAR-VECM MODEL

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Abstract

There is a well-established debate on whether defence spending generates a crowding-out or crowding-in effect. This paper contributes to the theory of the two-sector growth model. This study attempts to find a functional relationship between defence spending and growth in India from 1960 to 2017. The study has selected the VAR-VECM model from the unit root test result. The short-run outcome is quite discouraging, and no significant relationship exists between defence spending and its determinants. Defence spending and economic reforms both positively and significantly impact economic growth. The non-defence spending significantly but negatively affects economic growth. The study advocates increasing defence expenditure for geographic stability and growth stimulating effect. The study observed the crowding-in effect of defence spending in India. JEL Classification: E6, H5, O4

Key Words: *Crowding in, Macroeconomics, Defence Spending, Economic Growth*

I. Introduction: The Keynesian debate (Keynes, 1940) is intriguing, whether the defence spending stimulus economic growth or (Cohen et al., 1996a) discourages it. (Magdoff, 1967) stated in his review of the book "Monopoly Capital" quoted by (Baran & Sweezy, 1966a) that the prosperity witnessed in the West after the Second World War was the result of defence spending. (Henderson, 1998) and (Aziz & Asadullah, 2017) conclusion aligned with the view, whereas (Haseeb et al., 2014a) gave the opposite view. Empirically, this phenomenon was absent in India from 1980 to 2016. (Yetkiner, 2012) realised that the theoretical work on the causal relationship between defence spending and growth is still inconclusive. (Szymanski, 1973) found that global defence spending increased by 51% in the first decade of the twenty-first century, which is why the topic is still relevant. To bridge the research gap, this study intends to find the causality between defence spending and economic growth over time. India is one of the promising developing nations with a combination of high military spending and one of the fastest-growing

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economies. The core objective of the study is to find a relationship between defence spending and economic growth, and the study will also incorporate the effect of economic reforms as a policy break; as (Mukherji, 2009) noted, the Indian growth story can be divided into two stages before 1991 public sector role was quite extended. (Chatterji, 1990; Jackson, 2004a) The study also gives weightage to the Walras regional and geographical model.

The dynamics of military expenditure do not work in a vacuum; direct and indirect benefits and costs are involved. (Malik & Kanwal, 2000) Noted national security policy requires a comprehensive view of political, social, economic, technological, and strategic, and both deterrence and defence are integral. Pre-independence budget service worked on a contractual basis; after independence, the Shino-Indian conflict – in 1962 raised new awareness about the future defence challenges. The fourth plan (1969-74), the "roll-on" basis policy, was adopted, but it was not carried out after the India-Pak conflict in 1971. 1974, a long-term defence program was set up to achieve cost-effectiveness and economic objectives. Later, 15 years of defence planning strategy was divided into three broad categories: Definitive plan, Indicative plan, and vision plan. (Srinivas, 2006) analysed the geopolitical importance of Indian defence planning concerning its diplomatic relationship with China and Pakistan. (Lal, 1995) has done a cost-benefit analysis of defence spending and realised that it has several indirect benefits, like the skills of military personnel, which must be helpful to civil society and the national economy. (Berthelemy et al., 1994) have listed the limitations of defence expenditure, which is equally important to understand as the benefits. The rising military spending is an outcome of the failure of diplomatic measures. This study does not obviate the importance of external, internal, regional, and economic security treaties in the world order, which are victims of asymmetric information on defence capabilities and game theory in which hiding information has strategic military importance.

II. Review of Literature: (Baran & Sweezy, 1966b) and (Smith, 1977) found that capitalistic economy defence spending stimulated growth during the World War period. (Benoit, 1978a) pioneered the empirical analysis and found a positive effect of defence spending on growth in developing nations. (Grobar & Porter, 1987) revisited Benito's work, and gave aberrant arguments. (Deger, 1986; Deger & Smith, 1983) used a simultaneous equation model to trace the impact of defence spending on economic growth. (Biswas & Ram, 1986) Defence spending remains neutral to the economic growth of LDCs. (Cohen et al., 1996b) Defence spending on economic growth has an indirect impact, as it generates an indirect crowding out effect. (Yildirim & Öcal, 2006a) Observing the outcome of an arms race between India and Pakistan from 1949 to 2003, the VAR model revealed that defence spending positively affects growth in the short run, but in the long run, the effect is negative (Shahbaz et al., 2013). (Halicioglu, 2007a) claimed the

impact of defence spending on growth is one-tenth of that of non-defense spending. (Pradhan, 2010a) has traced the long-run positive functional relationship between defence spending and economic growth for China, India, Pakistan, and Nepal from 1988 to 2007, with the help of an error correction model. (Tiwari & Tiwari, 2010) applied VECM to find bi-directional causality between military spending and economic growth in India. (Haseeb et al., 2014b) We have used an ARDL model and found a log-run negative relationship between defence spending and economic growth in Pakistan from 1980 to 2013. (Knight et al., 1996) revealed that a cut in military expenditure improves economic growth. (Aziz &s Asadullah, 2017) a panel data analysis 70 shows a uni-directional negative relationship between defence and economic growth from 1990 to 2013. (Kusi, 1994) investigated the panel data of 77 developing nations from 1978 to 1989 and empirically found that defence spending might generate crowding out or crowding in effect, which depends on socio-economic conditions. (Joerding, 1986) found that defence spending is a weak exogenous factor that affects growth. The outcome of different studies varies, which is the study's base. c claimed to offer new findings on the relationship between defence spending and economic growth in the case of Turkey from 1950 to 2002; the outcome of the VAR-VECM model indicates that the change in defence spending caused a macroeconomic change in the long run. (Ozsoy & Ipek, 2010) empirically found in Egypt, Jordan, Turkey, and Israel from 1980 to 2006, a uni-directional relationship exists between defence spending and inflation for Egypt and Israel. In contrast, in Israel, defence spending affects growth positively; for Turkey, the effect is negative.

III. Research Methodology: The research methodology has considered the availability of data, its stationarity level, past studies based on literature review, and evidence-based practices.

Data Sources: The study has used time series data from 1961 to 2017 from secondary sources, including Macrotrends.net, Imf.org, Stockholm International Peace Research Institute (SIPRI), data.worldbank.org, and Arms Control and Disarmament Agency (ACDA), which have provided data on nations' defence expenditure, import of defence goods, and GDP.

Theoretical Background: The Fundamental classical and neo-classical two-sector growth model emphasises the accumulation of labour and capital for economic growth. (Feder, 1983) has developed a sectors growth model in which the economy is divided into export and non-export classification (Biswas & Ram, 1986) have developed it to trace the crowding effect of defence spending and (Yildirim & Öcal, 2006) further developed it to trace the relationship between the arms race and economic growth in India and Pakistan. (Jackson, 2004b) Based on Walras's contribution, Garrison, Berry, Marble, Getis, Morrill, Tobler, Wolpert, and the rest of the researchers have further contributed to the subject. (Chatterji, 1990; Jackson, 2004c) Walras gave the "Walrasian general equilibrium" model as an extension of the two-sector growth model.

(Walter et al., 1998) has developed the regional and interregional development model from Leontief's initial work. Regional and geographical studies were developed during the 1950s and 1960s, and both concepts have influenced each other. (Gillespie & Zinnes, 1975) observed the progress of the mathematical model on international conflict; his study inserted Richardson's two variable-based models as the trajectory of the arms race model for two nations. Brito added the nation's goals in the Richardson model that incorporated economic growth. (Simaan & Cruz, 1975) also incorporated the national objectives in the Richardson model with different game points of view.

Econometrics Model & Hypothesis Development: The basic Cobb-Douglas production function can be expressed as,

$$Q = A.\ L^{\alpha}.\ K^{\beta} \text{ where } \alpha + \beta = 1$$

In which Q = output, L = labour, K = Capital, α and β are coefficient

Cobb-Douglus production function is also based on a two-factor model. This study's two major variables are defence spending and non-defence spending. The study also offers an extended version of the Walrasian Input-Output analysis (Jackson, 2004d). The study has included two more variables: trade openness and economic reforms. Economic reforms are a combination of a few policy initiatives which have brought a drastic change in the Indian growth story, which includes trade openness but is not exclusive. (Arshad et al., 2017a) used Solow's growth model to find the relationship between defence spending and economic growth; in his model, the study has incorporated military expenditure, trade openness, capital stock, total population, secondary school enrolment, military conflicts, and arms imports as independent variables. Several studies (Agrawal, 2009; Klein, 2000; Panagariya, 2004a) observe that economic reforms in India have brought high growth.

$$LnGDP_t = \alpha + \beta_1 LnDE_t + \beta_2 LnRNDE_t + \beta_3 LnTOR + \beta_4 LnD1 + \varepsilon$$

Here, G = Economic Growth, DE =Defense expenditure, NDE = Ratio of Non-Defence expenditure, TOR = Trade Openness Ratio, and D1 = Dummy variable for economic reforms or policy breaks. The β_1, β_2, β_3, β_4, and β_5 are different co-efficient of respectively DE_t, NDE_t, TOR_t, and D1.

The following two equations respectively represent the long-run relationship and the short-run relationship, which can be derived with the help of the above equation.

$$LnGDP\ (-1) = C + \beta_1.\ LnDE(-1) + \beta_2.\ LnRNDE(-1) + \beta_3\ .\ LnTOR(-1) + \beta_5.\ D1(-1)$$

$$\Delta LnGDP = C + \beta_1 \sum_{i=0}^{n-1} \Delta LnDE + \beta_2 \sum_{i=0}^{n-1} \Delta LnRNDE + \beta_3 \sum_{i=0}^{n-1} \Delta LnTOR + \beta_4\, D1 + \theta\, ECT\ (-1)$$

Summary of Statistics: To analyse the impact of defence and non-defence expenditure on economic growth, the study has taken GDP at a constant price, Indian defence expenditure, the ratio of non-defence expenditure in proportion to GDP, trade openness that is, the ratio of the volume of total import-export to the GDP and economic reforms in the form of a dummy variable.

Table I: Summary of Statistics:

Variable/Parameter	*IND_DE*	IND_GDP	TOR	*RNDE*
Mean	17.70014	658.4725	23.63291	18.30853
Standard Deviation	20.43508	812.9606	15.17599	6.593145
Kurtosis	0.816549	0.937482	-0.7848	-1.60376
Skewness	1.427343	1.487064	0.811984	-0.33082
Range	72.20568	2794.522	48.1319	19.89206
Minimum	0.681766	37.02988	7.6618	8.427992
Maximum	72.88745	2831.552	55.7937	28.32005
No of Obs.	61	61	61	61

Source: SIPRI, ACDA, macrotrends.net

The mean defence expenditure was USD 17.70 billion, given at a constant price, whereas the mean GDP was USD 658.47 billion during the study period. The non-defence spending is expressed in terms of ratio to GDP.

IV. Data Analysis and Findings: The study has used two tests for the unit root test, the Augmented Dickey-Fuller Test and the Phillips-Perron Test; the output of both tests is more or less quite similar. Both tests have confirmed that all independent and dependent variables are stationary at one time, whereas the time series of the error correction term (ECT) is stationary at zero. This result directs us to apply the VAR-VECM model.

Table II: Result of Unit Root Test:

	At Level				1st Degree				Order of Integration
	Intercept		Trend & Intercept		Intercept		Trend & Intercept		
Variable	ADF	PP	ADF	PP	ADF	PP	ADF	PP	
LnDE	-1.22	-1.34	-4.16*	-3.03	-4.67 *	-4.33*	-5.26*	-4.37*	I(1)
LnGDP	-0.06	-0.07	-1.96	-2.05	-6.97*	-6.97*	-6.90*	-6.90*	I(1)
LnTOR	-0.37	-0.51	-2.09	-2.38	-6.14*	-6.14*	-6.06*	-6.06*	I(1)
LnPE	-0.83	-0.81	-1.51	-1.53	-7.12*	-7.08*	-7.04*	-6.99*	I(1)
ECT	-4.54*	-4.52*	-4.61*	-4.60*	NA	NA	NA	NA	I(0)

Source: Author's Calculation

Table III: Result of VAR Lag Selection Criteria:

Lag	LogL	LR	FPE	AIC	SC	HQ
0	14.2398	NA	4.95e-07	-0.3300	-0.14916	-0.2600
1	329.7782	563.4613	155e-11	-10.7064	-9.6214*	-10.2857*
2	359.1836	47.2588	1.35e-11*	-10.8637	-8.8745	-10.0925
3	376.9495	25.3798	1.85e-11	-10.6053	-7.7120	-9.4836
4	411.4185	43.0863*	1.47e-11	-10.9435	-7.1460	-9.4712
5	439.4024	29.9827	1.61e-11	-11.0501*	-6.3484	-9.2272

Source: Author's Calculation

Table 3 presents various Var Lag order selection criteria; it is found that the optimum lag criteria is 1, based on the majority rule. The Schwarz information (SC) criteria and Hannan-Quinn information criterion (HQ) indicate lag criteria 1. The other criteria are the LR test statistics (LR), Final prediction error (FPE), and Akaike information criterion (AIC), which indicate different criteria which are in the minority.

The table-4 indicates the null hypothesis that "there is no cointegration between dependent (GDP) and independent variables (Defense spending, non-defence spending, trade openness ratio, and economic reforms)" is rejected at 1% level of significance, and there is a long-run relationship between the variables. The result indicates there is at least one cointegrating equation. Since variables are cointegrated, it becomes valid to perform the VECM test further to examine the long-run relationship in the model.

Table IV: Result of Unrestricted Cointegrated Rank Test:

Unrestricted Cointegration Rank Test (Trace)			
Hypothezed of CE	Trace Statistics	Critical Value at 5%	P-Value
None*	90.2564	69.8189	0.0005*
At most 1	28.8591	47.8561	0.7750
At most 2	17.6357	17.6357	0.5931
At most 3	6.9017	15.4947	0.5891
At most 4	0.0394	3.8415	0.8426
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Hypothezed of CE	Trace Statistics	Critical Value at 5%	P-Value
None*	61.40	33.8769	0.0000*
At most 1	11.2234	27.5843	0.9594
At most 2	10.7340	21.1316	0.6738
At most 3	6.8623	14.2646	0.5056
At most 4	0.0007	3.8415	0.8426

Source: Author's Calculation

Table V: Result of Long run Relationship using VECM model

Cointegration Equations:	Cointegration Equation 1	Standard Error	T-Statistics
Ln_GDP (-1)	1.0000		
Ln_DE (-1)	-1.0773	(0.0313)	[-34.4386]*
Ln_RNDE (-1)	0.3582	(0.0734)	[4.8822]*
Ln_TOR (-1)	-0.0524	(0.0623)	[-0.8407]
D1 (-1)	-0.2063	(0.0541)	[-3.8111]*
C	-4.1190		

Source: Author's Calculation

The result of the long-run relationship is quite promising. The result of the VECM model for the long run relationship between variables shows the value of T-statistics that is more than 1.96 (avoiding negative sign) indicating a significant relationship between dependent and independent variables. The output in Table 5 indicates defence spending; non-defence expenditure and economic reforms significantly impact economic growth. Economic growth and economic

reforms have generated long-term positive impacts on growth, whereas the effect of non-defence spending is negative. Trade openness also generates a positive but insignificant effect on growth.

Defence spending and economic reforms have a significant and positive impact on economic growth, whereas non-defence spending has a significant and negative impact on economic growth. The output of Table 6 shows there is an absence of any kind of unilateral or bilateral relationship between GDP and its determinants. It indicates that economic growth is insignificant with changes in defence spending, non-defence spending, trade openness ratio, and economic reforms in the short run.

Table VI: Result of Short run relationship using ECM

Error Correction	D(LnGDP)	D(LnDE)	D(LnNDE)	D(LnTOR)	D1
CointEq1	0.08050	0.6364	-0.2019	-0.0659	0.08742
	(0.1090)	(0.1023)	(0.0814)	(0.1036)	(0.1731)
	[0.7385]	[6.2186]*	[-2.4804]*	[-0.6364]	[0.5051]
D(LnGDP(-1))	-0.0442	-0.1481	-0.1850	0.6165	0.1085
	(0.1788)	(0.1679)	(0.1335)	(0.1699)	(0.2839)
	[-0.2474]	[-0.8825]	[-1.3857]	[3.6277]	[0.3824]
D(LnDE(-1))	0.1843	0.5634	0.1436	-0.1163	-0.1634
	(0.1277)	(0.1199)	(0.0954)	(0.1214)	(0.2028)
	[1.4428]	[4.6983]*	[1.5056]	[-0.9580]	[-0. 8052]
D(LnNDE(-1))	0.0786	-0.0299	0.0404	0.0421	-0.0072
	(1754)	(0.1647)	(0.1310)	(0.1667)	(0.2785)
	[0.4484]	[-0.1815]	[0.3082]	[0.2523]	[-0. 0258]
D(LnTOR(-1))	0.2041	0.0717	0.0176	0.2469	0.0226
	(0.1305)	(0.1225)	(0.0975)	(0.1240)	(0.2072)
	[1.5642]	[0.5849]	[0.1806]	[1.9907]*	[0.1090]
D1	0.0212	0.0157	-0.0479	0.1579	-0.0321
	(0.0950)	(0.0891)	(0.0709)	(0.0903)	(0.1508)
	[0.2234]	[0.1766]	[-0.6761]	[1.7498]	[-0.2129]
C	0.0542	0.0428	0.0199	-0.0227	0.02203
	(0.0178)	(0.0167)	(.0.0133)	(0.0169)	(0.0283)
	[3.0407]*	[2.5552]*	[1.4952]	[-1.3398]	[0.7782]

Source: Author's Calculation

Table VII: Result of Diagnostic Test:

Diagnostic Test:		
Test	Statistics	P-Value
X2Auto (2)	23.3955	0.5567
X2Hetro (2)	181.9180	0.0978
X2Norm (2)	212.4836	0.0000*

Source: Author's Calculation

Table 7 shows the outcome of the Serial correlation LM test, Normality test, and Heteroscedasticity test, as the p-value is insignificant at 5% level. The result indicates there is no issue of auto-correlation and heteroscedasticity. The outcome of the normality test is significant at 1% level. The output of the Jarque-Bera test in Table-8 indicates the residual of defence spending, non-defence spending, and trade openness, which is normally distributed. These outcomes indicate that the econometrics model used in the study is quite fit and the result is reasonably acceptable.

Table VIII: Jarque-Bera Normality Test: VECM Residual Normality Rest

Cointegration Equations:	Jarque-Bera	P-Value
LnGDP	28.0636	0.0000
LnDE	1.7617	0.4144
LnNDE	0.0299	0.9852
LnTOR	0.5012	0.7783
D1	2071.422	0.0000

Source: Author's Calculation

Discussion: (Looney, 1991a) said it is ironic that one nation's security generates insecurity for another nation, and thus it leads to the exponential growth of defence spending in the world. The question that arises is its implications for the welfare of people. Understanding its growth effect and other macroeconomic implications in developing nations like India is essential. Let us discuss the significant findings of the study; first of all, the study matches the findings of (Pradhan, 2010b)**,** (Benoit, 1978b), (Yildirim & Öcal, 2006b) that there is a significant and positive relationship between defense spending and economic growth in the long run. This might be due to crowding in effect (Ambler et al., 2017). Secondly, in the long run, the economic reforms (Agrawal, 2009; Klein, 2000; Panagariya, 2004b) also significantly affect economic growth positively. Thirdly, in

the long run, non-defence spending generates a significant but negative impact on growth. The result does not match the finding of (Halicioglu, 2007c; Looney, 1991b), which indicates that defence spending might have a crowding-out effect. (Carlson & Spencer, 1975; Buiter, 1975). The policymakers should allocate funds for military spending with the consideration of (Arshad et al., 2017a) study that a proper policy frame is required to spend money on defence as it might comparatively encourage corruption. Even the study does not discourage the importance of social sector spending as it generates the positive flypaper effect (Aragon, 2008).

Conclusion: The output of the Feder-Ram model used in this study does match with the outcome of the study of (Mintz & Huang, 1990) and it indicates that both variables military spending and non-military spending generate an opposite effect on economic growth; notably the defence spending generates crowding in effect. The study finds a weak relationship between economic growth and its determinants in the short run. However, in the long run, defence spending and economic reforms positively impact economic growth. The government should spend money on defence to increase economic growth. The result has ample theoretical support and the model's outcome is quite acceptable. The study emphasises crowding in and crowding out effects of public expenditure, including appending on arms. The study has extensively studied various econometric models and their historical progression. Looking at India's current geographical position in the world and the kind of external threat it is facing from neighbouring countries, military spending has its strategic importance for the stability of the geopolitics of Asia. Looking at the current global geopolitics, the modernisation of the defence sector through military spending is inevitable. In the long run, military spending ensures peace, stability, and progress worldwide. The study further demands an investigation of the macroeconomic dynamics that took place due to the crowding in and out effects.

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