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Do Defense Expenditures Augment Economic Growth in Pakistan and India? A Deger-type analysis using GMM Approach

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Abstract

Defense spending is a multifaceted phenomenon. In recent years, economists and policy makers have been interested in the explanation of the relationship between defense spending and macroeconomic variables especially growth. This study explores the connection between defense outlays and growth in two neighboring but hostile countries i.e. Pakistan and India by applying GMM technique to Deger-type model. The findings of study for Pakistan reveal that the net effect of defense spending is positive while for India it turns out to be negative. It means that the defense sector in Pakistan fosters the economic growth via aggregate demand and modernization effects. For India, defense sector is hampering growth due to reallocation of resources and creation of new resources arguments.

Key Words: defense expenditures, economic growth, deger-type analysis, GMM approach

1. Introduction

Defense spending being the part of fiscal policy is a political option with economic constraints. There may be many determinants of defense spending i.e. economic, political, strategic, moral, psychological etc. So, defense spending is a multi-faced phenomenon and it is not easy to understand the theoretical analysis of defense spending. (Sheikh and Chaudhry, 2013; Sheikh and Aslam, 2015, Fatah and Salihoglu,2016).

The question regarding the effects of defense spending on growth has widely been addressed in the literature. There is no consensus among the economists on the defense-growth issue. Although numerous studies have depicted that defense spending accelerates growth (See Benoit, 1973, 1978; Kennedy, 1974; Frederiksen & Looney, 1982, 1983; Looney & Frederiksen, 1986; Alexander, 1995, Sheikh, 2014, McDonald and Reitano,2016) and others have reported that defense expenditures hinder the growth (Deger & Sen, 1983; Deger & Smith, 1983; Lim, 1983;Leontief & Duchin, 1983; Fainiet al., 1984; Cappelen et al., 1984; Deger, 1986a and Gyimah-Brempong, 1989, Chen,

2014). Owing to much controversy on the subject, we have investigated the impacts of defense expenditures on growth for Pakistan and India over time span of 1972-2010 by employing the Deger-type (demand and supply) model. This study gives the overall picture of the scenario by offering the more robust and sophisticated results focusing on both demand and supply side effects.

The issue of defense spending has a great importance for the developing countries like Pakistan and India. Both the countries allocate a plentiful share of their budget to defense sector for internal and external security threats to each other. The example of both the countries is like two persons drowning in a swimming pool due to huge weights of defense spending in their boats to get the military might and still they are unwilling to reduce their weights for safe come out.

In brief, over the years the issue of defense expenditures of both the countries has attracted the attention of the researchers and this area has become an important topic of the day. The atomic power performs the role of deterrence for both the countries. So, it is very important to investigate issue of defense expenditures of these two countries.

The study has been structured as follows: Section 2 provides the review of previous studies. Section 3 specifies the model. Section 4 presents data, methodology and description of variables. The empirical results and discussions have been given in Section 5. Conclusions and policy implications have been offered in section 6.

2. Review of Previous Studies

In an array of related studies on Deger-type model, Smith and Smith (1980) were the first who applied the simultaneous equation model (SEM) to show both the demand and supply side effects of defense spending in 50 developing countries and OECD countries over the period 1965-1973. The authors specified a production function with three-equation. The findings of study demonstrated a positive but insignificant direct effect and negative indirect effects of defense expenditures on growth for fifty developing countries. The study also found the negative and significant effects of defense expenditures for OECD countries. Further, they explored that the negative effects of defense spending on investment outweighed positive R&D effects of defense for OECD countries. The authors estimated the equations initially by OLS to avoid the feedback effects and then by 3SLS by forming a system of equations to observe the net effect.

Deger and Smith (1983), Deger and Sen (1983, 1995) and Deger (1986a, 1986b) used SEM to examine the possible direct and indirect effects of defense expenditures on growth for 50 countries. They estimated the equations by 3SLS and found the positive direct effect of defense burden on growth but negative indirect effect via saving, investment and trade balance. They concluded that negative effects of defense expenditures offset the positive effects of defense to formulate the net effect negative.

Scheetz (1991) used four equations to examine the effect of defense spending on growth in 4 Latin America countries over the period 1969-1987. By using the time-series and pooled data, Scheetz (1991) suggested the negative impacts of defense burden on growth. Dunne and Mohammed (1995) added one more equation of education spending in traditional four equations. The study found negative and insignificant effect of defense expenditures for 13 Sub-Saharan African countries by conducting the cross-section and pooled estimations. Another study by Galvin (2003) estimated three equations by 2SLS and 3SLS to investigate the defense-growth relation based on cross-sectional analysis of

sixty four developing countries in 1999. The estimates of the study showed the net negative effect of defense sector on growth. Furthermore, it was also observed that low income economies had less negative impact than middle income economies.

Now we switch to the national studies under Deger-type framework. Roux (1996) found no impact of defense outlays on growth in South Africa by utilizing the four equation Deger-type model over the period 1960-1990. Antonakis (1997b) estimated the three-equation Deger-type model for Greece over the period 1960-1990. The study concluded that net effect of defense spending was negative. Dunne et al. (2000) found the net negative effect of defense spending on growth in South Africa with four equations over the period 1961-1997.

Sezgin (2001) applied the Deger model with four equations to examine the defense-growth association in Turkey for the period 1956-1994. The study estimated the simultaneous equation model by 2SLS and 3SLS. The estimated results suggested that there is positive defense-growth relationship in Turkey. The bearing of defense expenditures on savings and trade balance was found insignificant.

Ramos (2004) specified the three equations to estimate the Deger-type model in Mexico over the period 1970-2000. The study used 3SLS methodology to estimate the equations simultaneously. The study found positive defense-growth relationship along with crowding out effect on savings. The study concluded that the net effect of defense expenditures on growth was positive. Klein (2004) adopted the three-equation Deger type model to investigate the defense-growth relationship in Peru over the period 1970-1996. The author suggested the overall negative effect of defense spending on growth in Peru.

In view of the above literature we can conclude that the studies under the Deger-type models or (demand and supply combined) exhibit the net negative effect of defense spending except some studies which find the net positive effect.

3. Model Specification

Keynesian models focus on demand-side while Neoclassical models concentrate on supply side. Keynesian aggregate demand function captures the demand-side influences while supply-side effects are exhibited in growth equation. Deger and other economists developed a defense-growth model in order to capture both the demand and supply effects in a model and to avoid the problem of focusing on one side only. Therefore, Deger type models are called the demand and supple-side models.

The pioneer study by Smith and Smith (1980) applied SEM to show both the demand and supply side effects. Following the framework by Smith and Smith (1980), Deger and Smith (1983), Deger and Sen (1983, 1995) and Deger (1986a, 1986b) constructed SEM to incorporate the likely positive (direct) effects of defense expenditures on economic growth by Keynesian demand stimulation and other spin offs effects and negative (indirect) effects via diminution in savings or investment, trade balance, health and education. The relative strength and direction of defense expenditures determine the net influence on growth.

The simultaneous equation model by Deger and Sen (1995) consists of following equations:

$$g = \alpha_1 + \alpha_2 S + \alpha_3 D + \alpha_4 TB + \alpha_5 E_1 \quad \text{(Growth Equation)}$$
$$S = \beta_1 + \beta_2 D + \beta_3 g + \beta_4 TB + \beta_5 E_2 \quad \text{(Saving Equation)}$$
$$TB = \gamma_1 + \gamma_2 D + \gamma_3 g + \gamma_4 E_3 \quad \text{(Trade Balance Equation)}$$
$$D = \delta_1 + \delta_2 E_4 \quad \text{(Defense Equation)} \quad (1)$$

Where g is GDP growth rate, S is the saving ratio, D is defense expenditures as a share of GDP, TB is the trade balance as a share in GDP, E*i* are a set of exogenous variables and (αi, βi, γi, δi) are the set of parameters.

So, the Deger-type simultaneous equation model has four equations consisting of growth equation, savings equation, trade balance equation and defense expenditures equation. We have augmented the Deger-type simultaneous equation model by adding one more equation i.e. education equation. No study has specifically been conducted for Pakistan and India using the five-equation Deger type model. This adds to the literature of defense economics. The analysis of empirical studies provides the view that the techniques of 2SLS and 3SLS have been used to sort out the issues of simultaneity, endogeneity and high covariance. But the present study adds to the prevailing literature by utilizing the most sophisticated technique i.e. Generalized Method of Moments (GMM) by making a system of five equations. Now we specify the equations to comprehend the Deger-type model.

3.1 Growth Equation

Traditionally, production function i.e. *Y=f (K,L,T)* is used to derive the growth equation where Y is output, *K* and *L* are capital and labor, T is technology (Deger and Smith, 1983). In this equation, we have specified five variables as savings, defense expenditures, balance of trade, labor force and education expenditures. Savings is an important source of capital formation. So, savings must be in the equation, with expected positive effects based on conventional growth theories. Defense spending is the more concerned variable in the growth equation. From the various channels or mechanisms of defense spending, we know that defense spending can affect the growth by two conduits i) directly through spin offs and reallocation of resources and ii) indirectly through creation of new resources. The growth equation is not sufficient to capture both the effects as it depicts the direct effect of defense outlay only and for the explanation of indirect effects, another equation of 'savings' is specified. The direct impact of defense spending is captured by spin offs and reallocation of resources. Spin off effects are positive and can be realized by two ways: additional aggregate demand creation (Direct Spin-off) and modernization effects (Indirect Spin-off). Reallocation of resources effect of defense spending is negative. Therefore, the sign of defense spending is ambiguous depending on the relative size of direct effects. The variable of balance of trade is intended to grasp the net exports effect on economic growth. Labor force is used in the growth equation, with expected positive sign as suggested by basic growth theories. Finally, the education expenditures enter the equation with expected positive effects postulated by structuralist approaches of development.

The standard form of the growth function can be specified in the following equations for both the countries as:

$$RGDP = \alpha_0 + \alpha_1 RGNS + \alpha_2 RDEP + \alpha_3 TB + \alpha_4 LF + \alpha_5 REE \text{ (For Pakistan)}$$

$$RGDP = \alpha_0 + \alpha_1 RGNS + \alpha_2 RDEI + \alpha_3 TB + \alpha_4 LF + \alpha_5 REE \text{ (For India) (2)}$$

3.2 Savings Equation

The national income identity identifies the savings equation and can be written as:

$$Y = Y^* - Z = C + I + D + TB \quad (3)$$

where Y is actual output, Y^* is potential output (full employment output), Z is the gap between the actual and potential output, C is the aggregate civilian consumption (public and private), I is aggregate civilian investment (public and private), D is the defense expenditures, and TB is the trade balance. We have manipulated the above output/expenditure relationship along with the addition of two other variables.

The variable of defense expenditures is assumed to have positive or negative sign in the light of resource creation effect. An increase in defense spending results in inflation. In many developing countries which are in fact supply-constrained economies, defense spending is inflationary. The profitability and investment level increases due to inflationary defense spending and hence growth is promoted. Conversely, defense spending may enhance the inflationary expectations of the masses producing the consumption boom and investment in those sectors of the economy which have low potential growth. Thus, the sign of the coefficient of defense expenditures is vague. Growth rate of GDP is a vital determinant of the savings as explained by the life cycle consumption theories. These theories assume the positive association between savings and GDP growth. The external sector variable i.e. trade balance enters the equation with positive expected sign through trade taxes and income multipliers. Inflation is incorporated to encompass the inflationary effects on creation of new resources. Inflation can enhance or retard the savings level depending on the structure of the economy and behaviors of the people. Therefore, the sign of inflation cannot be determined with certainty. Finally, effects of non-defense government expenditures are ambiguous.

The standard form of the savings function can be specified in the following equations for both the countries as:

$$RGNS = \beta_0 + \beta_1 RDEP + \beta_2 RGDP + \beta_3 TB + \beta_4 INF + \beta_5 RNDGE \text{ (For Pakistan)}$$

$$RGNS = \beta_0 + \beta_1 RDEI + \beta_2 RGDP + \beta_3 TB + \beta_4 INF + \beta_5 RNDGE \text{ (For India)(4)}$$

3.3 Trade Balance Equation

The impacts of defense spending can also be depicted by the external sector equation i.e. trade balance equation. An increase in defense expenditures influences the trade balance of a country negatively. Under the assumption of relative inelastic indigenous aggregate supply, a rise in defense outlays enhances the AD that affects the trade balance adversely due to fall in exports and rise in imports as the country has to divert all its resources to accommodate the increasing aggregate demand. The variable of GDP can impact the

trade balance positively or negatively depending upon either the country is adopting export promoting strategies or import substitution strategies. The expected sign of inflation is ambiguous as it can affect the trade balance (TB) positively or negatively. If the exchange rate is fixed, inflation disturbs the TB adversely. But if exchange rate is flexible, inflation can have a positive bearing on TB. Real exchange rate is an essential factor of TB that captures the effects of relative price levels on trade balance. The macroeconomic theory suggests that trade balance is a negative function of real exchange rate. So, the expected sign of real exchange rate is negative. So in the light of above discussion, the standard form of the trade balance function can be specified in the following equations for both the countries as:

$$TB = \gamma_0 + \gamma_1 RDEP + \gamma_2 RGDP + \gamma_3 INF \text{ (For Pakistan)}$$

$$TB = \gamma_0 + \gamma_1 RDEI + \gamma_2 RGDP + \gamma_3 REER + \gamma_4 RGDPC \text{ (For India) (5)}$$

3.4 Defense Expenditures Equation

To determine the defense expenditures equation, we have to focus the various factors of defense spending for both the countries. The variable of GDP is included to represent the resource constraint of the country. Defense is a public good and the theory of public finance proposes the positive nexus between defense spending and GDP. But this relationship can be negative with certain security levels. To capture the effects of openness of the economy, the variable of trade balance has been added in the equation. The expected sign is ambiguous due to uncertain direction of openness. The political milieu is exhibited by democracy index but its expected sign is vague. Finally, the strategic factors i.e. defense burden of the rival country and war enter the equation with expected positive sign. So in the light of above discussion, the standard form of the defense expenditures function can be specified in the following equations for both the countries as:

$$RDEP = \delta_0 + \delta_1 RGDP + \delta_2 TB + \delta_3 DEMOC + \delta_4 RDEI + \delta_5 WAR \text{ (For Pakistan)}$$

$$RDEI = \delta_0 + \delta_1 RGDP + \delta_2 TB + \delta_3 DEMOC + \delta_4 RDEP + \delta_5 WAR \text{ (For India) (6)}$$

3.5 Education Expenditures Equation

Mostly the above mentioned equations (except Dunne and Mohammad, 1995) have been considered in the literature for Deger type analysis, but we have specified another equation i.e. education expenditures equation. To specify the equation, resource constraint variable GDP enters the equation with expected positive sign. National Savings is equal to domestic savings plus net factor income from abroad. National savings can affect the education government spending positively or negatively. The positive channel is when the domestic savings or net factor income from abroad is positive, the government has more resources or funds at its disposal so the government can use these funds either in education spending or other projects. Therefore, the sign of government spending on education is unclear and it would depend upon how the economy and the political process work. The variable of trade balance is included to show the effects of openness in economy and the expected sign of trade balance is ambiguous due to uncertain direction of openness. Defense spending may reduce the resources available for the other sectors of the economy so negative sign is expected. Tax is an important source of government receipts. The expected sign of taxes is unclear because it depends upon

government policies about the education sector. If government is making efforts to promote education programs and projects, tax revenues may be transformed into educational expenditures. On the other hand, if education is not the priority of the government, tax revenues would not be used in education sector. Inflation affects the government spending adversely. As the inflation prevails in the economy, the cost of public projects increases, hence, the coefficient of inflation is expected with negative sign. So in light of the above discussion, the standard form of the education expenditures function can be specified in the following equations for both the countries as:

$$REE = \phi_0 + \phi_1 RGDP + \phi_2 RGNS + \phi_3 RDEP + \phi_4 TB + \phi_5 RTAX \text{ (For Pakistan)}$$

$$REE = \phi_0 + \phi_1 RGDP + \phi_2 RGNS + \phi_3 RDEI + \phi_4 TB + \phi_5 RTAX + \phi_6 INF$$

(For India) (7)

Now the next task is to estimate the above mentioned equations (which are in general form) for both countries. But before this, it is necessary in the time series data to check integration properties of the variables by ADF test before estimation. We have examined the stationarity of the data in the next section along with data sources and methodology.

4. Data and Methodology

The data sources both for Pakistan and India have been given in Table 1.

Table 1: Data Sources for Pakistan and India

Variables	Data Source for Pakistan	Data Source for India
▪ Dollar Exchange rate ▪ GDP at current and constant 2000USD ▪ Education Expenditures	World Development Indicators Global Development Finance	World Development Indicators Global Development Finance
▪ Savings ▪ Trade balance ▪ Real exchange rate ▪ Inflation ▪ Defense Expenditures ▪ Non-defense Government Expenditures	Handbook of Statistics on Pakistan Economy	Handbook of Statistics on the Indian Economy
▪ Taxes and Labor force	Pakistan Economic Survey (various issues).	
▪ Democracy index	Polity IV Regime Authority Characteristics and Transitions Datasets	Polity IV Regime Authority Characteristics and Transitions Datasets

The democracy index varies from +10 to -10. The value of +10 shows democracy while -10 exhibits autocracy. The index has been standardized from 0 to 1 showing autocracy and democracy respectively.

War is dummy variable that exhibits the war or war like conditions prevailing in both the countries assumes the value of one for the years 1984, 1985, 1986, 1987, 1995, 1999, 2001 and 2002 and zero elsewhere. To compute the non-defense government

expenditures, we have subtracted defense expenditures from the total central government expenditures.

4.1 Description of Variables

RGDP = Real GDP (Proxy used for growth rate)
RDEP = Real Defense Expenditures of Pakistan
RGNS = Real Gross National Savings
RDEI = Real Defense Expenditures of India
TB = Trade Balance
LF = Labor force
REE = Real Education Expenditures
INF = Inflation Rate
RTAX= Real Taxes
WAR = Dummy variable
REER = Real Effective Exchange Rate
RNDGE = Real Non-Defense Government Expenditures
RGDPC = Real GDP Per-capita
DEMOC = Democracy Index

We have used ADF test to diagnose the unit root. After applying all the specifications of ADF test, we have found unit root in many series of the variables (See Table 2).

We have applied OLS and GMM techniques to estimate the equations by taking the first difference of the variables but the results were fragile and weak. Thus, we have concentrated on original variables to estimate the results.

Table 2: Augmented Dickey Fuller (ADF) Test

(For Pakistan)							
Variables	**None**	**Lags**	**Intercept**	**Lags**	**Intercept and Trend**	**Lags**	**Conclusion**
RDEP	0.452976	0	-1.83097	0	-1.68005	0	I(1)
RGDP	2.2422	4	2.4333	1	-0.5962	1	I(1)
RNDGE	2.7142	0	-0.6641	0	-3.9778	1	I(0)
TB	0.0344	0	-1.8499	3	-2.3368	0	I(1)
RGNS	1.0206	1	-0.6992	1	-2.6224	0	I(1)
LF	6.6176	0	4.0568	1	0.9677	1	I(0)
REE	1.3673	0	-0.8918	0	-3.7256	1	I(1)
INF	-1.3276	0	-3.2477	0	-3.3763	0	I(1)
REER	-2.0346	5	-1.2468	0	-1.1540	0	I(1)
RGDPC	6.7734	0	1.1308	0	-2.4132	0	I(1)
RTAX	-3.1697	1	0.5789	1	-3.1986	0	I(1)
(For India)							
Variables	**None**	**Lags**	**Intercept**	**Lags**	**Intercept and Trend**	**Lags**	**Conclusion**
RDEI	2.0877	0	0.3518	0	-0.0287	0	I(1)
RGDP	17.5319	0	12.4944	0	5.1692	0	I(0)
RNDGE	6.7651	0	4.6036	0	2.4488	0	I(0)
TB	0.0155	0	-2.6888	0	-2.6240	0	I(1)
RGNS	5.4892	0	3.5061	0	0.6948	0	I(0)
LF	0.8836	3	-1.5258	2	-1.2053	2	I(0)
REE	4.2832	0	2.02880	0	-0.8145	0	I(1)
INF	-2.0565	2	-4.5747	0	-4.6432	0	I(0)
REER	-0.7622	0	-3.1446	0	-2.9866	0	I(1)
RGDPC	10.6060	0	8.4572	0	3.2277	0	I(1)
RTAX	3.5601	0	1.8463	0	1.8463	0	I(1)

Source: Authors' calculations

To sidestep the likelihood of feedback or simultaneity or effects, the specified equations are initially estimated by OLS technique.

After that, the equations are mingled to develop a simultaneous equation system. Generalized Method of Moments (GMM) technique has been applied on simultaneous equation system to cope with high covariance, endogeneity and simultaneity problems and to estimate the net effect of defense outlays on economic growth.

5. Results and Discussions

OLS estimates of the single equations for both the countries show the satisfactory results with the exemption of trade balance equation. In each equation, almost all explanatory variables have the correct and reasonable signs. However, there are some problems of simultaneity, endogeneity and high co-variances with the OLS estimates of single equations.

Therefore, we make a system of simultaneous equation and estimate the system by instrumental variable technique titled by generalized method of moments (GMM) rather than traditionally used instrumental variable techniques of 2SLS and 3SLS in the literature.

The system of simultaneous equations for Pakistan and India are as follows:

5.1 For Pakistan

$$RGDP = \alpha_0 + \alpha_1 RGNS + \alpha_2 RDEP + \alpha_3 TB + \alpha_4 LF + \alpha_5 REE$$

$$RGNS = \beta_0 + \beta_1 RDEP + \beta_2 RGDP + \beta_3 TB + \beta_4 INF + \beta_5 RNDGE$$

$$TB = \gamma_0 + \gamma_1 RDEP + \gamma_2 RGDP + \gamma_3 INF$$

$$RDEP = \delta_0 + \delta_1 RGDP + \delta_2 TB + \delta_3 DEMOC + \delta_4 RDEI + \delta_5 WAR$$

$$REE = \phi_0 + \phi_1 RGDP + \phi_2 RGNS + \phi_3 RDEP + \phi_4 TB + \phi_5 RTAX$$

5.2 For India

$$RGDP = \alpha_0 + \alpha_1 RGNS + \alpha_2 RDEI + \alpha_3 TB + \alpha_4 LF + \alpha_5 REE$$

$$RGNS = \beta_0 + \beta_1 RDEI + \beta_2 RGDP + \beta_3 TB + \beta_4 INF + \beta_5 RNDGE$$

$$TB = \gamma_0 + \gamma_1 RDEI + \gamma_2 RGDP + \gamma_3 REER + \gamma_4 RGDPC$$

$$RDEI = \delta_0 + \delta_1 RGDP + \delta_2 TB + \delta_3 DEMOC + \delta_4 RDEP + \delta_5 WAR$$

$$REE = \phi_0 + \phi_1 RGDP + \phi_2 RGNS + \phi_3 RDEI + \phi_4 TB + \phi_5 RTAX + \phi_6 INF$$

Now we discuss the GMM based results of the system of simultaneous equations for both the countries. The estimates of Deger type model (for Pakistan and India) have been shown in Table 3 and 4 respectively.

Table 3: Estimates of Deger type Model (for Pakistan)

Equation	Dependent Variable	Regressors	OLS Estimates	GMM Estimates
Growth Equation	RGDP	Intercept	-23728.37 (-4.75)***	4245.681 (0.72)
		RGNS	0.009160 (2.11) **	0.029493 (5.88) ***
		RDEP	2.125438 (2.30) **	3.545015 (3.59) ***
		TB	-261.4999 (-0.25)	109.3971 (0.08)
		LF	1790.635 (6.88) ***	354.5332 (1.18)
		REE	9.654399 (3.72) ***	23.11834 (8.43) ***
		R^2	0.98	0.98 [a]
		DW	1.52	1.54
Savings Equation	RGNS	Intercept	141825.7 (1.23)	401880.4 (2.36) **
		RDEP	-215.9261 (-5.51) ***	-252.5701 (-4.73) ***
		RGDP	15.31067 (9.30) ***	20.11386 (6.44) ***
		TB	-99708.18 (-2.20) **	-167341.9 (-2.83) ***
		INF	-2240.740 (-0.81)	-3097.995 (-0.68)
		RNDGE	8.841498 (0.57)	-28.37548 (-0.94)
		R^2	0.95	0.94 [a]
		DW	1.28	1.57
Trade Balance Equation	TB	Intercept	2.062886 (8.34) ***	2.803785 (10.53) ***
		RDEP	-0.000272 (-2.59) **	-0.000473 (-6.15) ***
		RGDP	0.00000215(0.83)	0.00000336 (1.02)
		INF	0.006070 (0.59)	-0.018164 (-1.97) *
		R^2	0.32	0.30 [a]
		DW	1.50	1.62
Defense Expenditures Equation	RDEP	Intercept	2173.408 (5.02) ***	2905.880 (7.70) ***
		RGDP	0.041126 (4.70) ***	0.045263 (3.12) ***
		TB	-265.2450 (-1.27)	-528.8749 (-2.26) **
		DEMOC	402.7920 (2.21) **	379.1408 (2.63) **
		RDEI	0.319739 (3.09) ***	0.402088 (2.79) ***
		WAR	602.9776 (3.12) ***	543.8620 (2.74) ***
		R^2	0.70	0.68 [a]
		DW	1.80	1.89
Education Expenditures Equation	REE	Intercept	-466.58 (-3.27) ***	-813.0506 (-4.36) ***
		RGDP	0.031548 (9.45) ***	0.044214 (7.62) ***
		RGNS	-0.000710 (-3.44) ***	-0.001098 (-4.60) ***
		RDEP	0.149769 (1.84) *	-0.283006 (-2.84) ***
		TB	59.47486 (0.90)	239.2089 (2.95) ***
		RTAX	-0.093186 (-1.77) *	-0.298390 (-2.94) ***
		R^2	0.97	0.94[a]
		DW	1.60	1.74

In columns, t-statistics are in parentheses.
a :the value of R^2 is irrelevant in GMM technique.
Significance level is shown by: 1% by ***, 5% by **, 10% by *.

Table 4: Estimates of Deger type Model (for India)

Equation	Dependent Variable	Regressors	OLS Estimates	GMM Estimates
Growth Equation	RGDP	Intercept	45990.22 (2.49)***	55446.64 (4.75) ***
		RGNS	1.767116 (12.90) ***	1.722384 (11.982) ***
		RDEI	13.42876 (2.955) ***	-16.81211(-1.2534)
		TB	-22749.81 (-1.759)*	22561.50 (0.83437)
		LF	39.65848 (0.86474)	17.75764 (3.2288) ***
		REE	7.552982 (3.269) ***	24.20072 (0.61952)
		R^2	0.98	0.98 [a]
		DW	1.51	1.71
Savings Equation	RGNS	Intercept	-31010.61 (-3.13) ***	-36120.88 (-2.781) ***
		RDEI	-11.43476 (-4.55) ***	-20.76662(-6.245) ***
		RGDP	0.450400 (10.72) ***	0.426250 (7.399) ***
		TB	24692.91 (3.540) ***	49797.83 (3.639) ***
		INF	-373.6461 (-1.2710)	-954.8495 (-1.31806)
		RNDGE	-0.003530 (-0.0100)	0.837264 (1.48115)
		R^2	0.98	0.98 [a]
		DW	1.68	1.58
Trade Balance Equation	TB	Intercept	4.259665 (2.15198)	20.82611 (3.09299)
		RDEI	1.74E-05 (0.28781)	-7.62E-05 (-0.7879)
		RGDP	1.47E-05 (1.52177)	9.98E-05 (2.84958)
		REER	-0.003693 (-0.8113)	-0.01647 (-2.62741)
		RGDPC	-0.020686 (-1.5575)	-0.13882 (-2.85425)
		R^2	0.40	-2.31 [a]
		DW	1.70	1.74
Defense Expenditures Equation	RDEI	Intercept	1783.449 (2.064) **	-392.526 (-0.44332)
		RGDP	0.010133 (14.80) ***	0.00948 (20.483) ***
		TB	278.3037 (0.56)	1352.030 (2.81) ***
		DEMOC	-223.7873 (-0.4775)	-233.3979 (-0.73652)
		RDEP	0.078665 (0.45281)	0.497741 (2.842) ***
		WAR	879.2663 (3.283) ***	651.8311 (4.1040) ***
		R^2	0.94	0.92 [a]
		DW	1.51	1.63
Education Expenditures Equation	REE	Intercept	-2381.938 (-1.72) **	-2335.223 (-0.893)
		RGDP	0.042179 (4.39) ***	0.053052 (2.2777) **
		RGNS	-0.052727 (-2.58) **	-0.086480 (-1.78) *
		RDEI	0.435999 (1.26384)	-0.81271 (-1.012432)

		TB	-513.0817 (-0.5424)	-1295.955 (-0.64821)
		RTAX	0.136113 (1.919) **	0.017253 (0.24321)
		INF	-31.72005 (-0.9009)	-50.19486 (-0.73331)
		R^2	0.98	0.97 [a]
		DW	1.75	1.78

In columns, t-statistics are in parentheses.

a :the value of R^2 is irrelevant in GMM technique.

Significance level is shown by: 1% by ***, 5% by **, 10% by *.

First we discuss the estimates of growth equations for both the countries. The dependent variable is real GDP which is used for the proxy of economic growth in both growth equations specified for Pakistan and India. The explanatory variables specified in the growth equations of both the countries are real gross national savings, real defense expenditures, trade balance, labor force and real educational expenditures. We have used the lag of all the variables as instruments except labor force.

Savings is an important source of capital formation. The parameter of Real Gross National Savings (RGNS) in both countries' growth equations is positive and highly significant. These findings are according to the conventional growth theories which suggest the positive link between savings and growth. Our results are in line with the following studies (Deger and Smith, 1983; Scheetz, 1991; Antonakis, 1997; Dunne and Nikolaidou, 2001).

The second variable is defense expenditures which is the more focused variable in the growth equation. In Pakistan's growth equation, the sign of the estimate of Real Defense Expenditures (RDEP) is positive and strongly significant. While in contrast to Pakistan, the sign of defense expenditures in India's growth equation is negative and statistically insignificant. Indeed, there are two routes by which defense outlays can influence growth: one is direct route i.e. spin offs and reallocation of resources and the other one is indirect through creation of new resources. The growth equation shows the direct effect of defense expenditures only through Keynesian demand simulation and additional spin-off effects and for the explanation of indirect effects (creation of new resources), the equations of savings, trade balance and educational expenditures have been specified. Spin off effects are the positive externalities that can be attained by two ways: additional aggregate demand creation (Direct Spin-off) and modernization effects (Indirect Spin-off). However, reallocation of resources effect of defense spending is negative.

Therefore, the sign of defense spending is vague depending on the comparative magnitude of direct effects (Antonakis, 1997). The positive sign of defense spending in Pakistan's growth equation indicates the presence of spin-off or externalities effects in Pakistan. Following studies show the empirical evidence of the positive effects of defense expenditures on growth (Deger and Sen, 1983; Deger and Smith, 1983; Deger, 1986; Sezgin, 2001; Galvin, 2003; Klein, 2004 and Ramos, 2004).

Coming towards the parameter of Real Defense Expenditures (RDEI) in India's growth equation, it is inversely linked with growth supporting the reallocation of resources effect. This may seem to suggest that in India defense spending is retarding the economic growth by reallocation and reducing the funds for investment purposes. The volume and size of defense spending is more in India than in Pakistan. The results of India are

compatible with the following studies (Smith and Smith, 1980; Scheetz, 1991; Dunne and Mohammed, 1995; Antonakis, 1997 and Dunne et al. 2000).

The Trade Balance (TB) is another important macroeconomic variable that provides the net exports effect on economic growth. In both countries' growth equations, the external sector variable does not show a significant (though a positive) relationship with economic growth. Labor Force (LF) as a primary factor of production is used in the growth equation, with expected positive sign as suggested by basic growth theories. In Pakistan's case, the labor force has no significant impact on growth, although it has the expected sign. The coefficient of labor force appears with positive sign in India's growth equation and it is statistically significant as well. The positive labor-growth nexus may be justified on the investment in human capital grounds. Many studies have also reported positive labor-growth relationship (for example, Deger and Smith, 1983; Alexander, 1990, 1995; Huang and Mintz, 1991; Mueller and Atesoglu, 1993). Finally, the Real Education Expenditures (REE) appears in the equation with expected positive effects. In both countries' growth equations, the structural variable of education spending shows a positive connection with growth as postulated by structuralist approaches of economic development. The REE is used as a proxy for human capital formation and has no significant impact on growth, although it has the expected sign in both the countries but it is significant for Pakistan. So far as the diagnostic tests are concerned, our results are fairly robust. The values of DW in both equations are also within the acceptance range and indicate that the residuals are not serially correlated.

Now turning our attention to the second equation (savings equation) of the simultaneous equation model, we discuss the estimates of savings equations for both countries. The regresand is real gross national savings while the regrossors are real defense expenditures, real GDP, trade balance, inflation and real non-defense government expenditures in both equations specified for Pakistan and India. We have used the lag of all the variables as an instrument.

Firstly, we switch to the main variable of concern that is defense expenditures. The coefficient of real defense spending in both equations is negative and highly significant postulated by resource creation effect. According to resource creation effect, defense spending can affect the savings either positively or negatively. In many supply-constrained economies, defense spending escalates the price level by increasing the aggregate demand that leads to boosting the growth by rising in profits and investment level. Conversely, defense spending may enhance the inflationary expectations of the masses producing the consumption boom and investment in those sectors of the economy which have low potential growth (Antonakis, 1997). For both the countries, the negative sign on this variable indicates that defense spending translates in investment in low priority sectors and retarding the growth. So, the results here are line with several empirical studies (See Smith and Smith, 1980; Deger and Sen, 1983; Deger and Smith, 1983; Deger, 1986; Dunne and Mohammed, 1995; Antonakis, 1997; Dunne et al. 2000; Sezgin, 2001; Galvin, 2003; Klein, 2004 and Ramos, 2004) except Scheetz (1991).

Growth rate of GDP is a vital determinant of the savings as explained by the life cycle consumption theories. These theories assume the positive relation between savings and growth rate of GDP. Deger and Smith (1983) call this positive relationship between growth and savings "as LDC twist". The coefficient of real GDP (RGDP) in both equations is highly significant and appears with expected positive sign according to the

life cycle effects. Our results are similar to the following studies that also found the same empirical evidence for life cycle effects (See for example, Smith and Smith, 1980; Deger and Smith, 1983; Deger, 1986; Antonakis, 1997; Dunne et al., 2000; Sezgin, 2001; Galvin, 2003; Klein, 2004 and Ramos, 2004).

The external sector variable i.e. trade balance comes in the equation with expected positive sign through trade taxes and income multipliers. The parameter of trade balance in India's savings equation is significant. This positive sign suggests that government is getting more revenues from trade taxes that result in boosting the public savings and national savings. The second reason may be the presence of income multiplier which indicates that due to increase in exports, national income and savings rise. Our results of India are in line with studies (Scheetz, 1991; Dunne and Nikolaidou, 2001).

It is also interesting to note that the coefficient of trade balance in Pakistan's saving equation is negative and strongly significant. This outcome is against the theoretical underpinning. The possible interpretation of this inverse relationship in Pakistan may be that trade taxes and income multipliers are not so effective (Weisskopf, 1972;Deger and Smith,1983).

Inflation is incorporated to encompass the inflationary effects on the creation of new resources. Inflation can enhance or retard the savings level based on the configuration of the economy and behaviors of people. In both countries' savings equations, the coefficient of inflation (INF) does not show a significant (though a negative) relationship with national savings. This may seem to suggest that these countries have less Disposable Personal Income (DPI) due to inflation and taxes; therefore, savings level is low (Sezgin, 2001)

The results here are in accordance with the findings of following studies (See Deger and Smith, 1983; Sezgin, 2001; Dunne and Nikolaidou, 2001).

Finally, the effect of Real Non-defense Government Expenditures (RNDGE) has appeared with mixed nature in savings equations of both the countries. In Pakistan's savings equation, RNDGE is insignificant and inversely correlated with the real gross national savings. While in India's savings equation, RNDGE show a positive (though insignificant) relationship with the real gross national savings.

The studies (See for example Sezgin, 2001; Dunne and Nikolaidou, 2001) found the negative empirical evidence for the non-defense government expenditures and savings. The diagnostic tests of the savings equations indicate that the results are vigorous. The values of DW in both the equations suggest that the evidence of serial correlation.

Switching to the third equation (trade balance equation) of SEM and talk about the parameter estimates of trade balance equations for both the countries. To begin with Pakistan's trade balance equation, the dependent variable is trade balance while the independent variables specified are real defense expenditures, real GDP and inflation. In India's trade balance equation, the regressand is trade balance while the explanatory variables specified are real defense expenditures, real GDP, real effective exchange rate and real GDP per-capita. We have used the lag of all the variables as an instrument.

Firstly, we discuss the estimates of Pakistan's trade balance equation. The parameter of Real Defense Expenditures (RDEP) which is our main variable turns out to be negative and highly significant. The negative sign on this variable reveals that under the

assumption of relative inelastic indigenous aggregate supply, defense spending enhances the aggregate demand which affects the trade balance adversely due to fall in exports and rise in imports.

Scheetz (1991) also advocates the same argument which Deger (1986) has claimed about the inverse relation between trade balance and defense spending.

The variable of GDP can impact the trade balance positively or negatively depending upon either the country is following export promoting strategies or import substitution strategies. The parameter of real GDP (RGDP) appears as positive though insignificant in the equation. The positive sign indicates that Pakistan is following export promoting strategies. If a country adopts export promotion policy, GDP affects the trade balance positively and if the country pursues the import substitution policy GDP affects the trade balance negatively.

The final regressor in Pakistan's trade balance equation is inflation. The expected sign of inflation is ambiguous as it can affect the trade balance positively or negatively. If exchange rate is fixed, inflation disturbs the trade balance adversely. But if exchange rate is flexible, inflation can have a positive impact on trade balance. The coefficient of inflation (INF) shows a significant (though a negative) relation between trade balance and inflation.

Now, we explain the estimates of India's trade balance equation. The parameter of Real Defense Expenditures of India (RDEI) is significant but negative as expected. The coefficient of Real GDP (RGDP) is positive and significant. The positive sign on the variable indicates that India is also pursuing export promoting strategies. Real exchange rate is an important determinant of trade balance that captures the effects of relative price levels or variation in international purchasing power of local currency on trade balance. The macroeconomic theory suggests that trade balance is a negatively related with real exchange rate. The parameter of Real Effective Exchange Rate (REER) is negative and strongly significant as expected. If the real exchange rate is high, domestic goods are relatively expensive and foreign goods are relatively cheaper so trade balance would deteriorate due to fall in exports and rise in imports and vice versa. (Mankiw,2000).

Finally, the last regressor is Real GDP per-capita (RGDPC) that is negative and significant. The diagnostic tests of the trade balance equations indicate that the results are robust. The values of DW in both equations are within the limits and there is no evidence of serially correlation.

Now considering the fourth equation (defense expenditures equation) of the simultaneous equation model we explain the parameters of defense expenditures equations for both the countries. In both equations specified for both the countries, the response variable is real defense expenditures of the respective country and the independent variables are real GDP, trade balance, democracy index, real defense expenditures of rival country and dummy variable of war. We have used the lag of all the variables as an instrument. The variable of GDP represents the resource constraint of the country. In literature of public finance, defense is taken as a public good and assumes the positive association between defense and GDP. However, this relationship may be negative with the certain security level (Antonakis, 1997). The parameter of real GDP (RGDP) in both countries' defense expenditure equations is found positive and statistically significant. The positive sign on the variable suggests the public good considerations for both the countries.

To capture the effects of openness of the economy, the variable of trade balance has been added in the equation. The expected sign is ambiguous due to uncertain direction of openness. The parameter estimate of trade balance (TB) is negative and strongly significant in Pakistan's equation (Dunne and Mohammed, 1995). It is interesting to note that coefficient of trade balance (TB) is positive and statistically significant for India. The positive sign on the variable indicates that India is not spending on defense with poor trade balance.

The democracy index exhibits the political setting in any country. Many studies on the determinants of defense spending have explored the fact that the non-democratic countries have more tendencies to spend on defense rather than the countries with more democratic setup. This is due to the fact that they want to remain intact with power and to justify their regime according to militarism philosophy. For Pakistan, the sign of democracy index is positive and significant in keeping with our anticipations as Pakistan has remained in military rule frequently. Our findings are in line with the studies(Maizels and Nissanke, 1986; Dommen and Maizels, 1988 and Hewitt, 1996). For India, the variable of democracy index has appeared with negative sign although it is insignificant as well. As India is democratic country so the sign is correct as we are expecting. The democratic countries make their defense spending decisions based on political process, rule of law and contending demand of other primacies (See for example, Batchelor et al., 2002 .Dunne and Perlo Freeman, 2003a, 2003b and 2007).

Finally, the strategic factors i.e. defense burden of the rival country and war enter the equation with expected positive sign. In both countries' defense expenditures equations, the parameters of adversary's defense spending and war are positive and highly significant according to the Richardson arms race model (Antonakis, 1997; Sheikh and Chaudhry, 2013).

The diagnostic tests of the trade balance equations indicate that the results are robust. The values of DW in both equations are within the limits and there is no indication of serial correlation. The diagnostic tests of defense expenditure equations also indicate that the results are satisfactory and robust.

Turning our attention to the final equation (education expenditures equation), which we have augmented in the Deger-type model to reconnoiter the indirect effect of defense outlay on growth. The dependent variable is real education expenditures and the explanatory variables specified are real GDP, real gross national savings, real defense expenditures, trade balance, real taxes and inflation. We have used the lag of all the variables as an instrument except labor force.

The resource constraint variable GDP is intended to enter the equation with expected positive sign. In both equations, the coefficient of this variable (RGDP) is positively significant. National savings can affect the education government spending positively or negatively. The positive channel is when the domestic savings or net factor income from abroad is positive, the government has more resources or funds at its disposal so the government can use these funds either in education spending or other projects. Therefore, the sign of government spending on education is unclear and it would depend upon how the economy and the political process work. The parameter of Real Gross National Savings (RGNS) is negative and statistically significant in both countries' equations. The negative sign suggest that education is not the priority of both countries.

Defense spending may reduce the resources available for the other sectors of the economy so negative sign is expected. The parameter of defense spending is negative in both counties' equations as expected. The variable of trade balance is included to encapsulate the effects of openness in the economy and the expected sign of trade balance is ambiguous due to uncertain direction of openness. The coefficient of trade balance is positive and significant in Pakistan even though in it is negative and insignificant in India. Tax is an important source of government receipts. The expected sign of taxes is unclear because it depends upon government polices about the education sector. If government is making efforts to promote education programs and projects, tax revenues may be transformed in educational expenditures. On the other hand, if education is not the priority of government, tax revenues would not be used in education sector. The parameter of real taxes is negative in Pakistan while it positive in India. Inflation affects the government spending adversely. As the inflation prevails in the economy, the cost of public projects increases, hence, the coefficient of inflation has negative sign in India's equation. The diagnostic tests suggest that Pakistan's education expenditure equation has performed well but results in India's equation are not satisfactory.

According to J-statistic, both the models specified for Pakistan and India are correctly specified and over identifying restrictions are valid. The critical values of chi square for Pakistan and India are 1.582 and 1.402 respectively suggesting that we are unable to reject the null hypothesis.

By considering the direct effects of defense expenditures on growth through spin-off effects and indirect effects of defense outlays on growth through savings, trade balance and education, the defense expenditure multiplier can be calculated as:

$$\frac{dRGDP}{dRDE} = \frac{\alpha_2 + \alpha_1\beta_1 + \alpha_3\gamma_1 + \alpha_4\varphi_3 + \eta\gamma_1 + \lambda\beta_1 + \lambda\beta_3\gamma_1}{1-(\alpha_1\beta_2 + \alpha_3\gamma_2 + \alpha_4\phi_1 + \eta\gamma_2 + \lambda\beta_2 + \lambda\beta_3\gamma_2)}$$

Where: $\eta = \alpha_1\beta_3 + \alpha_4\phi_4$ and $\lambda = \alpha_4\phi_2$

The value of defense expenditure multiplier in case of Pakistan is 52.51 which show the positive net effect of defense spending. The direct effects of defense on growth are positive while the indirect effects of defense are negative. The strength of direct effects of defense spending is more than the indirect effects so the net effect is positive. Thus, in Pakistan, defense spending has stimulatory spin-off effects on the economy.

So far as the value of defense expenditure multiplier is concerned in India, it is -10.2979 suggesting that the net effect of defense spending is negative. The direct effects of defense spending are negative supporting the reallocation of resources effect while the indirect effects of defense spending through savings, trade balance and education are also negative. In case of India, the strength of effects does not matter as all the effects go in the same direction.

6. Conclusion and Policy Implications

This study has investigated the impacts of defense expenditures on economic growth for Pakistan and India over the time span of 1972-2010 by employing the Deger-type (demand and supply) model. The study gives the overall picture of the scenario focusing on both the demand and supply side effects. We have estimated a five-equation system in

two ways: i) by using single equation method i.e. OLS and ii) system equation method i.e. GMM.

Fundamentally, the Deger-type model takes into account the three mechanisms or channels of defense spending: a) spin-off effects b) reallocation of resources and c) creation of new resources. These effects are simultaneously taken by system equation method and partially by single equation method.

The results of Pakistan, suggest that the positive net effect of defense spending. The direct effects of defense on growth are positive while the indirect effects of defense on growth are negative. The positive direct effects mean that defense sector is performing stimulatory role in the economy through creation of additional aggregate demand and modernization effects. The negative indirect effects capture that creation of new resources effects via savings, trade balance and education. The positive direct effects of defense spending out-weight negative indirect effects of defense expenditures so overall effect is positive for Pakistan.

For India, the findings suggest that direct effects of defense spending are negative according to reallocation of resources argument and indirect effects via savings, trade balance and education are negative supporting the creation of new resources argument. So both the direct and indirect effects of defense expenditures are negative and the overall effect is also negative.

The study has also pointed out some policy inferences. Taking view of both the demand and supply side model (Deger-type) for both the countries, the net effect for Pakistan turns out to be positive whereas for India, it is negative. For Pakistan, the positive effects of supply-side channel offset the negative effects of demand-side, hence suggesting that Pakistan should follow the tread of spending more on defense to accelerate its growth. However, for India, the suggestion is upside down. The negative effects of demand channel outweigh the positive supply-side effects hence suggesting that India should not spend more on the defense sector as a means to achieve higher economic growth.

In a nutshell, we can conclude that defense spending is beneficial for Pakistan while harmful for India. Our results for India clearly reinforce the Deger's conclusions, while for Pakistan our findings are contrary to Deger's results.

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