The Determinants of Defense Expenditures in Pakistan and India: An ARDL Bounds Testing Approach

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Abstract
Using the ARDL approach for the years of 1972-2010, this study has employed the general model of aggregate defense expenditures to explore the determinants of defense spending for Pakistan and India. The demand for defense spending for both the countries is determined by economic, political and strategic factors. The findings of the study regarding economic determinants suggest that RGDP and Non-defense Government Expenditures positively influence the defense spending of both the countries while the trade balance has mixed results. The political determinant i.e. democracy index used as proxy for regime of government has positive effects on Pakistan’s defense spending while in India it has negative effects. The study finds out that the strategic factors such as atomic threat, internal threats and wars have positive impact on the defense expenditures of both the countries. Hence, the study has highlighted the cogent determinants of the defense spending in short run and long run suggesting that the arm race factor and associated economic and political factors are imperative for the defense spending of Pakistan and India.

Keywords: Defense Expenditures; Pakistan and India; ARDL

I. Introduction
Since their inception as independent states in 1947, Pakistan and India have constant conflicting and hostile relationships with each other. There are a lot of factors behind the unfriendly and skirmish behaviors of the two neighboring countries. The main factor is the religious difference as claimed by [Alexander, 1987; Deger and Sen, 1990; Ganguly, 1995, 1997 and Tibbett and Akram-Lodhi 1997]. Besides religious factor, many other factors (such as social, economic, racial and political) exist. Even the governments of both sides do not accept that they are in an arms race but due to enmity, a large proportion of their budget is allocated for defense purpose [Tibbett and Akram-Lodhi, 1997]. Ganguly (1995) asserted three main reasons for the conflicts between the two countries: the common British imperial heritage, paucity of highly sophisticated weaponry and the lack of doctrinal innovation.
There are a lot of studies found\(^1\) on the determinants of defense spending for various countries and especially for developing countries but a few studies [See Alexander, 1987; Deger and Sen, 1990; Oren, I, 1994; Tahir, R, 1995; Ganguly, S,1995; Tibbett and Akram-Lodhi, 1997; ÓOcal N, 2003; Jüülide Yildirim and Nadir ÓOcal, 2006] have been conducted for Pakistan and/or India. In this study, we have explored the determinants of defense spending for both the nations empirically. This study is an attempt to fill the gap by supplementing the existing literature on the determinants of defense expenditures of Pakistan and India. The study employs the autoregressive distributed lag (ARDL) technique. The analysis has been conducted for the time period 1972-2010 and to the best of our knowledge it is the first study that investigates aggregate defense model by employing this technique.

The rationale for considering Pakistan and India, as a valuable case study is as follows: Firstly, both the countries are situated in a strategic part of South Asia which has witnessed a great level of insecurity. Some authors (Dunne et al., 1999; ÓOcal N, 2003; Jüülide Yildirim and ÓOcal, N 2006) have an opinion that Pakistan and India are in arms-race due to various factors but they are inconclusive regarding the factors determining the defense spending.

Secondly, both the countries have internal and external security issues. Thirdly, both the nations have become nuclear powers after conducting the nuclear explosions in 1998. This has increased the hostility and uncertainty in the region. Finally, even both are placed in the category of developing countries but they are allocating an ample share of their budget and resources for defense purpose. In 2010, defense expenditures of Pakistan and India were US$ 2897 and US$11465 (in constant 2000 prices) respectively [Hand book on Pakistan economy, 2010; Hand book on Indian economy, 2011].

The rest of the study has been organized as follows: Section II outlines the theoretical general approaches of the determinants of defense spending. The model specification of general aggregate defense spending approach has been presented and discussed in section III. Section IV explains the data and description of variables. Section V portrays the ARDL approach to cointegration whereas empirical results of aggregate defense model for both the nations have been discussed in section VI. Finally, section VII concludes the study.

**II. Aggregate Defense Spending: General Approaches**

Various studies (based on variety of theories and models) have been conducted to explore the determinants of defense expenditures over the years. These studies\(^2\) have identified economic, political, strategic, bureaucratic, military and other related factors that affect defense expenditures. Military factors include defense spending of enemy or potential enemies, defense spending of allies, external war, civil war, great power enemy and security web. Political factors consist of the form of government i.e. democracy/autocracy, Military Industrial Complex (MIC), interest groups and

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1 See Smith,1980; Majeski and Jones, 1981; Georgiou,1990; Kollias,1991; Brito and Intriligator,1995; Refenes, Kollias, and Zarpanis, 1995; Georgiou, Kapopoulos, and Lazaretou,1996; Kollias and Makrydakis, 1997b etc.
government ideology. Economic factors contain GDP, Per-capita Income, investment, central government expenditures, non-defense government expenditures, foreign exchange, and international trade. The other considerations in determining the defense spending are bureaucratic factors, regional factor and population.

The Neoclassical models or the general approaches of aggregate defense expenditures concentrate the economic, political, strategic determinants of defense spending. These models give a broader and comprehensive vision about the demand for defense spending as these include all the determinants or influences of defense expenditures. Various studies have been conducted on general approaches of aggregate defense spending [See Smith, 1980b, 1995; Dunne et al, 1984; Maizels and Nissanke 1986; Weede, 1986; McGuire, 1987; Ball, 1988; Rosh, 1988; Dommen and Maizels 1988; Looney, 1989; Antonakis and Karavidas 1990; Deger and Sen 1990; Hewitt, 1991,1996; Kapopoulos and Lazaretou 1993; Kollias 1994,1996; Dunne and Mohammed, 1995; Antonakis 1995,1997a; Avramides, 1997; Sun and Yu 1999; Batchelor, et al. 2002; Yu 2002; Collier et al. 2002, 2003; Dunne and Perlo-Freeman 2003a and 2003b; Yildirim and Sezgin 2005; Tumbudzai 2005, 2007; Dunne, Perlo Freeman and Smith 2008].

In these studies, the objective is to maximize the social welfare function subject to budget and security constraints. Different versions of social welfare function and constraints have been used in the empirical studies. Smith (1980,1995) presented the pioneer study to explore the potential determinants of defense spending in neoclassical framework.

III. Model Specification of General Aggregate Defense Spending Approach

Smith (1980, 1995) broke the new ground to explore economic, political, strategic determinants of defense spending under the neoclassical framework. The Neoclassical models or the general approaches of aggregate defense expenditures concentrate the various determinants of defense spending to give a broader and comprehensive vision about the demand for defense spending. Based on neoclassical framework, we develop a general aggregate defense spending model for both the countries. It is the state that maximizes the social welfare function as a rational actor subject to security and resource constraints. The state determines the social welfare function according to the preferences of the community. Moreover, the defense expenditures are settled on the cost and benefits analysis. Social welfare function depends on nonmilitary private consumption (C), security produced by defense spending (S), non-defense government expenditures (NDGE) and other strategic and political factors (E). Thus, social welfare function (W) is shown as:

\[ W = f(C, S, NDGE, E) \]  

Security (S) is a subjective matter (unobservable) and determined by the perceptions regarding the threats of attacks. The defense expenditures of the specific country (D) and other allies and rival countries\(^3\) (Di=Di, D2, .......... Dn) determined by

\(^3\) The defense spending of allies enhances the security level of a country while the defense expenditures of the rival countries increase the threat to the security of a country.
strategic and political factors \( (E) \) produce a certain level of security. The security function can be written as:

\[
S = f \left( D, D_i, E \right) \quad \text{(Security constraint)} \quad (2)
\]

The nominal aggregate income or national output \( (Y) \) is exhausted to defense \( (D) \) and civilian \( (C) \) purposes. Assuming that \( P_d \) and \( P_c \) are the prices of \( D \) and \( C \), the budget constraint is defined as:

\[
Y = P_d D + P_c C \quad \text{(Budget constraint)} \quad (3)
\]

After maximization of social welfare function subject to security and budget constraints, the demand for both countries’ defense expenditures can be written as:

\[
D = f \left( Y, E, P_d, P_c \right) \quad (4)
\]

The data on prices of \( D \) and \( C \) are not available in both the countries so we ignore the prices as many studies do this due to lack of data. The above mentioned neoclassical framework suggests that economic, political and strategic effects must be considered while modeling the determinants of defense spending of both Pakistan and India. Therefore, following specification is proposed for the two countries:

\[
RDEP = f \left( RGDP, RNDGE, TB, RDEI, DEMOC, ATOMIC_{7498}, TERROR, WAR \right) \quad (5)
\]

\[
\text{(For Pakistan)}
\]

\[
RDEI = f \left( RGDP, RNDGE, TB, RDEP, DEMOC, ATOMIC_{98}, TERROR, WAR \right) \quad (6)
\]

\[
\text{(For India)}
\]

**IV. Data and Description of Variables**

**a) Data**

Data used in this study have been acquired from different sources. For Pakistan’s data, Handbook of Statistics on Pakistan Economy 2010, World Development Indicators and Global Development Finance have been utilized. Specifically, data on dollar exchange rate, GDP at constant 2000US$ and GDP at current 2000US$ are acquired from world development indicators and global development finance while the data on trade balance, defense expenditures and non-defense government expenditures are taken from Handbook of Statistics on Pakistan Economy. To capture the internal and external threats to Pakistan, we have used the dummy variables of ATOMIC, TERROR and WAR. ATOMIC\(_{7498}\) shows the external threat to Pakistan from India due to atomic explosions conducted by India in 1974 and 1998. We have used 1 for these two years and 0 for other years. TERROR incorporates the internal threats to Pakistan like bomb explosions,
kidnapping, thefts etc. WAR captures the wars and war like conditions exhibiting the external threat to Pakistan from India.

For India’s data, Handbook of Statistics on the Indian Economy 2011, World Development Indicators and Global Development Finance have been used. Specifically, data on dollar exchange rate, GDP at constant 2000 US$ and GDP at current 2000US$ are acquired from world development indicators and global development finance while the data on trade balance, defense expenditures and non-defense government expenditures are taken from Handbook of Statistics on the Indian Economy. To encapsulate the internal and external threats to India (explained in study 2), we have used the dummy variables of ATOMIC98, TERROR and WAR. ATOMIC98 shows the external threat to India from Pakistan due to atomic explosions conducted by Pakistan in 1998. We have used 1 for 1998 and 0 for other years. TERROR incorporates the internal threats to India like bomb explosions, kidnapping, thefts etc. WAR captures the wars and war like conditions exhibiting the external threat to India and Pakistan.

The data on democracy index for both the countries are taken from Polity IV Regime Authority Characteristics and Transitions Datasets. The range of the index is +10 (democracy) to -10 (autocracy). We have standardized the index scaling from zero (autocracy) to one (democracy). With respect to the variable 'non-defense government expenditures’, defense expenditures are subtracted from the total central government expenditures.

For both the countries, we have converted all the variables from local currency to US$ by means of exchange rates and then deflated all the variables by GDP deflator to find inflation adjusted or real variables. To check the stationarity or nonstationarity of all the series of the variables, Augmented Dickey Fuller (ADF) test is used to examine the integration properties of variables. There is an evidence of unit root (nonstationarity) found in all the variables specified in the above mentioned equations except Real non-defense government expenditures. The results are exhibited in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Augmented Dickey Fuller Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Root Test on Level (For Pakistan)</strong></td>
</tr>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>RDEP</td>
</tr>
<tr>
<td>RGDP</td>
</tr>
<tr>
<td>RNDGE</td>
</tr>
<tr>
<td>TB</td>
</tr>
</tbody>
</table>

<p>| <strong>Unit Root Test on Level (For India)</strong> |</p>
<table>
<thead>
<tr>
<th>Variables</th>
<th>None</th>
<th>Lags</th>
<th>Intercept</th>
<th>Lags</th>
<th>Intercept and Trend</th>
<th>Lags</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDEI</td>
<td>2.0877</td>
<td>0</td>
<td>0.3518</td>
<td>0</td>
<td>-0.0287</td>
<td>0</td>
<td>I(1)</td>
</tr>
<tr>
<td>RGDP</td>
<td>17.5319</td>
<td>0</td>
<td>12.4944</td>
<td>0</td>
<td>5.1692</td>
<td>0</td>
<td>I(0)</td>
</tr>
<tr>
<td>RNDGE</td>
<td>6.7651</td>
<td>0</td>
<td>4.6036</td>
<td>0</td>
<td>2.4488</td>
<td>0</td>
<td>I(0)</td>
</tr>
<tr>
<td>TB</td>
<td>0.0155</td>
<td>0</td>
<td>-2.6888</td>
<td>0</td>
<td>-2.6240</td>
<td>0</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations
We have applied Autoregressive Distributed Lag Model (ARDL) to estimate the equations as it requires any order of integration. We would discuss the ARDL technique in the section V.

b) Description of Variables
RDEP = Real Defense Expenditures of Pakistan
RDEI = Real Defense Expenditures of India
RGDP = Real Gross Domestic Product proxy used for growth rate
RNDGE = Real Non-defense government Expenditures
TB = Trade Balance
DEMOC = Democracy Index
ATOMIC\textsubscript{74\&98} = Atomic Threat to Pakistan from India’s atomic explosions in 1974 & 1998
ATOMIC\textsubscript{98} = Atomic Threat to India from Pakistan’s atomic explosions in 1998
TERROR = Internal threats to the country
WAR = Dummy variable for war or war like conditions

V. ARDL Approach to Co-integration

The empirical studies on demand for defense expenditures have used different techniques to explore the determinants of defense spending in various countries. Some studies have applied simultaneous equation approach but this approach has been criticized due to endogeneity and exogeneity problems. Some studies have adopted various cointegration techniques to estimate the determinants of defense spending but these approaches have also weaknesses\(^4\) and are not appropriate for this study due to degree of freedom problem as there are a lot of determinants of defense expenditures of both countries. So, we are using autoregressive distributed lag model (ARDL) technique for this study due to following reasons and merits.

i) ARDL approach to cointegration uses one equation to find the short and long run effects simultaneously.

ii) The ARDL cointegration estimates are unbiased and efficient.

iii) This approach avoids the serial correlation and endogeneity problems (Pesaran et al., 2001).

iv) Narayan and Narayan (2007) pointed out that ARDL approach to cointegration can be applied in small samples while the other approaches do not perform well in small samples. Pesaran and Shin (1999) argued that ARDL approach to cointegration is reliable in small sample size in comparison with Johansen-Juselius cointegration approach that needs a large sample size for valid results.

v) The ARDL approach to cointegration does not require that all variables are integrated of the same order. In this approach, the variables can be integrated of order one I(1) or they can be stationary I(0) or mixture of both\(^5\). This is a sound

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4. Engle–Granger (1987) two-step residual-based cointegration has following limitations: i) It gives no idea about the dependence of variables ii) if the number of independent variables are more than one, more than one cointegrating relationships can exist but this approach does not capture this possibility iii) This approach is based on two-steps and if an error is made in first step, it would be present in the second step. The limitations of Johansen and Juselius (1990) cointegration technique are following: It assumes the same order of integration of all the variables with certainty. Moreover, it calculates long run relationship within a system of equations.

5. ARDL approach requires that the dependent variable should be I(1) and independent variables should not be integrated of order higher than one.
ARDL approach to cointegration was developed by Pesaran et al. (2001) to overcome the demerits of Engle-Granger and Johansen cointegration approaches. This approach is an amalgamation of autoregressive and distributed lag models.

### a) ARDL Model Specification

The general form of the error correction model (ECM) by using the two variables $X_t$ and $Y_t$ with n lags for $Y_t$ and n lags for $X_t$ is:

$$
\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \theta X_{t-1} + \sum_{j=1}^{n-1} a_j \Delta Y_{t-j} + \sum_{j=0}^{m-1} b_j \Delta X_{t-j} + \epsilon_t
$$

(7)

Thus on the basis of equation (7), the Unrestricted Error Correction Models (UECMs) relating to the determinants of defense spending for Pakistan and India are given below respectively:

$\Delta(RDEP)_t = \alpha + \beta_1(RDEP)_{t-1} + \beta_2(RGDP)_{t-1} + \beta_3(RNDGE)_{t-1} + \beta_4(TB)_{t-1} + \beta_5(RDEI)_{t-1}$

$+ \beta_6(DEMOC) + \beta_7(ATOMIC_{to}) + \beta_8(TERROR) + \beta_9(WAR) + \sum_{i=1}^{p} \delta_i \Delta(RDEP)_{t-i}$

(8)

$\Delta(RDEI)_t = \alpha + \beta_1(RDEI)_{t-1} + \beta_2(RGDP)_{t-1} + \beta_3(RNDGE)_{t-1} + \beta_4(TB)_{t-1} + \beta_5(RDEP)_{t-1}$

$+ \beta_6(DEMOC) + \beta_7(ATOMIC_{to}) + \beta_8(TERROR) + \beta_9(WAR) + \sum_{i=1}^{p} \delta_i \Delta(RDEI)_{t-i}$

(9)

The parameters $\beta_i$ are the corresponding long run multipliers whereas the $\delta_i$ are the short run dynamic coefficients of the ARDL models. $\epsilon_i$ is white noise error and $\Delta$ is the first difference operator.

### b) Bounds Testing Procedure

It is essential to test the existence of long run relationship before estimating long run coefficients and error correction models. For the purpose, Ordinary Least Squares (OLS) method is employed to locate the value of F or Wald Statistic for the joint significance of the parameters of lagged variables i.e.

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0 \quad \text{(No Cointegration)}$$
The null hypothesis shows that the parameters of the lagged variables in equations (8) and (9) are simultaneously equal to zero indicating no long run relationship or no cointegration. The alternative hypothesis explains that at least one of the parameters of the lagged variables is not equal to zero suggesting long run relationship or cointegration. The null hypothesis is tested against the alternative hypothesis using F-statistic. The F-statistic has a non-standard distribution which depends upon whether the variables included in the ARDL model are integrated of order I(0) or I(1) or a mixture of I(0) and I(1). The computed F is compared with critical values proposed by Pesaran et al. (1996). If the computed F statistic is greater than the upper bound critical value, the null hypothesis of no long run relationship is rejected. If F-statistic is less than the lower bound critical values, the null hypothesis is accepted implying that there is no a long run relationship or cointegration. Finally, if the F-statistic lies between the lower and upper bound critical values, the test is inconclusive for the given level of significance.

If long run relationship exists, the long run parameters can be estimated by using the following equations for both countries:

\[
RDEP_{t} = \alpha + \sum_{i=1}^{p} \eta_1(RDEP)_{t-i} + \sum_{i=0}^{p} \eta_2(RGDP)_{t-i} + \sum_{i=0}^{p} \eta_3(RNDGE)_{t-i} + \sum_{i=0}^{p} \eta_4(TB)_{t-i} + \sum_{i=0}^{p} \eta_5(RDEI)_{t-i} + \varepsilon_t
\]

(10)

\[
RDEI_{t} = \alpha + \sum_{i=1}^{p} \eta_1(RDEI)_{t-i} + \sum_{i=0}^{p} \eta_2(RGDP)_{t-i} + \sum_{i=0}^{p} \eta_3(RNDGE)_{t-i} + \sum_{i=0}^{p} \eta_4(TB)_{t-i} + \sum_{i=0}^{p} \eta_5(RDEP)_{t-i} + \varepsilon_t
\]

(11)

The short-run dynamics can be found by estimating the following equations for Pakistan and India:

\[
\Delta RDEP_t = \alpha + \sum_{i=1}^{p} \lambda_1 \Delta(RDEP)_{t-i} + \sum_{i=0}^{p} \lambda_2 \Delta(RGDP)_{t-i} + \sum_{i=0}^{p} \lambda_3 \Delta(RNDGE)_{t-i} + \sum_{i=0}^{p} \lambda_4 \Delta(TB)_{t-i} + \sum_{i=0}^{p} \lambda_5 \Delta(RDEI)_{t-i} + \omega ECM_{t-1} + \varepsilon_t
\]

(12)

\[
\Delta RDEI_t = \alpha + \sum_{i=1}^{p} \lambda_1 \Delta(RDEI)_{t-i} + \sum_{i=0}^{p} \lambda_2 \Delta(RGDP)_{t-i} + \sum_{i=0}^{p} \lambda_3 \Delta(RNDGE)_{t-i} + \sum_{i=0}^{p} \lambda_4 \Delta(TB)_{t-i} + \sum_{i=0}^{p} \lambda_5 \Delta(RDEP)_{t-i} + \omega ECM_{t-1} + \varepsilon_t
\]

(13)

In the equations (12) and (13) the parameters associated with the summation signs represent the short run parameters and the coefficient of ECM in both equations represent
shows the speed of adjustment towards the long-run equilibrium. Coefficient of adjustment should be negative and statistically significant for convergence.

VI. Empirical Results

a) The Order of Lag and Bound Testing

We have used the Schwarz Bayesian Criterion (SBC) to determine the maximum lag length of the variables for both countries’ models. The SBC has suggested optimal lag length 2 in both ARDL models. We have employed the OLS on (8 & 9) to find the F-statistic by applying the Wald test. The results of Wald test for both models are reported in Table 2.

Table 2: The F-test for Co-integration

<table>
<thead>
<tr>
<th>Country</th>
<th>F-Statistic</th>
<th>5% Critical Value Bounds</th>
<th>10% Critical Value Bounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
<td>3.84</td>
<td>2.26</td>
<td>3.35</td>
</tr>
<tr>
<td>India</td>
<td>5.13</td>
<td>2.26</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Note: Critical values are obtained from Pesaran et al. (1996). The critical values bounds table is given in Appendix D.

For Pakistan, the calculated value of F-statistic is 3.84, which is greater than the upper bound at 5% and 10%. Similarly, for India, the calculated value of F-statistic is 5.13, that is above than the upper bound at 5% and 10%. These results show that we are unable to accept the null hypothesis of no cointegration. So long run relationship exists in both models for Pakistan and India.

b) Long-Run Estimating Results

Now the next step is to find out the long run coefficients of ARDL models for the both countries. The results of the estimated long run coefficients are presented in Table 3.

Table 3: Estimated Long Run Coefficients using the ARDL Approach

<table>
<thead>
<tr>
<th>Country</th>
<th>Dependent variable: RDEP</th>
<th>ARDL(1,1,0,0,2,0,0,2,0)</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>Dependent variable: RDEI</th>
<th>ARDL (0,1,2,0,0,0,2,0)</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
<td>RGDP</td>
<td>.0043613</td>
<td>.28921</td>
<td></td>
<td>RGDP</td>
<td>.0085047</td>
<td>2.7573</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RNDGE</td>
<td>1.8231</td>
<td>2.1099</td>
<td></td>
<td>RNDGE</td>
<td>.037796</td>
<td>1.5717</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TB</td>
<td>-766.1100</td>
<td>-3.1308</td>
<td></td>
<td>TB</td>
<td>688.8445</td>
<td>2.1239</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RDEI</td>
<td>.64641</td>
<td>4.2450</td>
<td></td>
<td>RDEI</td>
<td>.076618</td>
<td>2.4413</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DEMOC</td>
<td>58.1626</td>
<td>31974</td>
<td></td>
<td>DEMOC</td>
<td>-642.6611</td>
<td>-1.6857</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ATOMIC$^9$</td>
<td>1892.1</td>
<td>2.9178</td>
<td></td>
<td>ATOMIC$^9$</td>
<td>3619.9</td>
<td>4.6613</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TERROR</td>
<td>1253.9</td>
<td>4.4408</td>
<td></td>
<td>TERROR</td>
<td>163.8206</td>
<td>.90297</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WAR</td>
<td>302.6431</td>
<td>1.9612</td>
<td></td>
<td>WAR</td>
<td>1173.1</td>
<td>4.1017</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>2082.7</td>
<td>4.2078</td>
<td></td>
<td>C</td>
<td>1264.4</td>
<td>2.0468</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations

For both the countries, we have specified eight variables. The dependent variable is Real Defense expenditures whereas Real GDP, Real Non-defense Government
Expenditures, Trade balance, Real Defense expenditures of rival country, Democracy Index, Atomic threat, Terror and war are explanatory variables.

First we discuss the economic determinants of defense expenditures of both the countries. Real GDP is an income constraint in determining the defense expenditures of a country. If RGDP of a country increases, it implies that the country has more resources to spend on defense activities. The estimated parameter of RGDP is positive in both the equations and it is statistically insignificant in the case of Pakistan. The defense is considered a public good and conventional theory of public finance suggests the positive relationship between income level and defense spending. Therefore, our results are in line with the expectations. The studies by (Looney, 1989; Hewitt, 1996; Sun and Yu, 1999; Yu, 2002; Batchelor et al, 2002 and Tambudzai, 2007) found the positive impact of income on defense spending.

The second economic determinant is Real Non-defense Government Expenditures (RNDGE). The variable of RNDGE shows the opportunity cost of defense or economic burden of defense. So, the sign of RNDGE should be negative but in our models it is positive. This suggests that with an increase in non-defense government expenditures, defense spending in both the countries is also rising. The possible reason of this type of result may be that the two countries are allocating their resources in both types of spending i.e. defense due to security or arms race etc and non-defense due to social, political and economic reasons. The other economic determinant is trade balance (TB). The estimated coefficient of TB is negative in the case of Pakistan while it is positive in India. Trade balance shows the openness of the economy and its sign can be positive or negative depending on the openness. When a country has more openness, she can arrange more finance to buy arms leading to more defense spending. Our results are compatible with the studies (Rosh, 1988; Dunne and Mohammed, 1995; Dunne and Perlo Freeman, 2003; Dunne, Perlo Freeman and Smith, 2008).

Now we discuss the military, political and strategic factors of defense spending of both the countries. In Pakistan’s case, the defense spending of India (rival) is highly statistically significant and positively related to the defense expenditures of Pakistan. The same is true in the case of India where the defense spending of Pakistan (rival) is positive and statistically significant. These results are due to the rivalry and confrontation between the two neighboring countries. We have already found the arms race between the two countries. So, our results are in line with the arms-race studies conducted especially for rival countries [Sun and Yu, 1999; Dunne et al, 2000; Yildirim and O"ocal, 2006; and Tambudzai, 2007].

The political environment or regime is represented by the variable of democracy index. The expected sign of democracy index is vague. The literature on the demand for military expenditures suggests that in order to uphold their control on power and to justify their rule which is in consonance with the culture and ideology of militarism, the non-democratic countries spend more on defense as compared to the democratic countries.
The parameter of democracy index in Pakistan’s equation is insignificant and positive. This result is in accordance with our expectations because in Pakistan, military regime remained in power for most of the time. Sivard (1983) argued that:

"the positive coefficient of the dictatorship dummy provides evidence of the fact that military governments are prone to have larger armies than the civilian controlled regimes"

Our results are consistent with the studies [Hewitt, 1996; Maizels and Nissarke, 1986 and Dommen and Maizels, 1988, which provide the evidence of military regime in determining the level of defense expenditures.

The estimate of democracy index in India’s equation is negative. The negative sign on this variable is in accordance with our expectations for India because India is a democratic country as a whole. In democratic countries, defense spending decisions are made according to political process, competing demand of other priorities and rule of law. Batchelor et al. (2002) showed that the political dummy is negatively related with the defense expenditures in South Africa. Dunne and Perlo Freeman (2003a, 2003b and 2007) explored that the impact of democracy index is significant and negative on defense burden in developing countries. The coefficients of atomic threat, terror and war are positively related with the defense expenditures of the respective country.

c) Error Correction Estimating Results

The short run dynamic parameters are estimated by the unrestricted error correction model (UECM). We have reported the error correction estimation results in Table 4. In Pakistan’s equation, the dependent variable is dRDEP and in India's equation, the dependent variable is dRDEI where d shows the first difference of the variable. The change in RGDP is positively related with defense spending of Pakistan and India. The change in RNDGE has positive effects on defense spending of both the countries. The lag of change of RNDGE in India is negatively related with India’s defense expenditures. The change in trade balance has negative relation with defense spending in Pakistan while in India it is positive. The lag of change of trade balance is positive in Pakistan. The change of defense expenditures of rival is positively related with the individual country. The change in democracy index is positive in Pakistan whereas it is negative in India. The change of atomic threat is negative in Pakistan while in India it is positive. The lag of change of Atomic threat is positive in Pakistan while it is negative in India. The change of internal threat or terror and war is positively related with both the countries’ defense outlays.

Table 3: Error Correction Representation for the Selected ARDL Model

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>Regressor</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>dRGDP</td>
<td>.12306</td>
<td>4.0079</td>
<td>dRGDP</td>
<td>.030157</td>
<td>3.6423</td>
</tr>
<tr>
<td>dRNDGE</td>
<td>.10576</td>
<td>2.7914</td>
<td>dRNDGE</td>
<td>.064035</td>
<td>2.7930</td>
</tr>
<tr>
<td>dTB</td>
<td>-292.3963</td>
<td>-1.3854</td>
<td>dNDGE1</td>
<td>-.039237</td>
<td>-1.6338</td>
</tr>
<tr>
<td>dTB1</td>
<td>527.7657</td>
<td>2.6822</td>
<td>dTB</td>
<td>688.8445</td>
<td>2.1239</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent variable: dRDEP</th>
<th>ARDL(1,1,0,2,0,2,0,0)</th>
<th>Regressor</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>dRGDP</td>
<td>.12306</td>
<td>4.0079</td>
<td>dRGDP</td>
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<tr>
<td>dRNDGE</td>
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<td>-.039237</td>
</tr>
<tr>
<td>dTB1</td>
<td>527.7657</td>
<td>2.6822</td>
<td>dTB</td>
<td>688.8445</td>
</tr>
<tr>
<td>dRDEI</td>
<td>17679</td>
<td>2.2774</td>
<td>dRDEP</td>
<td>.076618</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>--------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>dDEMO</td>
<td>33.7410</td>
<td>.31172</td>
<td>dDEMO</td>
<td>-642.6611</td>
</tr>
<tr>
<td>dATOMIC</td>
<td>-137.6698</td>
<td>-.74061</td>
<td>dATOMIC</td>
<td>820.6140</td>
</tr>
<tr>
<td>dATOMIC1</td>
<td>651.7752</td>
<td>3.4820</td>
<td>dATOMIC1</td>
<td>-929.7532</td>
</tr>
<tr>
<td>dTERROR</td>
<td>727.3965</td>
<td>2.8916</td>
<td>dTERROR</td>
<td>163.8206</td>
</tr>
<tr>
<td>dWAR</td>
<td>175.5677</td>
<td>1.7545</td>
<td>dWAR</td>
<td>314.1909</td>
</tr>
<tr>
<td>dC</td>
<td>1208.2</td>
<td>2.5490</td>
<td>dC</td>
<td>548.3131</td>
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<tr>
<td>ecm(-1)</td>
<td>-.58011</td>
<td>-.0971</td>
<td>dC</td>
<td>1264.4</td>
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<tr>
<td>ecm(-1)</td>
<td>-.67005</td>
<td>-4.9587</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations

The error correction term exhibits the speed of adjustment to restore the equilibrium in the dynamic model. The coefficient of error correction term (ECM) indicates how quickly or slowly the variables move towards equilibrium. The term should be statistically significant with negative sign. The parameter of ECM for Pakistan and India is equal to -0.58011 and -0.67005 respectively. It suggests that the deviation from the long term equilibrium following a short run shock is corrected by more than half within one year. The findings indicate that the speed of adjustment is fairly high and it would return to its equilibrium level quickly.

VII. Conclusion

This study was designed to investigate the determinants of defense expenditures in Pakistan and India. The analysis has been conducted for the time period 1972-2010. The general model of aggregate defense expenditures has been employed. The study has analyzed the aggregate defense spending model (neoclassical model) by applying the autoregressive distributed lag (ARDL) technique for both the countries.

We have specified many determinants in the demand for defense spending equation of both the countries. The rival country defense spending is found positive as suggested by Richardson arms-race model. In the same fashion, the signs of all the determinants i.e. economic, political and strategic are almost according to the expectations. The economic determinants are Real GDP, Non-defense Government Expenditures and Trade balance while the political and strategic factors include democracy, internal and external threats. The RGDP and Non-defense Government Expenditures positively influence the defense spending of both the countries while trade balance has mixed results. The political factor i.e. the regime of government is measured by democracy index has positive effects on Pakistan’s defense spending while in India it has negative effects. The other factors such as atomic threat, internal threats and wars between the two the countries have influenced the defense expenditures of both countries positively.

Therefore, from this study, we can conclude that both the countries have an arms race due to hostility and aggression in their relations and they cannot ignore the defense spending of each other. Even there are some internal and external threats as well but the most important for each country is defense spending of the other country.

In a nutshell, delving into the minute details of the security impasse between Pakistan and India, this study has elaborated the demand for defense as the public good
both in the short and long run. Both the arm race factor and associated economic and political factors are imperative for the defense spending of Pakistan and India.

References


Govt. of Pakistan (various issues). Pakistan Economic Survey, Federal Bureau of Statistics, Statistical Division


