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Arms Race, Economic Growth, and Government (Military and Non Military) Expenditure: Empirical Investigation for India and Pakistan

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Abstract
This study examines the relationship of economic growth with civilian and military portions of government expenditure for two neighboring countries and nuclear powers; India and Pakistan. Considering the rough bilateral relationship between the two countries, the paper also seeks to determine the existence of arms race between them. For this purpose, Johansen cointegration and Granger causality tests are applied while taking account of the limitations of time series data. Our cointegration results indicate a positive impact of military spending on economic growth for India and a negative impact for Pakistan. In case of government civilian expenditure and economic growth, the relationship is statistically insignificant for Pakistan while it is negative and significant for India. The Granger causality results show lack of any causal relationship of economic growth with government and military spending for Pakistan. In case of India, economic growth is Granger caused by government as well as military expenditure. Bidirectional causality is found between defense spending of India and defense spending of Pakistan.
Keywords: Government expenditure, Military expenditure, Economic Growth, Arms race, Cointegration, Granger causality

1. Introduction:

Economists and policy makers have shown considerable amount of interest in assessing the impact of government spending (whether civilian or military) on economic growth. The study of Benoit (1973) can be termed as a groundbreaking work in finding out the relationship between military spending and economic growth. Subsequently, a plethora of studies can be traced back in literature carried out on the subject. These studies include, among others, Feder (1983), Landau (1983), Kormendi & Meguire (1985), Ram (1986), Grier & Tullock (1989), Romer (1986), Barro (1990, 1991), Levine & Renelt (1992), Devarajan, Swaroop, & Zou (1996), Sala-i-Martin (1997), Abu-Bader & Abu-Qarn (2003), Dritsakis (2004), Habibullah, Law, & Dayang-Afizzah (2008) and Wijeweera & Webb (2011). Most of these studies came up with mixed results, yet the most obvious findings present that government spending has a negative relationship with economic growth. Since majority of these results came from cross section analysis Barro (1991), thus they gave only pooled estimates of the relationship between government spending and economic growth. Cross country analysis ignore the country specific factors and do not capture dynamics of the relationship.

Moreover, when regression was run between economic growth and other variables and coefficient of government spending came out to be significant; scholars counted it as a confirmation of the relationship running from government expenditure to economic growth which is in line with Keynesian's view. But those studies totally ignored the fact that a significant coefficient of government expenditure can be compatible with Wagner's law-causality running from economic growth to government spending as well as it can be an indication of bidirectional causality. Conventional regressions only account for the relationship between government spending and economic growth while they do not provide any evidence of the direction of causality. Studies that used cross section analysis came up with mixed results. Benoit (1973, 1978) carried out regression analysis and Spearman correlation test and found out that military expenditure has a positive impact on economic growth for the sample of 44 least developed countries and a time period of 1950-1965. Other studies which proved positive relationship between defense spending and economic growth are Yildirim†, Sezgin, & Öcal (2005) and Yildirim & Öcal (2014). On the other hand, Faini, Annez, & Taylor (1984), Lim (1983), Abu-Bader & Abu-Qarn (2003), Galvin (2003), Klein* (2004), and H.-C. Chang, Huang, & Yang (2011) empirically proved negative impact of military expenditure on economic growth. Mixed findings across different countries were presented by Chowdhury (1991), Kusi (1994), Kollias, Manolas, & Paleologou (2004), T. Chang, Lee, & Chu (2013)and Pan, Chang, & Wolde-Rufael (2014). Studies that showed empirical evidence of no statistically significant relationship between military expenditure and economic growth are Ram (1986), Chen (1993), Dakurah, Davies, & Sampath (2001) and Safdari, Keramati, & Mahmoodi (2011).

The current body of literature on the relationship between government spending (civilian and military)

does not provide similar findings across countries. This may be because of the different regional as well as internal factors for different countries.

Before 1947, India and Pakistan were one country. People of the country were striving for freedom against the British rule. After getting independence from British rule, Indo-Pak was divided into two countries and since then, many wars have been fought between the two countries. There are conflicts on line of control, water resources and last but not the least; the Kashmir dispute. It is also worth mentioning that Bangladesh (the then called West Pakistan) came into existence after a bloodbath in 1971. Given these issues, both the countries spend a significant portion of their GDP on defense. Therefore, we attempt to find out whether the military and civilian portions of government spending enhance or detriment economic growth in case of the two neighboring countries. We also aim to find out the existence of any possible arms race between India and Pakistan.

The remainder of the paper is structured as: Section 2 explains data and econometric methodology; Section 3 presents empirical findings; and Section 4 discusses conclusion and policy implications.

2. Data and Methodology:

2.1. Data and Variables:

Annual data ranging from 1988 to 2013 is used in our study for both the countries. All the variables are measured in million dollars and are expressed in logarithms. Data for Gross domestic product and Government consumption is taken from World Development Indicator (WDI) while Military Expenditure's data is taken from Stockholm International Peace Research Institute (SIPRI). The list and symbols of variables used in our study are as follows.

LGDP: Log of Gross domestic Product used an indicator for economic growth.
LGE: Log of Government expenditure
LME: Log of Military Expenditure

2.2. Methodology:

Our econometric methodology consists of the following steps.

2.2.1. Augmented Dickey Fuller Test:

Since our data set includes time series data, thus we have to test the properties of the time series. In order to find out whether the data is stationary or not, we use Augmented Dickey Fuller test. This test was proposed by Dickey & Fuller (1979) and is widely used in the literature. Economic time series is typically non stationary and non stationary data can give us misleading results. Therefore, such time series should be made stationary or in other words such data should be differenced d times. The time series which is made stationary after differencing it d times is called integrated of order d. When the test value comes out to be greater than the critical value, we interpret that the time series is stationary and vice versa.

2.2.2. Optimal Lag selection:

After testing for stationarity; if the variables are integrated of the same order, the next step is to choose optimal lag length. Different criterions have been used for lag selection in the literature but the most widely used method is to select the lag length suggested by majority of the criterion.

2.2.3. Johansen Co Integration Test:

In order to find the cointegrating relationship among the variables, we use Johansen (1988) test.

Johansen's procedure starts with VAR of order p and is given by

$$y_t = \mu + A_1 y_{t-i} + ... + A_p y_{t-p} + e_t$$

Where yt is an *n*x1 vector of variables that are integrated of order one – commonly denoted I (1) – and *εt* is an *n*x1 vector of innovations. This VAR can be re-written as

$$\Delta y_t = \mu + \prod y_{t-i} + \sum_{i=1}^{p-1} \prod_i \Delta y_{t-i} + e_t$$

Where

$$\prod = \sum_{i=1}^{p} A_i - I \qquad \text{And} \qquad \prod_i = -\sum_{j=i+1}^{p} A_j$$

If the coefficient matrix **Π** has reduced rank *r*<*n*, then there exist *nxr* matrices **α** and **β** each with rank *r* such that **Π** = **αβ′** and **β′y** *t* is stationary. Johansen proposes two different likelihood ratio tests: the trace test and maximum eigenvalue test,

$$\Rightarrow J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i)$$

$$\Rightarrow J_{\max} = -T\ln(1-\lambda_{r+1})$$

2.2.4. Granger Causality Test:

Granger (1988) argued that if cointegration exists between the variables, there is causality running between these variables in at least one direction. In order to test the causal relationships among the variables we use Granger causality test proposed by Engle & Granger (1987).

The null hypothesis of Granger causality can be formulated as:

H0: Y does not Granger cause X

As per the definition of Granger causality, Y does not cause X if,

$$\alpha_1 = \alpha_2 + \alpha_3 + \alpha_{t-i} + ...\alpha_j = 0$$

And

X does not cause Y if,

$$\beta_1 = \beta_2 + \beta_3 + \beta_{t-i} + ...\beta_j = 0$$

Granger causality can be interpreted as Y is Granger caused by X if current value of Y can be forecasted with the help of past values of X.

3. Empirical Results:

3.1. Unit Root test:

Table 1 presents results of Augmented Dickey Fuller test for GDP, ME and GE for both the countries. Results of Augmented Dickey Fuller test suggest that all the variables are non stationary in level form. However, all of these variables are stationary at first difference. All of these variables are integrated of order 1 which means Johansen (1988) analysis can be performed to test the long run relationship among these variables.

Table 1: Augmented Dickey Fuller Test

Country	Variables	Trend	Intercept	Lag Length	T Value/Critical Value	Order of Integration
Pakistan	LGDP	Yes	Yes	8	-2.27 (-4.498)	Level
	ΔLGDP	Yes	Yes	1	-6.34 (-4.39)***	First Difference
	LME	Yes	Yes	2	-1.60 (-3.61)	Level
	ΔLME	Yes	Yes	2	-3.16 (-2.99)**	First Difference
	LGE	No	Yes	5	-0.96 (-4.37)	Level
	ΔLGE	No	Yes	5	-5.05 (-4.39)***	First Difference
India	LGDP	Yes	Yes	5	-2.26 (-4.37)	Level
	ΔLGDP	Yes	Yes	5	-4.63 (-4.39)***	First Difference
	LME	No	Yes	3	-2.33 (-3.60)	Level
	ΔLME	No	Yes	3	-3.99 (-3.61)**	First Difference
	LGE	Yes	Yes	2	-2.60 (-3.61)	Level
	ΔLGE	No	Yes	6	-3.44 (-2.99)**	First Difference

'***' ** and * Implies that the series is stationary at 1%, 5% and 10% respectively

3.2. Optimal Lag Selection:

In order to examine the long run relationship among the three variables for both the countries, we need to find the optimal lag length. Different criterion has been suggested by literature for selecting the optimal lag length. However, we prefer to choose the lag length suggested by majority of the criterion. Thus, it is evident from the table that the optimal lag length is 1 for both Pakistan and India.

Table 2: VAR Lag order selection criteria

Country	Lag	LogL	LR	FPE	AIC	SC	HQ
Pakistan	Lag	LogL	LR	FPE	AIC	SC	HQ
	0	56.53989	NA	2.32e-06	-4.461658	-4.314401	-4.422590
	1	**105.1199**	**80.96669***	**8.64e-08***	**-7.759992***	**-7.170965***	**-7.603723***
	2	112.1050	9.895521	1.07e-07	-7.592081	-6.561284	-7.318611
India	Lag	LogL	LR	FPE	AIC	SC	HQ
	0	81.23805	NA	2.96e-07	-6.519838	-6.372581	-6.480770
	1	**180.1608**	**164.8713***	**1.66e-10***	**-14.01340**	**-13.42438***	**-13.85713***
	2	189.5540	13.30705	1.68e-10	-14.04617*	-13.01537	-13.77270

3.3. Johansen Cointegration Test:

Table 3 reports results of Johansen cointegration test and the corresponding cointegrating equations for the two countries. It also presents the Trace statistics and L-max (eigenvalue) statistics for the bivariate system of military expenditure of India and military expenditure of Pakistan. It can be inferred from trace and eigen value statistics that 1 cointegrating vector is found in case of the trivariate systems for each of the countries. Although in case of the bivariate system of military expenditure of Pakistan and India, the null hypothesis of no-cointegration is accepted.

Table 3: Co integrating Relationship

Country	Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statistic
Pakistan	H0: r = 0	28.03354*	19.14443*
	H0: r ≤ 1	8.889105	6.735503
	H0: r ≤ 2	2.153601	2.153601

Cointegrating Equation

LGDP	=	5.57***	+	1.02LGE	-	2.72LME**	(1)
t-statistics		(-3.00)		(0.41)		(2.43)	

Country	Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statistic
India	H0: r = 0	55.03391*	43.69002*
	H0: r ≤ 1	11.34388	11.32967
	H0: r ≤ 2	0.014214	0.014214

Cointegrating Equation

LGDP	=	-7.16**	-	1.23LGE**	+	1.07LME***	(2)
t-statistics		(-2.48)		(-2.35)		(3.09)	

* denotes rejection of the hypothesis at the 0.05 level

Note= r = 0 means there is no cointegrating vector

	No. of CE(s)	Trace	Max-Eigen
India ME, Pak ME	H0: r = 0	9.148066	8.473673
	H0: r ≤ 1	0.674393	0.674393

Trace test indicates no cointegration at the 0.05 level

The cointegration results show there is one cointegrating vector in case of each of the trivariate system for both the countries while there is no cointgrating vector found in case of the bivariate system of military spending of Pakistan and military spending of India. In order to examine the long run relationship among the variables, the cointegrating vector is normalized on GDP for both the countries. The first normalized cointegration equation shows the long run relationship among the three variables for Pakistan. The second cointegration equation shows the long run relationship among the three variables for India.

The cointegrating relationship between economic growth and government spending is statistically insignificant for Pakistan. While the equation shows that a 2.72 percent increase in military expenditure will

decrease the economic growth by one percent. These findings are consistent with Lim (1983), Khilji, Mahmood, & Siddiqui (1997), Abu-Bader & Abu-Qarn (2003), Galvin (2003), Klein* (2004),and Shahbaz, Afza, & Shabbir (2013). Our results are also in line with H.-C. Chang et al. (2011) who argues that military expenditure negatively affects economic growth for low income countries. However, our findings contradict Yildirim† et al. (2005) and Yildirim & Öcal (2014) who found out positive impact of military expenditure on economic growth. The implication of the negative relationship between defense spending and economic growth in Pakistan may be the socioeconomic situation of the country. The idea behind a positive relationship between defense expenditure and economic growth is that defense sector provides public infrastructure. It also improves human capital through education, training and medical care. Arms export is also one of the reasons behind the positive relationship between these two variables. However, Pakistan is facing external and internal security threats and thus a major portion of defense spending goes to manufacturing and acquiring arms. Apart from that, Pakistan is not an arm exporter country and thus the expenditure on manufacturing arms does not enhance the economic growth.

The cointegration equation shows a negative relationship between economic growth and Government spending in case of India. Economic growth is impeded by 1 one percent if the government expenditure is increased by 1.23 percent. Studies that came up with similar findings are Landau (1983) and DiPeitro & Anoruo (2012),. However, our results contradict Murdoch, Pi, & Sandler (1997), Alexiou (2009) and Wu, Tang, & Lin (2010). Our results also contradict Abu-Bader & Abu-Qarn (2003) who presented positive effect of government spending on economic growth for Egypt and Israel. The equation further reveals positive impact of military expenditure on economic growth for India. A rise of 1.07 percent in military spending will boost the economic growth by 1 percent. These results support Yildirim & Öcal (2014; Yildirim† et al. (2005). Our findings contradict Lim (1983), Abu-Bader & Abu-Qarn (2003), Galvin (2003), Klein* (2004), , Shahbaz et al. (2013) and H.-C. Chang et al. (2011) who argued that military expenditure has negative relationship with economic growth.

3.4. Granger Causality Results:

The Granger causality test helps us in order to determine the weak exogeneity among variables. This test suggests us the causal relationship of one variable with the other variable. The results of VECM Granger causality test are reported in Table 4. The significant chi-square statistic shows that the dependent variable is Granger caused by independent variable.

Table 4: Granger Causality Results

Country		Independent Variables		
Pakistan			Independent	
	Dependent			
		LGDP	LGE	LME
	LGDP	----	1.41	3.57
	LGE	1.27	----	-----
	LME	0.94	----	----
India			Independent	
	Dependent			
		LGDP	LGE	LME
	LGDP	----	7.31**	12.02***
	LGE	0.14	----	----
	LME	1.44	----	----
India ME, Pak ME			Independent	
		LMEI	LMEP	
	LMEI	----	7.42**	
	LMEP	6.26**	----	

*, **, *** implies 10%, 5% and 1% significance respectively

Table 4 reports causality among variables within the framework of vector error correction. The table suggests that GDP is not caused by any of the variable in case of Pakistan. Our results contradict Tahir (1995), Khilji et al. (1997) and Khan (2004)who found bi-directional causality between defense spending and economic growth. Our results also contradict Shahbaz et al. (2013) who found a unidirectional causality running from defense spending to economic growth. Our results are consistent with Ram (1986) and Kollias (1997). These results are also in line with Safdari et al. (2011) who found no statistically significant relationship between military spending and economic growth for Saudi Arabia and Iran. Our findings support the findings of Pan et al. (2014) who presented no significant relationship between military expenditure and economic growth for Jordan,

Oman and Saudi Arabia. The implication of the no-relationship is that defense spending belongs to non-economic factors. Military expenditure of Pakistan mainly depends upon the perception of the policy makers regarding external and internal threats. The table further reveals GDP is caused by government civilian and military expenditure in case of India. Our findings support the findings of Abu-Bader & Abu-Qarn (2003), Karagol* & Palaz (2004), Dritsakis (2004), Özsoy (2008), Tang (2008)and Shahbaz et al. (2013). These findings do not support the findings of Rotschild (1977), Ram (1986), Kollias (1997), Safdari et al. (2011) and Pan et al. (2014) who found no statistically significant relationship between defense expenditure and economic growth. Bidirectional causal relationship between defense spending of both the countries is found which is consistent with Dritsakis (2004). The existence of bidirectional causality between military expenditures of both the countries is evident from the table. These results indicate that arms race exists between Pakistan and India. These findings are consistent with Kollias & Paleologou (2002) and Dritsakis (2004) who found out bidirectional causality between military expenditure of Greece and military expenditure of Turkey.

4. Conclusions and Policy Implications:

The relationship between Pakistan and India has been rough ever since the partition and emergence of the two countries in 1947. Kashmir dispute is being considered an important factor responsible for the crisis between these countries; not to mention conflicts on water resources, and border issues. Given these circumstances, a major portion of their GDP goes to the defense sector. A peaceful relationship between Pakistan and India is must for the very existence of both the countries as well as for the regional and global harmony. Researchers and Policy makers have shown interest in the India-Pakistan armament.

Our results of the triviate co integration analysis of GDP, Government expenditure and military expenditure of Pakistan reveal that military expenditure is detrimental to economic growth of the country. These results should be taken into account by the policy makers of Pakistan since military spending is slowing down the economic growth. The relationship between economic growth and Government civilian expenditure came out to be insignificant. In case of India, our co integration results show a negative relationship between Government civilian expenditure and economic growth. The implication of the negative relationship between government spending and economic growth is the lack of public investment in infrastructure and excessive government consumption. Military expenditure was found to be incremental to economic growth of India. This may partly be due to investment in public infrastructure by the defense sector. These findings may also imply that defense spending helps in improving security situation in the country and thus enhancing FDI and private investment which in turn improves economic growth. No co integrating relationship between the defense expenditures of Pakistan and India was found.

The results of Granger causality test for Pakistan show the lack of causality of economic growth with the civilian and military government expenditure. The implication of the independence of military expenditure from economic growth is that military spending depends on the perception of Pakistan's policy makers of the external and internal security threats. The lack of causality running from government civilian and military expenditure to economic growth shows economic growth of Pakistan depends upon other factors. Granger causality results for India reveal that GDP is Granger caused by government spending as well as military expenditure. Collectively, the results of co integration and Granger causality test for India show that government spending whether civilian or military has the power to influence economic growth. These results need to be considered during policy formulation for India. Furthermore, bidirectional causality is found between defense spending of Pakistan and defense spending of India. These results suggest that defense expenditure of Pakistan and India is not autonomous in the short run. It means the policy makers of one country while devising defense policy of their own country; determine the level of defense spending of the other country. Therefore, it can be concluded that arms race exist between the two countries in the short run.

Future studies can include other countries in the analysis to observe the relationship among these variables in a more generalized manner. From a methodological viewpoint, more variables can be included in the system in order to expose economic growth and government spending to other economic and non economic factors. The socioeconomic conditions of both the countries and geopolitical situation of the region can also be considered in further analysis. Such factors can be the instability in Afghanistan, internal security threats to Pakistan and the unstable bilateral relationship of India and China. These factors can affect the defense expenditure of the two countries and can outshine the fundamental relationship between the tested variables.

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