



Munich Personal RePEc Archive

Nexus between defense expenditure and economic growth in BRIC economies: An empirical investigation

Dash, Devi Prasad and Bal, Debi Prasad and Sahoo,
Manoranjan

Indian Institute of Technology, Ropar, Punjab, India, Xavier
Institute of Management, Bhubaneswar, Odisha, India, Indian
Institute of Technology, Madras, Tamil Nadu, India

2016

Online at <https://mpra.ub.uni-muenchen.de/77014/>

MPRA Paper No. 77014, posted 10 May 2017 01:00 UTC

Nexus between defense expenditure and economic growth in BRIC economies: An empirical investigation

Devi Prasad DASH

Indian Institute of Technology, Ropar, Punjab, India
devi100.dash@gmail.com

Debi Prasad BAL

Xavier Institute of Management, Bhubaneswar, Odisha, India
debiprasad.bal@gmail.com

Manoranjan SAHOO

Indian Institute of Technology, Madras, Tamil Nadu, India
msahoo100@gmail.com

Abstract. *This paper considers the defense expenditure and economic growth nexus based on the cross-border problems and increasing geo-political presence for BRIC blocs over the period 1993-2014. Our approach is more methodological in terms of employing Panel cointegration and causality to highlight the fundamental relation between the defense expenditure and economic growth. Here we emphasize various economic considerations in terms of pre and post war, strategic and spatial phenomenon to capture the magnitude of gains from the increased defense spending in the region. We are using panel unit-root; panel cointegration and panel-Granger causality to highlight the fundamental relationship between the variables. We conclude by discussing the issues as well as quantifying the consequences of present geostrategic conditions associated with these economies.*

Keywords: Defense Expenditure, BRIC, Panel cointegration.

JEL Classification: O39, O50, C22.

1. Introduction

The policy analysts put startlingly different opinions regarding the effect of defense expenditure upon the economic growth. Similarly the economists have been estimating and putting the analyses regarding efficiency and trade-off of defense expenditure and growth differently. One of the key barriers to the mainstream approach in this field is the prevalence of misconception regarding its stand from geo-political fronts. Historically, the trends of war, defense mechanism, controlling extremism and restoring peace have been defined as the geo-political phenomenon. Being characterized as an economic approach, the defense and peace mechanisms have come up with certain pioneering contributions - Peck and Scherer (1962), Brito (1972), Benoit (1973), Intriligator (1975). Some of the papers as cited above have provided the strategic significance to the new economic field. Further the applications of asymmetric information and game theory in defense economics have made the analysis quite robust (See *Handbook of Defense Economics Vol-1, Ch-1*). Though the attempt has been made to justify the theoretical foundation, still it is increasingly complex to satisfy the proposition because of the multifarious approaches in terms of strategic, political, domestic, spatial and international factors.

As far as the practical prospects of the existing literature are concerned, the analysis has invoked the series of time series, panel studies by focusing on individual economies and the regions as the whole. The result derived from this paper suggested that there are long relation between defense expenditure and economic growth in the case of BRIC countries. Here we confine our analysis to the most important block- BRIC.⁽¹⁾ Except growth standpoint, their defense expenditures have been rising over the years due to the looming cross-border problems and increasing geo-political presence. 2014 BRIC Summit has advocated the needs to propel the defense industries to pursue certain common security interests and handle other domestic spheres.

The post-cold war scenario brought some significant momentum in terms of the formation of new blocs based on some common parameters like economic development, security interests and strategic affairs. BRIC literally fulfills most of the common parameters laid down by Jim O Neill. BRIC economy as a whole shares 11% of global GDP in 1990, which further rose to 25% in 2011 and is forecasted to post 40% by 2050.⁽²⁾ The defense component always plays key role in BRIC⁽³⁾ policy paradigm due to the various internal and external factors associated with it. Some factors are Chechnya, Ukraine problems of Russia, Naxalism and Kashmir problem of India, Drug war in Brazil, Xinjiang problem and ethnic conflicts with China. Further, some conflicting interests like Russia-China border crisis, China-India border problems, Silk Route, Geo strategic influence in South-East Asia have fueled tensions among the BRIC nations. The defense expenditure has been increasing leading to three major reasons - 1) internal security 2) border crisis and external issues 3) geo-strategic competition.⁽⁴⁾ Among the BRIC nations, Russia is the primarily the biggest arm exporter to the rest of the world with the larger consumers being from China and India. As per SIPRI report, India is the largest importer of arms and ammunitions in the world.⁽⁵⁾ With the latest agreements with France and American companies regarding the purchase of defense weapons and fighter

jets, India's defense import bill has been swelled to more than \$20 billion. China is the 2nd largest spender in defense sectors behind USA, with a budget tantamount to \$ 188 billion in 2013. It constitutes 1.4% of Chinese GDP.⁽⁶⁾

Our aim is to undertake the detailed investigation regarding the effect of defense expenditure upon the economic growth in BRIC nations. Though previous studies have concentrated on analyzing the relation between defense expenditure and growth in a considerably bigger panels (Chen et al., 2014; Topcu and Aras, 2015), a very few number of studies like (Zhong et al., 2014) have concentrated in terms of smaller panels with the notable omissions like BRIC, N-11 nations etc. Here we focus our analysis on a relatively shorter and important panel of economies like BRIC. More prominently, with the rising income, each of the economies in this bloc has invested heavily in their concerned defense sector and also involved heavily in arms, ammunition trading among each other as well as with other economies. In 2014-15, India's defense deals with France, USA and Russia are the significant events. Similarly, China has doubled its defense spending in last couple of years. Brazilian government is in the process of reviving its defense industry in terms of modernization, investments in arms and ammunitions and recruiting more defense personnel. Russia has been traditionally largest arms exporter in the world. Further, Russia has shaped its defense and other strategic avenues due to the increasing threat of proxy war with NATO and to tackle ongoing Ukraine crisis.⁽⁷⁾ Here we need to see, whether the spectacular growth of 1990s and early 2000s have ascribed to a rising defense expenditure in these economies.

Our paper goes further compared to the other conventional papers of the recent times in terms of econometric investigations. We use the BRIC panel data for defense expenditures, *per capita* GDP and Real GDP growth for the estimation. The logic behind taking GDP parameters in two forms is to capture the effect of defense expenses on the economy as a whole and on the income of the individuals. Further, the notion behind adding the per-capita income part is to capture whether increasing per-capita defense expenditure has the impact upon the per-capita growth or not.

The modern literature's focus on the defense-growth nexus contrasts sharply with the traditional theory since Benoit (1973). Recent empirical framework has not found any convincing evidences in terms of defense-growth relations across the world. Motivated by a wealth of evidences from several studies, we undertake study with respect to BRIC nations due to some underlined reasons. **First**, BRIC region has gained importance economically, spatially and strategically due to their roles in world economy. Such a defense- growth theory in case of BRIC revolves around two key questions. (a) Why do these economies find it optimal to spend more on arms and ammunitions despite their persistent failures in achieving their social sectors initiatives? (b) What prompts those economies to push for more arms import despite the looming of higher deficit pictures (exception in case of Russia being the arms exporter)? **Second**, this region, to the best of our knowledge, has not been studied with respect to defense- growth relation. In the light of several issues like Xinjiang problem, Ukraine crisis, South China Sea, India's border issues and other defense deals, it is quite imperative to assess the trend and pattern of defense sector's performance of these economies. **Third**, rising defense trade and defense

deals among BRIC economies in recent BRIC meetings at Fortaleza, 2014 have revived the interests of focusing on such mechanism. **Fourth**, given the importance of the study, our empirical findings will give an insight to the issue, which can open up the channels for further research on this region irrespective of our results. This study though not a very different study, still acts as a building block approach to capture the relative volatility in defense spending and capture the stylized trends of unbalanced domestic development in these developing economies (Hassan et al., 2003; Yildirim and Öcal, 2006; Narayan and Singh, 2007; Hirmissa et al., 2009; Muhanji and Ojah, 2014).

We consider our paper to complement the existing line of research that relies heavily on the long run relationship. The rest of the paper has been organized as follows. Section-2 summarizes the literatures on effects of defense expenditures on growth of the developed and developing economies. Section-3 describes the data and methodology of the study. Section-4 discusses the econometric procedures and empirical results. Section-5 concludes the analysis.

2. Literature review

Using Benoit (1973) as a starting point, here we have collected a large set of previous theoretical and empirical literatures to corroborate in the existing framework. This section considers the evidences presented below as the meaningful supplements to our present analysis. From this standpoint, establishing the correlation among defense expenditure, economic growth and spatial development stand inevitable as far as our analysis is concerned.

Benoit (1978) was one of the pioneering papers in this field, where 44 less developed countries were taken into the analysis. The analysis reported the positive relationship between defense expenditure and economic growth. Though being a starting point, still later analyses are not consistent with the Benoit's paper. Factors like strategic features, geographical constraints, cross-border conditions, extremisms seem to have put comparable effects in the financing of defense sectors across the economies. Some non-traditional determinants like defense cluster, modern artillery exercise turn out to be the important factors in popping up the increasing defense expenses. In another seminal paper, Deger (1986) found out the negative relation between economic growth and defense expenditure in less developed economies. The paper cited the reason that rising defense expenditure was the concomitant result of the non-developmental expenditure of the economy, which further was unable to channelize it into the productive sources. Post-cold war literatures notably Ram (1995), Dunne (1996) have augmented the analyses by stating negative and no correlation between defense expenditure and growth patterns in less developed economies. However, still some studies have reported positive relationship (Yildirim and Öcal, 2006; Pradhan, 2010; Shahbaz et al., 2013). Here we have further typified the literatures into certain types.

In this section of literature review, we outline the effect of defense expenditure on economic growth by citing some time series specific analysis- mostly individual economy based study. This type of study rationalizes and captures the economic specific

externalities from defense expenditure, domestic defense spheres, and geo-strategic relation with neighbors and internal interactions of social sector parameters. Yildirim and Öcal (2006) analyzed the arms race strategies between India and Pakistan. The causality approach pinpointed the causal relation between the defense expenditures of India and Pakistan, because of arms race and nuclearization of the region. Further, the causal relation stated that defense expenditure did granger cause economic growth in India, not in Pakistan. A VAR analysis framework emphasized that defense expenditure might have certain short run impact on growth but not in long run in case of India. Shahbaz et al. (2013) provides a tractable platform of the Portuguese economy by taking trend of defense expenditure and economic growth from 1980 to 2010. His framework applied ARDL model through which, they found a significant relation between defense expenditure and growth rate. In addition, they found the unidirectional causality from defense expenditure to growth in Portugal. Ali and Dimtriakis (2014) have studied the impact of defense expenditure on economic growth in case of China by undertaking two state Markov switching model analysis. Their results pinpointed the fact that defense expenditure generally exerted two way effects upon growth rate- positively during boom and negatively during slowdown.

The last ten years have seen an exponential rise in the panel studies of defense- growth-inequality mechanism. Demonstration of such panel studies are strived to fulfill one such objective- to establish the strategic and geo-political importance in the world. Hirmissa et al. (2009) empirically examined the relation between defense spending and economic growth in ASEAN-5 nations. In case of Singapore, they got bi-directional causality, while uni-directional causality was obtained in case of Thailand and Indonesia. No meaningful relation was found in context of Malaysia and Philippines. Dunne (2010) has focused such an analysis with respect to the Sub-Saharan African nations. His analysis hardly found any positive relation between defense spending and economic growth despite being those economies frequently involved in war. Pradhan (2010) analyzed the nexus between defense expenditure and economic growth in the European Union economies from 1973 to 2010. The results were showing the strong nexus between defense spending and economic growth in the European Union economies. Other promising works with respect to the European Union are Kollias et al. (2007). Muhanji and Ojah (2014) have studied the panel of highly indebted war-prone African economies. Their analysis has shown the positive relation between defense spending and external debt across the nations and also during pre-war, war time, and post war periods. Further Topcu and Aras (2015) have extended their analysis of previous work on EU nations by adding some new members of European Union. Their analysis however refuted the previous results by stating no uniform approach in this context. Their analysis discovered the fact that during Post-Cold War, defense expenditure had exerted negative impact upon the economic growth in some East European economies.

3. Empirical Model and Data

In this study, we used two common proxy for “increasing state expenditure” i.e. government defense expenditure and government *per capita* defense expenditure (Narayan et al. (2008). Our panel data model is in the following form:

$$\ln X_{it} = \alpha_{1i} + \alpha_{2i}Y_{it} + \varepsilon_{it} \quad (1)$$

Where, X represents the defense expenditure and *per capita* defense expenditure; Y represents the proxy for economic growth (real GDP and real *per capita* GDP). ln denotes the natural logarithm form of the variables; and subscript i and t represent the cross-section countries and time period respectively.

This study covers 4 emerging countries of the World, i.e. Brazil, Russia, China and India. Our study has used annual data covering the period from 1993-2014. We have taken data solely from World Development Indicators (WDI) database. The time period taken here has been favored by 3 reasonable facts. Firstly, we have taken the full sample of data depending upon the availability, and more prominently, the era of globalization has brought some spectacular growth in those economies. Secondly, division of Soviet Republics has changed the regime from Communism to Capitalism in Russia. As our bloc takes into account Russia only, we prefer not to place the defense scenario of Soviet Republic prior to 1990. Thirdly, these emerging economies after 1990s have been inflicted by several terrorism and separatism movements. Fourthly, in our analysis we have deliberately excluded South Africa from the analysis due to certain reasons. A) South Africa has comparatively less *per capita* defense spending compared to its BRIC counterparts. B) There are no such cross-border and strategic issues revolved near its geographic boundaries. C) More prominently, there is severe discontinuity in South Africa’s defense spending data for which we seek to exclude it from our analysis.

4. Methodology and Results

Panel unit root test

In this section, this study trace the panel stationary property of the data in order to avoid any kind of spurious relation among the variables used in the model. Our dataset includes 4 variables namely real GDP, real *per capita* GDP, real defense expenditure and real *per capita* defense expenditure. We used Levin et al. (2002) unit root test and the result is presented in Table 1. It is derived from the unit root test is that we are not able to reject the null hypothesis of unit root test at the level series of the variables. In other words, all the variables are stationary at first difference. The main implication from the finding of I(1) of all the variables implies existence of long run relation among these variables. So, this study shows the long run relationship between expenditure and economic growth of BRIC countries in the next step.

Table 1. Result of Unit Root Test

Variable	Intercept	Intercept and Trend
lnGDP	0.50 (0.69)	-0.53 (0.29)
Δ lnGDP	-2.91 (0.00)	-2.23 (0.01)
lnPGDP	0.56 (0.71)	-0.57 (0.28)
Δ lnPGDP	-2.67 (0.00)	-2.18 (0.01)
lnMXP	0.68 (0.75)	0.67 (0.74)
Δ lnMXP	-1.50 (0.06)	-1.25 (0.09)
lnPMXP	0.89 (0.82)	0.62 (0.73)
Δ lnPMXP	-1.47 (0.07)	-1.23 (0.09)

Note: All variables are transformed logarithmically. PGDP and PMXP represent *per capita* GDP and *per capita* defense expenditure respectively. Δ indicates the first difference of the series concerned. Probability values are reported in the parenthesis.

Panel cointegration test

Once it is observed panel unit root, then in the next step this study performs a panel cointegration test proposed by Pedroni (2004). This test allows for heterogeneity in the intercept and slopes of the cointegration equation. In the Pedroni (2004) test conduct seven test statistics such as panel v-statistics, panel rho-statistics, panel pp-statistics, panel ADF-statistics, group rho-statistics, group PP-statistics and group ADF-statistics. So, the panel cointegration regression is as follows:

$$\ln X_{it} = \alpha_{1i} + \alpha_{2i} Y_{it} + \varepsilon_{it} \quad (2)$$

More specifically, Pedroni (2004) seven test statistics are based on estimated residual i.e. $\varepsilon_{it} = \eta_i \varepsilon_{i(t-1)} + \mu_{it}$. Hence, when the calculated values of these seven test statistics are greater than the Pedroni (2004) critical value indicates rejection of null hypothesis. This implies existence of long run relation between expenditure and economic growth.

We report Pedroni (2004) panel cointegration result in Table 2. The result shows, a long run relation is captured or not between defense expenditure and economic growth in the case of BRIC countries. We frame our model into two parts. Model 1 represents the relation between real GDP with real defense expenditure and Model 2 represents the relation between real *per capita* GDP with real *per capita* defense expenditure of BRIC countries. The need for the inclusion of *per capita* defense expenditure and *per capita* growth are quite imminent because of their relative impact on the economic welfare and wellbeing of the individuals. Many earlier literatures (Pan et al., 2014) have identified the fundamental consequences of inequality arising out of excessive defense spending. Though we have not solely taken the inequality aspect here, still the inclusion of *per capita* aspects with reference to defense expenditure and growth have been considered here to make our analysis more robust and significant. The first column of the Table 2 presents the relation between the real defense expenditure as well as real *per capita* defense expenditure and real GDP and real *per capita* GDP of BRIC countries. The second column of the Table 2 present the seven test statistics proposed by Pedroni (2004) and the third column present the calculated test statistics.

Table 2. Result of Cointegration Test

Model 1	Test Statistics	Calculated Statistics
lnMXP-lnGDP	Panel v-statistics	3.20 (0.00)
	Panel rho-statistics	-5.03 (0.00)
	Panel pp-statistics	-7.54 (0.00)
	Panel ADF-statistics	-2.64 (0.00)
	Group rho-statistics	-3.15 (0.00)
	Group pp-statistics	-6.27 (0.00)
	Group ADF-statistics	-2.87 (0.00)
Model 2	Test Statistics	Calculated Statistics
lnPMXP-lnPGDP	Panel v-statistics	-3.19 (0.05)
	Panel rho-statistics	-4.98 (0.00)
	Panel pp-statistics	-7.39 (0.00)
	Panel ADF-statistics	-2.53 (0.00)
	Group rho-statistics	-3.07 (0.00)
	Group pp-statistics	-6.09 (0.00)
	Group ADF-statistics	-2.72 (0.00)

Note: Figure in parenthesis shows the p-value, MXP = real defense expenditure, PMXP = *per capita* defense expenditure, GDP= real economic growth, PGDP = real *per capita* economic growth.

The result derived from the Table 2 clearly show that the null hypothesis of no cointegration between real defense expenditure and real economic growth as well as real *per capita* defense expenditure and real *per capita* economic growth reject in all of the Pedroni (2004) test statistics. In Brazil, the *per capita* GDP (7.923) from 1993 has risen to (9.35) in 2014. Similarly the *per capita* defense spending (3.80) from 1993 has increased to 5.04 in 2014 due to the drug war as well as some defense deal with some developed economies (all values in brackets are logarithmically transferred). Russia in the similar fashion has improved its defense position by reflecting its geo-strategic significance and initiative to counter to NATO. India with a rising growth prospective (5.72 in 1993 to 7.37 in 2014) has also been facing the internal threats as well as spatial induced terrorism (separatist problems) and maritime piracy problems.⁽⁸⁾ China has uniquely established its identity by employing geo-strategic influence over South China Sea and imminent problems with Japan, Taiwan and other southern neighbors. China's *per capita* defense spending has been increasing exponentially from 2.37 in 1993 to 5.06 in 2014.

Panel long run test

Once we find a long run relation between defense expenditure with economic growth, in the next step, this study shows the long run effect of real economic growth with real defense expenditure. This study used dynamic ordinary least square (DOLS) proposed by Kao and Chiang (2000), which includes leads and lags of the 'independent' variables to show the long run effect among them. The merit of DOLS over ordinary least square (OLS) and fully modified ordinary least square (FMOLS) explained by Kao and Chiang (2000) that OLS and FMOLS are biased up to $N = 60$ and $T = 60$ and hence DOLS is superior to OLS and FMOLS in all the case. We report the result of DOLS in Table 3. We

present the result of DOLS in the case of two models. Model 1 shows the long run effect of real economic growth on real defense expenditure and the model 2 shows the long run effect of real *per capita* economic growth on real *per capita* defense expenditure.

Table 3. Result of DOLS Test

Dependent variables are *lnMXP* and *lnPMXP* for Model 1 and Model 2 respectively

	Model 1		Model 2	
	Constant	lnGDP	Constant	lnPGDP
Coefficient	-0.60	0.86	-3.22	0.54
Std. Error	1.09	0.002	0.25	0.001
Prob.	0.58	0.00	0.00	0.00

Note: All variables are transferred into the logarithmic terms.

The result derived from Table 3 finds that real GDP positively affects to the real defense expenditure. More specifically, 1% change in real GDP, *ceteris paribus*, leads to raise 0.86% in real defense expenditure. Similarly, this study finds a positive relation between real *per capita* GDP to real *per capita* defense expenditure- 1% rise in real *per capita* GDP leads to raise 0.54% in real *per capita* defense expenditure. If we look at 20 year time span, except China, rest of the economies have experienced minor decrease in the real defense expenditure, although their *per capita* defense spending has increased significantly. Similarly, real GDP over 20 years for BRIC economies have also increased significantly.

Table 4. Average trend of total defense expenditure as percent to GDP

Country	1992-1996	1997-2001	2002-2006	2007-2011	2012-2013
Brazil	1.779	1.709	1.572	1.481	1.394
Russia	4.442	3.589	3.72	3.698	4.124
India	2.649	2.842	2.724	2.624	2.488
China	1.972	1.846	2.09	2.053	2.01

Source: World Development Indicators (WDI) of World Bank.

Table 5. Growth rate of real GDP for the BRIC countries

Country	1992-1996	1997-2001	2002-2006	2007-2011	2012-2013
Brazil	-0.317	-0.12	0.073	0.136	-0.096
Russia	-0.375	-0.214	0.13	0.062	-0.013
India	-0.012	-0.018	0.093	0.051	-0.085
China	0.038	0.089	0.138	0.182	0.097

Source: World Development Indicators (WDI) of World Bank.

Further, this study conducted a panel Granger Causality test to observe the direction of causality between the real defense expenditure and real GDP; real *per capita* defense expenditure and real *per capita* GDP. As panel Granger Causality test shows the short run relation between the variables, therefore, this study capture the speed of adjustment or ECM_{t-1} term through Arellano-Bond (1991) dynamic panel generalized method of moment (GMM) (Narayan et al., 2012; Narayan et al., 2008). We report the result in Table 6.

Table 6. Panel Granger Causality Result

	Model 1			Model 2		
	dlnMXP	dlnGDP	ECM _{t-1}	dlnPMXP	dlnPGDP	ECM _{t-1}
dlnMXP	-----	3.90 (0.23)	-0.78 (0.00)	-----	-----	-----
dlnGDP	5.88 (0.00)	-----	-0.76 (0.00)	-----	-----	-----
dlnPMXP	-----	-----	-----	-----	3.99 (0.00)	-0.80 (0.00)
dlnPGDP	-----	-----	-----	5.92 (0.00)	-----	-0.77 (0.00)

Note: Figure in parenthesis shows the p-value, MXP = real defense expenditure, PMXP = *per capita* defense expenditure, GDP = real economic growth, PGDP = real *per capita* economic growth.

The result of short run Granger causality is derived from the difference of the variables and the long run causality between the variables is observed from one period lag of error correction term (Narayan et al., 2012 and Bal and Rath, 2015). From the Table 6, it finds that there is unidirectional short run relation between real GDP to real defense expenditure for the BRIC countries. In addition to short run relation, we find significant ECM_{t-1} term which indicates existence of bidirectional relation between them in the long run. However, this study finds bidirectional causality between real *per capita* GDP and real *per capita* defense expenditure in the short run as well as in the long run in the case of BRIC countries.

Summary of the results

We set out another illustration of our notion of defense-growth nexus through the channel of a detailed empirical framework. Our main finding is quite interesting in terms of providing a strong and significant correlation among the variables of defense expenditure and growth rate.

In our analysis, initially we test the Pedroni cointegration, where almost all the 7 statistics have rejected the null hypothesis of no cointegration among the variables. The economies in the bloc have profoundly favored this aspect, if we study their distinctive geo-strategic, defense and security initiatives over the period from 1990s to till date. Incidents like maritime piracy, continuous terrorist threats, separatists' movements, extremist activities, border disputes and other random factors like territorial disputes have infused these economies to strengthen their defense mechanisms. Further, our panel DOLS analysis reflects the positive associations among the variables in the region. Every 1% rise in the economic growth has contributed nearly 0.54% rise in real defense expenditure, with the highest rise in case of China (0.60%). Despite the persistence of certain degree of skewedness in Brazilian defense spending, still a high correlation persists among the rest 3 superpowers (India, China, Russia) in terms of defense spending and economic growth. Russia is the leading arms exporter in the region, from which India and China are purchasing weapons over the years. Recent BRIC summit 2014 at Fortaleza has called for a BRIC defensive wall against the imminent external threat in the region. In addition to this, our Panel Granger result has reflected the bidirectional short run and long run causality among the variables. The causality test formally attributes to the fact that these variables are not only causally related in the long run, but also in short run. Many insignificant events in the short run like territorial disputes, defense deals have led to the significant rise in defense spending in these economies. Many prominent and unsolved

incidents like fundamentalism, terrorism have prompted these economies to adopt a collective long term strategy in the region, ultimately resulting in huge defense spending. Though this analysis has altogether got a significant relation among defense spending and growth rate, still it questions the ethos of such mechanism regarding which we are silent. We even baffle by such mechanism, whether a particular uniform threshold exists for defense spending or not in case of emerging economies.

5. Conclusion and future implication

Many interesting features of defense and economic growth are dynamic in nature because of present day's changing dynamics. In recent years, a large number of literatures have come up with different dimensions of economic growth by correlating with the defense mechanism. Using the empirical framework, we investigate the effect of defense spending upon the economic growth in so called BRIC bloc from 1993-2014. We primarily argue the essence of our study by using cointegration and causality tests. Cointegration tests show that there is a long run relation between defense expenditure and economic growth. We further apply Panel DOLS to show the long run effect of economic growth with defense expenditure. 1% change in real growth rate has attributed to 0.86% change in real defense expenditure in the region. Similarly the study finds the 0.54% change in *per capita* defense expenditure due to 1% change in economic growth. Further the application of Panel Granger causality test shows the short run relation among the variables and application of error correction mechanism reflects the long run bidirectional causality between the variables.

Through more sophisticated tools and highly detailed datasets, defense economists already reach a consensus that expansion of defense sector and economic growth are causally related with each other. Here our analysis shows a positive and significant relation among the variables, as found in many earlier literatures. The strategies used in this analysis leave open some innate possibility of researching further in this type of emerging bloc. A new insight may be gained in this BRIC region by exploring more options in the field of defense economics. Indeed, there is a more fundamental normative question persisting in case of emerging blocs after 1990s- should the emerging economies assign a tradeoff between social sector and defense sector spending in the name of growth. It is still highly controversial, how optimally the developing economies should spend and maintain their payoffs irrespective of their domestic and external scenarios. By looking at BRIC, each economy has been highly susceptible both domestic and external threats mostly in forms of separatism and terrorism. Furthermore, it is suggested here that given the financial backup of the respective government, defense spending can either be good or bad depending upon the time and spatial specific conditions.

Notes

- (1) Here we exclude South Africa from our analysis due to the fact that South Africa's defense expenses are far lesser than the rest four economies in this bloc. Its defense expenditure to GDP ratio is lesser than that of BRIC Economies.
- (2) Please See, "BRICS and the Global Economy" by B.R. Prasad - ORF Online Paper.
- (3) South Africa has been excluded due to its relatively less share of defense expenses to that of world's defense expenditure. Its share is comparatively lesser than those of other BRICS members.
- (4) Please refer to www.novinite.com/articles/162111/Are+the+BRICS+Putting+Up+a+Defensive+Wall%3F
- (5) For more, see SIPRI Report 2014.
- (6) See Military Balance Press Report, 2014 by IISS.
- (7) Please See Cooper, 2013 report on "Russian Military Expenditure- Data and Facts".
- (8) Maritime piracy is an act of criminal violence at sea. This problem is more prominent in the Indian Ocean, Bay of Bengal and some parts of Caribbean Sea. A joint military effort is needed by these 4 BRIC economies to combat such crisis because these are the important international waterways for trade. For more, Please refer to UNODC Report, 2014 on Maritime Crime.

References

- Ali, H.E. and Abdellatif, O.A. (2014). Defense expenditures and Natural Resources : Evidence from Rentier States in the Middle East and North Africa. *Defense and Peace Economics*, 26(1). pp. 4-13.
- Arellano, M. and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*. 58(2). pp. 277-297.
- Bal, D.P. and Rath, B.N. (2015). Nonlinear Causality between Crude Oil Price and Exchange Rate: A Comparative Study of China and India. *Energy Economics*. 51. pp. 149-156.
- Benoit, E. (1973). Defense and Economic Growth in Developing Countries. Boston MA: Health. Lexington Books.
- Benoit, E. (1978). Growth and Defense in Developing Countries. *Economic Development and Cultural Change*. 26(2). pp. 271-280.
- Brito, D.L. (1972). A Dynamic Model of an Armaments Race. *International Economic Review*. 13(2). pp. 359-375.
- Chen, P.F., Lee, C.C. and Chiu, Y.B. (2014). The Nexus between Defense Expenditure and Economic Growth: New Global Evidence. *Economic Modelling*. 36. pp. 474-483.
- Deger, S. (1986). Economic Development and Defense Expenditure. *Economic Development and Cultural Change*. 35(1). pp. 179-196.

- Dunne, J. (1996). Economic Effects of Military Expenditure in Developing Countries. *The Peace Dividend*. pp. 439-64.
- Dunne, J.P. (2000). The Economic Effects of Military Expenditure in Developing Countries. Economics Group, Middlesex University Business School, the Burroughs, Hendon, London, NW4 4BT.
- Dunne, J.P. and Smith, R.P. (2010). Military expenditure and Granger Causality: A Critical Review. *Defense and Peace Economics*. 21(5-6). pp. 427-441.
- Hassan, M.K., Waheed Uzzaman, M. and Rahman. A. (2003). Defense Expenditure and Economic Growth in The SAARC countries. *The Journal of Political, Social and Economic Studies*. 28(3). pp. 275-293.
- Hartley, K. and Sandler, T. (1995). Introductory Chapter (pp. 2-11). *Handbook of Defence, Economics*. Vol. 1. Elsevier.
- Hirmissa, M.T., Habibullah, M.S. and Baharom, A.H. (2009). Military Expenditure and Economic Growth in ASEAN-5 Countries. *Journal of Sustainable Development*. 2(2). p. 192.
- Intriligator, M.D. (1975). Strategic Considerations in the Richardson Model of Arms Races. *The Journal of Political Economy*. 83(2). pp. 339-354.
- Kao, C. and Chiang, M.H. (1999). On the Estimation and Inference of a Cointegrated Regression in Panel Data. *Advances in Econometrics*. 15. pp. 179-222.
- Kollias C., Mylonidis, N. and Paleologou, S.M. (2007). A Panel Data Analysis of the Nexus between Defense Spending and Growth in the European Union. *Defense and Peace Economics*. 18(1). pp. 75-85.
- Lai, C.N., Hung, B.N., Yang, C.Y. (2005). Defense Spending and Economic Growth across the Taiwan Straits: A Threshold Regression Model. *Defense and Peace Economics*. 16(1). pp. 45-57.
- Levin, A., Lin, C.F. and Chu, C. (2002). Unit Root Test in Panel Data: Asymptotic and Finite Sample Properties. *Journal of Econometrics*. 108 (1). pp. 1-24.
- Lin, E.S. and Ali, H.E. (2009). Military Spending and Inequality: Panel Granger Causality Test. *Journal of Peace Research*. 46(5). pp. 671-685.
- Malizard, J. (2014). Defense Spending and Unemployment in France. *Defense and Peace Economics*. 25(6). pp. 635-642.
- Muhanji, S. and Ojah, K. (2014). External Debt and Military Spending: The Case of Africa's Conflict Countries. (No. 56077). University Library of Munich, Germany.
- Narayan, P.K., Nielsen, I. and Smyth, R. (2008). Panel data, Cointegration, Causality and Wagner's Law: Empirical Evidence from Chinese Provinces. *China Economic Review*. 19(2). pp. 297-307.
- Narayan, S., Rath, B.N. and Narayan, P.K. (2012). Evidence of Wagner's Law from Indian States. *Economic Modelling*. 29(5). pp. 1548-1557.
- Narayan, P.K. and Singh, B. (2007). Modelling the Relationship between Defense Spending and Economic Growth for the Fiji Islands. *Defense and Peace Economics*. 18(4). pp. 391-401.
- Pan, C.I., Chang, T. and Wolde-Rufael, Y. (2014). Military Spending and Economic Growth in the Middle East Countries: Bootstrap Panel Causality Test. *Defense and Peace Economics*. pp. 1-14.
- Peck, M.J. and Scherer F.M. (1962). *The Weapon Acquisition Process: An Economic Analysis*. Boston: Harvard University.

- Pedroni, P. (2004). Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis. *Econometric Theory*. 20(03). pp. 597-625.
- Pedroni, P. (2007). Social Capital, Barriers to Production and Capital Shares: Implications for the Importance of Parameter Heterogeneity from a Nonstationary Panel Approach. *Journal of Applied Econometrics*. 22(2). pp. 429-451.
- Pradhan, R.P. (2010). Defense Spending and Economic Growth in China, India, Nepal and Pakistan: Evidence from Cointegrated Panel Analysis. *International Journal of Economics and Finance*. 2(4). pp. 65-74.
- Ram, R. (1995). Defense Expenditure and Economic Growth. *Handbook of Defense Economics*. 1. pp. 251-274.
- Shahbaz, M., Leitão, N.C., Uddin, G.S., Arouri, M. and Teulon, F. (2013). Should Portuguese Economy Invest in Defense Spending? A Revisit. *Economic Modelling*. 35. pp. 805-815.
- Topcu, M. and Aras, I. (2015). Defense Spending and Economic Growth: Extended Empirical Analysis for the European Union. *Defense and Peace Economics*. 26(2). pp. 233-246.
- Yildirim, J. and Öcal, N. (2006). Arms Race and Economic Growth: The Case of India and Pakistan. *Defense and Peace Economics*. 17(1). pp. 37-45.
- Yildirim, J. and Sezgin, S. (2002). Defense, Education and Health Expenditures in Turkey, 1924-1996. *Journal of Peace Research*. 39(5). pp. 569-580.
- Zhong, M., Chang, T., Tang, D.P. and Wolde-Rufael, Y. (2014). The Causal Nexus between Military Spending and Unemployment in The G7: a Bootstrap Panel Causality Test. *Defense and Peace Economics*. 26(6). pp. 609-622.

Important Reports' studies being cited

1. SIPRI Report, 2014 on "Trends in World Military Expenditure, 2014" edited by Sam Perlo-Freeman, Aude Fleurant, Pieter D. Wezeman and Siemon T. Wezeman.
2. Observer Research Foundation Draft, 2013 on "BRICS and the Global Economy" by Bandi Ram Prasad.
3. International Institute of Strategic Studies Report, 2014 on "The Military Balance 2014" by John Chipman.
4. Swedish Defence Research Agency Report, 2013 on "Russian Military Expenditure: Data, Issues and Facts" by Julian Cooper (Paper No- FOI-R--3688—SE, September, 2013).
5. UNODC Annual Report, 2014 on Maritime Crime Programme.