

The Nexus between Military Expenditures and Economic Growth in the BRICS and the US: An Empirical Note

Ming Zhong

Shanghai University of Finance and Economics,
School of Finance, Shanghai, CHINA
Email: zming777@163.com

Tsangyao Chang

Department of Finance, Feng Chia University
Taichung, TAIWAN
Email: tychang@mail.fcu.edu.tw

Samrat Goswami

Department of Rural Management and Development
Tripura University, Tripura, INDIA
Email: sam449@gmail.com

Rangan Gupta

Department of Economics
University of Pretoria, Pretoria, SOUTH AFRICA
Email: gupta.rangan@gmail.com

Tien-Wei Lou

Department of Banking & Finance, Chinese Culture University
Email: ltw@faculty.pccu.edu.tw

Abstract

This empirical note re-examines the causal linkages between military expenditures and economic growth for the BRICS countries (Brazil, Russia, India, China, and South Africa) and that for the USA during the period 1988-2012. Results of Granger causality tests show that military expenditures influence economic growth in the United States, economic growth influence military expenditures in both Brazil and India, a feedback between military expenditures and economic growth in Russia, and no causal relation exists between military expenditures and economic growth in China and South Africa. The findings of this study can provide important policy implications for the BRICS countries and also for the United States.

Keywords: Military Expenditures; Economic Growth; Bootstrap Panel Granger Causality Test; BRICS Countries

JEL Classifications: H56, O41, C23.

1. Introduction

Over the past several decades, the importance of military expenditures in the economic development process has led researchers to empirically identify the nature of causal linkages exists between military expenditures and economic growth. This empirical note represents our attempt to study the causal relationship between military expenditures and economic growth in a group of countries, i.e. for the BRICS countries (Brazil, Russia, India, China, and South Africa) and the United States over the period 1988-2012. The exponential rise in the growth and economic power of the emerging markets since the 1990s, with the emerging economies in general, and the BRICS economies in particular, have received widespread attention within the literature. Clearly, the BRICS economies stand out amongst all the emerging economies and have demonstrated remarkable economic progress over recent years. It is estimated that about two-thirds of the anticipated increase in GDP by the BRICS economies is likely to come from higher-end real growth. The BRICS countries and the United States are already playing important roles in global financial development, exerting significant influences on economic growth throughout the global economy and markets. According to the Stockholm International Peace Research Institute (SIPRI, 2011, 2012, 2013) report, the United States, China, and Russia are among the top three countries with the largest military budgets in 2013, followed by India ranked 9 and Brazil ranked 12. Russia, the United States and China are three main arm traders in the world. These three countries were responsible for more than 60 percent of all arms deliveries of the world during 2006–2012 (SIPRI, 2013).

This empirical note re-investigates the relationship between military expenditures and economic growth in the BRICS countries (Brazil, Russia, India, China, and South Africa) and in the United States over the period 1988-2012 by focusing on country-specific analyses. To

detect these causal linkages, the panel causality approach has been applied, which accounts for both cross-country interrelations and country-specific heterogeneity. While the United States has led the global rise in military spending over the past decade, this trend has been followed by many emerging (or re-emerging) regional powers such as China, Brazil, India, Russia, South Africa (BRICS in our case; SIPRI, 2011). All these rapidly growing economies have key economic and political roles in their respective regions and, sometimes, globally. All these 5 countries are also developing as military powers through their engagement in significant military modernization programmes. In BRICS countries cases, current conflict is a driver of military spending. For India, the conflict has aggravated due to the addition of the growing Naxalite movement along with the perennial conflict with Pakistan and that in Kashmir. Regional disputes and rivalries also create a desire not to lag behind other countries, even where relations are currently peaceful. For China, the overwhelming US military dominance in the region is a concern, especially in relation to potential conflict over Taiwan, whereas, India is concerned with China's growing military might, given the two countries' border disputes and rivalry to increase influence in the Indian Ocean region. Russia meanwhile views an expanding NATO as a potential, if not a current, threat. Even in the absence of regional rivalries, a perception of military power as a source of status may be a motivating factor, as in the cases of Brazil and South Africa. High military spending can be controversial in the face of more pressing social needs. In Brazil, this tension has recently led to changes in budget priorities regarding military spending. In South Africa, the recent major arms procurement package has been severely criticized for diverting funds from poverty and development goals, as well as for corruption. In India, however, civil society criticism on military spending is countered by strong popular concern over Pakistan (SIPRI, 2011).

This empirical note represents our attempts to use a new panel Granger causality approach, based on the seemingly unrelated regression (SUR) model and Wald tests with country-specific bootstrap critical values followed by the Kónya (2006) empirical method to

explore the relationship between military expenditures and economic growth in the BRICS countries and in the United States. This new methodology makes it possible to test for Granger-causality on each individual panel country separately, while accounting for possible bias and cross-sectional inconsistencies that may occur in our panel data.¹ We hope that this study can bridge the gap in the current literature between military expenditures and economic growth.

This empirical note has been divided in five sections. After introduction section, section 2 provides the data used in the study. The third section briefly describes the bootstrap panel Granger causality test proposed by Kónya (2006) and section 4 presents the empirical results, along with their economic and policy implications. Finally, section 5 concludes the study.

2. Data

This empirical note uses annual data for the period of 1988 to 2012, for both the BRICS countries (Brazil, Russia, India, China, and South Africa) and the United States. The variables used in this study include the per capita real military expenditure (*PRME*), the per capita real GDP (*PRGDP*),² along with the per capita real capital expenditure (*PRK*) as a control variable. All variables are measured in constant 2005 US dollars. Both *PRGDP* and *PRK* have been taken from the World Development Indicators (*WDI, 2013*), whereas the *PRME* from the *Stockholm International Peace Research Institute (SIPRI, 2013)*. Tables 1 to 3 report the summary statistics for the data series and military expenditures as a share of GDP. From these three tables, we can see that United States and South Africa have the highest and lowest mean *military expenditure* with US\$ 520,554 and US\$4,573.79 millions, respectively. The United States and India have the highest and lowest mean *PRGDP* values, US\$39,269.9 and US\$655.653, respectively. Table 3 depicts military expenditures as a share of GDP for each

¹ Bai and Kao (2006) demonstrated that the assumption of cross-sectional independence is difficult to satisfy in panel data, neglecting this information could cause bias and inconsistent results.

² Per capita numbers used in our study have two following reasons. First, per capita numbers are less sensitive to territorial changes. Second, per capita numbers provide variables in the same units for large and small countries and they can control for the scale of the economy.

Table 1. Summary statistics of military expenditure for BRICS and USA countries.

Countries	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	J.-B.
Brazil	27160.79	52182	12426	8271.686	1.085793	4.761324	7.818044**
China	60414.25	157603	16876	45212.71	0.914119	2.462075	3.631818
India	29853.08	49634	16783	11154.32	0.59758	2.04209	2.345996
Russia	87615.29	371073	23031	98086.02	2.182463	6.16883	29.09407***
South Africa	4573.792	7741	2892	1232.45	1.413013	4.625843	10.62979***
United States	520554	720386	378533	114473.4	0.316537	1.839827	1.746784

Note:

1. The sample period is from 1988 to 2012.
2. **and *** indicate significance at the 0.05 and 0.01 levels, respectively.
3. Data for military expenditure by country in constant price US\$ (millions), presented according to calendar year, and in current (2013) US\$ m. for 2013.

Table 2. Summary statistics of per capita real GDP for BRICS and USA countries.

Countries	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	J.-B.
Brazil	4523.76	5537.696	3874.762	504.4941	0.80448	2.45024	3.011475
China	1408.85	3352.728	437.1566	898.875	0.797735	2.421479	3.00022
India	655.653	1170.812	383.4264	241.7628	0.776792	2.390712	2.900889
Russia	4977.28	6876.842	3272.032	1197.342	0.022423	1.556383	2.172959
South Africa	4873.10	6269.518	4093.76	682.7491	0.727201	2.09885	3.049323
United States	39269.9	45360.29	31776.73	4871.892	-0.2265	1.487143	2.597857

Note: 1. The sample period is from 1988 to 2012.

country and we find that Russia and Brazil have the highest and lowest mean military expenditures as a share of GDP, which are 5.2 percent and 1.92 percent, respectively, over the period 1988-2012. From Table 3, we also find that military expenditures as a share of GDP decreased over time for most of the countries studied.

Table 3. Military expenditure as a share of GDP for BRICS and USA countries.

Years Countries	Brazil	China	India	Russia	South Africa	United States
1988	2.1	2.4	3.6	15.8	4.6	5.7
1989	2.7	2.5	3.5	14.2	4.4	5.5
1990	6.3	2.5	3.2	12.3	3.9	5.3
1991	2.0	2.4	3.0	8.9	3.2	4.7
1992	1.5	2.5	2.8	5.5	2.8	4.8
1993	1.9	2.0	2.9	5.3	2.5	4.5
1994	2.0	1.7	2.8	5.9	2.6	4.1
1995	1.9	1.7	2.7	4.4	2.2	3.8
1996	1.7	1.7	2.6	4.1	1.8	3.5
1997	1.6	1.6	2.7	4.5	1.6	3.3
1998	1.7	1.7	2.8	3.3	1.4	3.1
1999	1.7	1.9	3.1	3.4	1.3	3.0
2000	1.8	1.9	3.1	3.7	1.4	3.0
2001	2.0	2.1	3.0	4.1	1.5	3.0
2002	1.9	2.2	2.9	4.4	1.6	3.4
2003	1.5	2.1	2.8	4.3	1.5	3.7
2004	1.5	2.1	2.8	3.8	1.4	3.9
2005	1.5	2.1	2.8	3.9	1.4	4.0
2006	1.5	2.1	2.5	3.8	1.3	3.9
2007	1.5	2.1	2.3	3.7	1.2	4.0
2008	1.5	2.0	2.6	3.7	1.2	4.3
2009	1.6	2.2	2.9	4.6	1.3	4.8
2010	1.6	2.1	2.7	4.3	1.2	4.8
2011	1.5	2.0	2.6	4.1	1.1	4.7
2012	1.5	2.0	2.5	4.4	1.1	4.4
Average 1988-2012	1.92	2.064	2.848	5.2	1.96	3.685

Note:

1. Source: SPIRI Yearbook, 2013.

2. Data for military expenditure by country as a share of GDP, presented according to calendar year.

3. Methodology

The econometric method used in this empirical note has briefly been outlined in the following two subsections.

3.1. Preliminary Analysis

3.1.1. Cross-Sectional Dependence and Slope Homogeneous Tests

One of the important assumptions in the bootstrap panel causality is the existence of cross-sectional dependency among the countries in the panel. In case of cross-sectional correlated errors, the estimator from the regression system described with the SUR is more efficient than the estimator with the pooled ordinary least squares (pooled OLS) model because the country-by-country OLS approach does not consider cross-sectional dependency. Therefore, testing for cross-sectional dependency is the most crucial issue for the selection of an efficient estimator and hence for the panel causality results. The second important issue in the bootstrap panel causality approach is testing for cross-country heterogeneity. In order to test the null hypothesis of slope coefficient homogeneity against the alternative hypothesis, the familiar approach is to apply the Wald principle. Details on the cross-sectional dependence and slope homogeneous tests, interested readers can refer to Chang *et al.*, (2014), Chang and Tsai (2015), Pan *et al.*, (2015), and Zhong *et al.*, (2015).

3.2. Bootstrap Panel Granger Causality Test

To measure the determinants of causality between military expenditures and economic growth, we apply the bootstrap panel causality method proposed by Kónya (2006). Kónya (2006) emphasized that the results of the bootstrap panel causality method, unit root test, and cointegration test are all robust. This implies that not all variables need to be tested for stationary series properties. This robust feature of bootstrap panel causality arises from the generation of country-specific critical values from the bootstrapping method. The variables in the model need not be a stationary series (Kónya, 2006).³ It is important to note here that the variable levels used in empirical analysis play crucial roles in determining causal linkages.

³ We refer to Kónya (2006) for more details of the bootstrapping method and of country-specific critical values.

This is because to make the variables stationary, i.e. to use the difference form, differencing variables may lead to a loss of trend dynamics in the series.

The bootstrap panel causality approach of Kónya first requires estimating the described system by seemingly unrelated regression (SUR) to impose zero restrictions for causality by the Wald principle, and then requires generating bootstrap critical values. Since country-specific Wald tests with country-specific bootstrap critical values are used in the panel causality method, the Wald test does not require doing the joint hypothesis for all countries in the panel.

The equation system for panel causality analysis includes two sets of equations that can be written as follows:

$$\begin{aligned}
y_{1,t} &= \alpha_{1,1} + \sum_{i=1}^{ly_1} \beta_{1,1,i} y_{1,t-i} + \sum_{i=1}^{lx_1} \delta_{1,1,i} x_{1,t-i} + \sum_{i=1}^{lz_1} \gamma_{1,1,i} z_{1,t-i} + \varepsilon_{1,1,t} \\
y_{2,t} &= \alpha_{1,2} + \sum_{i=1}^{ly_1} \beta_{1,2,i} y_{2,t-i} + \sum_{i=1}^{lx_1} \delta_{1,2,i} x_{2,t-i} + \sum_{i=1}^{lz_1} \gamma_{1,2,i} z_{2,t-i} + \varepsilon_{1,2,t} \\
&\vdots \\
y_{N,t} &= \alpha_{1,N} + \sum_{i=1}^{ly_1} \beta_{1,N,i} y_{N,t-i} + \sum_{i=1}^{lx_1} \delta_{1,N,i} x_{1,N,t-i} + \sum_{i=1}^{lz_1} \gamma_{1,N,i} z_{N,t-i} + \varepsilon_{1,N,t}
\end{aligned} \tag{1}$$

and

$$\begin{aligned}
x_{1,t} &= \alpha_{2,1} + \sum_{i=1}^{ly_2} \beta_{2,1,i} y_{1,t-i} + \sum_{i=1}^{lx_2} \delta_{2,1,i} x_{1,t-i} + \sum_{i=1}^{lz_2} \gamma_{2,1,i} z_{1,t-i} + \varepsilon_{2,1,t} \\
x_{2,t} &= \alpha_{2,2} + \sum_{i=1}^{ly_2} \beta_{2,2,i} y_{2,t-i} + \sum_{i=1}^{lx_2} \delta_{2,2,i} x_{2,t-i} + \sum_{i=1}^{lz_2} \gamma_{2,2,i} z_{2,t-i} + \varepsilon_{2,2,t} \\
&\vdots \\
x_{N,t} &= \alpha_{2,N} + \sum_{i=1}^{ly_2} \beta_{2,N,i} y_{N,t-i} + \sum_{i=1}^{lx_2} \delta_{2,N,i} x_{N,t-i} + \sum_{i=1}^{lz_2} \gamma_{2,N,i} z_{N,t-i} + \varepsilon_{2,N,t}
\end{aligned} \tag{2}$$

In the equation systems (1) and (2), y refers to the indicator of per capita real military expenditures (*PRME*), x denotes the indicator of per capita real GDP (*PRGDP*), z denotes the indicator of per capita real capital expenditure (*PRK*) as a control variable, N is the number of panel members, t is the time period ($t=1, \dots, T$), and l is the lag length. In this regression system, each equation has different predetermined variables, while the error terms might be

cross-sectional correlated. Hence, we can express these sets of equations as an SUR system. To test for Granger causality in this system, alternative causal relations for each country are likely to be found are: (i) there is one-way Granger causality from X to Y if not all $\delta_{1,i}$ are zero, but all $\beta_{2,i}$ are zero; (ii) there is one-way Granger causality from Y to X if all $\delta_{1,i}$ are zero, but not all $\beta_{2,i}$ are zero; (iii) there is two-way Granger causality between X and Y if neither $\delta_{1,i}$ nor $\beta_{2,i}$ are zero; (iv) there is no Granger causality between X and Y if all $\delta_{1,i}$ and $\beta_{2,i}$ are zero.⁴

4. Empirical Results, Economics and Policy Implications

4.1. Empirical Results

As stated earlier, testing for cross-sectional dependency and slope homogeneity in a panel causality study is crucial for selecting the appropriate estimator. The results from the cross-sectional dependence and slope homogeneity tests are reported in Table 4. The cross-sectional dependence tests strongly indicate that the null hypothesis of no cross-sectional dependence is rejected at the one percent level of significance. The cross-sectional dependence tests thereby support evidence of high integration among the BRICS countries and the United States, which implies that any shock that occurs in one

⁴ Before proceeding to estimation, optimal lag lengths must be determined.⁴ Since the results from the causality test may be sensitive to the lag structure, determining the optimal lag length(s) is crucial for the robustness of empirical findings. In a large panel system, lag lengths and numbers of independent variables can cause a substantial computational burden. Following Kónya(2006), maximal lags are allowed to differ across variables, but that need to be the same across equations. In our study, the regression system is estimated by each possible pair of $ly_1, lx_1, ly_2, lx_2, lz_1$, and lz_2 ; we assume from 1 to 4 lags exist, and then we choose the combinations that minimize the Schwarz Bayesian Criterion. Kónya (2006) points out that this is an important step because the causality test results may depend critically on the lag structure. In general, lag decisions may cause different estimation results. Too few lags means that some important variables are omitted from the model and this specification error will usually cause incorrect estimation in the retained regression coefficients, leading to biased results. On the other hand, too many lags will waste observations and this specification error will usually increase the standard errors of the estimated coefficients, leading to inefficient results.

country can quickly be transmitted to other countries.

Table 4. Cross-sectional dependence and homogeneous tests for BRICS and USA countries.

Method	Test.Stat.	p-value
<i>Cross-sectional dependence test</i>		
CD_{BP}	30.313**	0.0108
CD_{LM}	2.796***	0.0052
CD	2.291**	0.0219
LM_{adj}	66.250***	0.0000
<i>Homogeneous test</i>		
$\tilde{\Delta}$	8.659***	0.0000
$\tilde{\Delta}_{adj}$	9.567***	0.0000
Swamy	60.010***	0.0000

Note:

1. ** and *** indicate significance at the 0.05 and 0.01 levels, respectively.
2. CD_{BP} , CD_{LM} , CD and LM_{adj} are the cross-sectional dependence tests of Breusch and Pagan (1980), Pesaran (2004, 2006), and Pesaran et al. (2008), respectively.
3. $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ are slope homogeneity tests of Pesaran and Yamagata (2008).

Table 4 also reports the results obtained from the slope homogeneity tests following Pesaran and Yamagata (2008). Both tests reject the null hypothesis of the slope homogeneity hypothesis, supporting country-specific heterogeneity. The rejection of slope homogeneity implies that by imposing a homogeneity restriction on the variable of interest, the panel causality analysis results in misleading inferences. The direction of causal linkages between military expenditures and economic growth in the BRICS countries and the United States seems to be heterogeneous, implying that the directions of causal linkages among the variables of interest may differ across countries. The existence of cross-sectional dependency and heterogeneity across countries is evidence for supporting the suitability of the bootstrap panel causality approach. The results from the bootstrap panel Granger causality analysis

Table 5. Military expenditure does not Granger cause per capita real GDP

Countries	Estimated coefficient	Wald Statistics	Bootstrap Critical Value		
			1%	5%	10%
Brazil	-0.01628	0.980844	9.94623	5.66767	4.40619
China	0.024955	0.378852	22.09207	11.37144	9.21281
India	0.075533	2.070315	10.1006	6.50834	4.89292
Russia	-0.09391	28.94662***	7.17934	4.80948	4.12322
South Africa	-0.02103	0.867749	11.66576	7.8059	6.03148
United States	-0.05582	12.18858***	6.54936	5.04855	3.33054

Note:

1. *** indicates significance at the 0.01 level.
2. Bootstrap critical values are obtained from 10,000 replications.

Table 6. Per capita real GDP does not Granger causes Military expenditure

Countries	Estimated coefficient	Wald Statistics	Bootstrap Critical Value		
			1%	5%	10%
Brazil	4.5299	14.62835**	16.96388	8.8327	6.30714
China	-0.89797	5.18655	18.09194	11.51636	8.72854
India	1.50789	11.95924**	15.40458	10.15406	7.41053
Russia	1.03345	38.20211***	12.99996	7.91116	6.20657
South Africa	-0.21884	0.153424	14.22139	9.06657	7.38503
United States	-0.49114	0.871304	26.55233	13.32557	10.07412

Note:

1. ** and *** indicate significance at the 0.05 and 0.1 levels, respectively.
2. Bootstrap critical values are obtained from 10,000 replications.

have been reported in Tables 5 and 6.⁵ We discuss our country by country empirical findings along with several interesting observations as follows:

The United States

In our empirical findings, we find one-way Granger causality running from military expenditures to economic growth only in case of the United States. This result indicates that

⁵ For the bootstrap procedure on how the country specific critical values are generated, interest readers can refer to Kónya (2006).

military expenditures play an important role in the economic development of the United States. However, looking to the coefficient from the economic growth equation, we find that military expenditures negatively affect economic growth (since the coefficient is negative). These results are consistent with most of the findings of previous studies which claimed that military expenditures are harmful to economic growth. That is, if military expenditures are financed through taxes or borrowings, it will crowd-out private investment. Therefore, it is a diversion of resources away from more productive government outlays such as education and health services (*Deger and Smith, 1983; Lim, 1983; Dunne and Vougas, 1999*). A reduction in military expenditures would make financial resources available for the use of other activities such as education, health, and many other social programs. Our result is not consistent with the findings of LaCivita and Frederiksen (1991) and Chang *et al.*, (2014). Both studies found a feedback between military expenditure and economic growth in the United States. Our empirical result is also not consistent with the findings of Atesoglu (2002, 2009), which states that military expenditures does not promote economic growth in real output but responds to aggregate income shocks in the United States. Our empirical findings are different from some of the previous studies might be due to the following reasons. First of all, this difference might be due to sample period selection (that we use longer period, 1988-2012). Second, different sample group countries selected used in our study and we called this group countries effect. Third, more advanced econometric techniques used in our study. We use bootstrap panel causality test taking into account both cross-sectional dependence and cross-country heterogeneity. Fourth, while previous studies do not consider per capita real capital expenditure (*PRK*) as a control variable, we have incorporated it in our panel causality model.

Brazil and India

In case of Brazil and India, we found one-way Granger causality from economic growth to military spending, and the coefficients depicted in Table 6 are also significant and positive.

The result indicates that when there is an economic boom, the military expenditures will grow in both Brazil and India. This empirical result is consistent with those of Smith and Tuttle (2008) and Heo (2010), stating that military spending does not promote economic growth in real output but responds to aggregate income shocks.

Russia

In case of Russia, our empirical results suggest bidirectional Granger-causality (feedback) between military expenditures and economic growth. Although military expenditures may affect economic growth through several channels, for example, through a Keynesian-type aggregate demand effect, it is also plausible that economic growth may causally be prior to military expenditures. For example, a country with a higher growth rate may wish to strengthen its external as well as internal security by increasing military spending (D'Agostino *et al.*, 2012). This feedback relationship found in Russia implies that neither economic growth nor military expenditures can be considered exogenous.

China and South Africa

In cases of China and South Africa, we found no causal link between military expenditures and economic growth. This result indicates that neither military expenditures nor economic growth will affect or reinforce each other in China and South Africa. These results further point out that military expenditures do not play important role for economic growth in China and South Africa. It supposes that military expenditure in both China and South Africa may primarily be related to security, and the burden of military expenditure is distributed independently of income, which support a neutrality hypothesis.

In case of South Africa, our empirical result is consistent with that of Aye *et al.*, (2014) that finds no causal link between military expenditures and economic growth during the 1951-2010. However our empirical result is not consistent with that of McMillan (1992) that

examines the link using a Feder Ram model based on a neoclassical production function for the period 1950–1985. The results indicate a negative size effect but a positive externality effect of military spending on economic growth in South Africa. Using the same theoretical model, Batchelor et al., (2000b) estimate a neoclassical (supply-side) model for the manufacturing sector, as well as the aggregate macroeconomic level in South Africa. Overall, they found military expenditures have no significant impact in aggregate, but a significant negative impact for the manufacturing sector. Birdi and Dunne (2002) criticized the Feder Ram model and use an aggregate production function model to underpin a VAR analysis of the impact of growth of military spending on GDP growth, which is found to be negative and insignificant. However, when they test the effect of military spending on manufacturing output, a positive long-run effect, but negative short-run effect has been observed in South Africa.

In China, the null hypothesis of no causality from military expenditure to economic growth or the other way around cannot be rejected, implying also that there is also no causality in either direction between military expenditures and economic growth in China. This result is not consistent with that found in Chang *et al.* (2014), stating that military spending does promote economic growth in China. On the other hand, our result is also not consistent with those of Chang *et al.*, (2001), Dimitraki and Ali (2013), and Furuoka *et al.*, (2014) that indicate a unidirectional causality from economic development to military expenditure in China. The justification for the difference between our study and that of Chang *et al.* (2014) might be due to sample group countries selected in our study (group countries effect). We select the BRICS and the United States and Chang et al. (2014) selected the G7 countries and China. The other reason is that if we look at Table 3, the share of military expenditure of GDP does not change over the past two years and remains at 2 percent in China however, economic growth in China remains higher (around 8 percent) during that period. Another justification of our empirical findings might be due to the higher cooperation

between China and the other BRICS countries than that of China and the other G7 countries. As we know that strategic alliance among the BRICS countries become more close and important over the past several years. China launches a new Asia Infrastructure Investment Bank (AIIB) in 2015 and this further increase the important role of China. Further, a big country like China with its abundant resources, and we would expect some other economic and/or social factors which will affect its growth (see Chang *et al.* 2001). We believe that our empirical findings are more reliable than previous papers.

4. 2. Policy Implications

Overall, our results indicate that, except the United States, military expenditure is not a strong exogenous variable relative to economic growth for most of the BRICS countries. The results appear to indicate that military spending plays an important role in economic growth only in the United States. Our empirical results thus lead us to conclude that the relationship between military expenditures and economic growth cannot be generalized across countries.

As mentioned previously, the time series approaches overlook cross-sectional dependence across countries in the causality tests, and, therefore, they may result in misleading inferences regarding the nature of causality between military expenditure and economic growth. We find clear evidence for the existence of cross-sectional dependence among the BRICS countries and the United States. Therefore, it might be concluded that more appropriate policy implications can be derived from causality approaches that account for cross-sectional dependence. Furthermore, we also detect cross-country heterogeneity in the panel of these 6 countries, implying that each country may develop its own military policies. Our empirical results lead us to conclude that the relationship between military expenditures and economic growth cannot be generalized across countries. This result is in line with the findings of others (Chowdhury, 1991; Landu, 1993; Kusi, 1994; Al-Yousif, 2002; Chang *et al.*, 2014; Pan *et al.*, 2014), who have concluded that military expenditure depends on a number

of factors including: the nature of the expenditure; the prevailing circumstances; and the concurrent government policies.

5. Conclusions

This empirical note re-examines the causal linkages between military expenditures and economic growth in the BRICS countries (Brazil, Russia, India, China, and South Africa) and the USA for the period 1988-2012. Panel causality was used to explain dependency and heterogeneity across countries. The results of Granger causality tests show that military expenditures influence economic growth in the United States, economic growth influence military expenditures in both Brazil and India, a feedback between military expenditures and economic growth in Russia, and no causal link exists between military expenditures and economic growth in both China and South Africa. These results obtained from the bootstrap panel Granger causality tests and indicate that the causality between military expenditures and economic growth varies across countries with different conditions. The findings of this study could provide important policy implications for both the BRICS countries and the United States that will assist them to develop sound military strategies in the context of economic development.

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