Chinese Business Review, ISSN 1537-1506
February 2011, Vol. 10, No. 2, 112-118

The Relationship Between Military Expenditure and Economic Growth in Four Asian Countries

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In this study, we use the ARDL bounds testing procedure suggested by Pesaran (2001) and modified version of the Granger causality test proposed by Toda and Yamamoto (1995) to test the robustness of the causality effect between military expenditure and economic growth in 4 Asian countries, two industrial countries (South Korea and Malaysia), and others are developing countries (Iran and Saudi Arabia), from 1988 to 2006 years, data series obtained from word development indicator (WDI). With respect to that military expenditure can affect economic growth so increase in GDP can increase or decrease military expenditure, too. We investigate the causality relationship between military expenditure and economic growth because the purpose of military expenditures is to provide national security. The results show that Iran and Saudi Arabia don't have any causality relationship between military expenditure and economic growth. The results of South Korea show a unidirectional relationship from LGDP (Logarithm of real GDP) and LGDPK (logarithm of real GDP per capita) to military expenditure, and in Malaysia there is unidirectional relationship from LGDPK to military expenditure. The comparison of these results, we can say that developing countries don't have meaningful relationship between military expenditure and economic growth, but we can find unidirectional or bidirectional relationship between military expenditure and economic growth in industrial countries.

Keywords: economic growth, military expenditure, ARDL bound test

Introduction

An exogenous increase in military spending increases demands and, if there is spare capacity, increases utilization and reduces unemployment of resources. Military expenditures have opportunity costs and may crowd out other forms of expenditure, such as investment. Increases in military expenditure will also change the composition of industrial output, with input-output effects. Security of persons and property from domestic or foreign threats is essential to the operation of markets and the incentives to invest and innovate (Dunne, Smith, & Willenbockel, 2005). Although military expenditure may affect growth through these mechanisms, Joerding (1986) contends that economic growth may be causally prior to defense spending. For instance, a country with high growth rates may wish to strengthen itself against foreign or domestic threats by increased defense spending. In contrast, it is equally plausible that countries with high growth rates may divert resources from defense into other productive uses. It is also possible that defense spending may increase less than

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proportionally at low levels of GDP. The foregoing discussion gives rise to four possible outcomes regarding causal relationships between economic growth and military expenditures: unidirectional causality from military expenditures to economic growth or vice versa; bidirectional causality between the two variables; and, finally, a lack of any causal relationship. Moreover, there are both positive and negative net effects, so that there may be unidirectional causality from military expenditures to economic growth that is on balance either positive or negative (Dakurah, Davies, & Sampath, 2001). The relationship between government expenditure and economic growth is one of the interesting issues among economists. However, empirical studies have found different results, some of this studies found meaningful relationship and some of them did not found significant relationship between government expenditure and economic growth. According to Keynes, expenditure may stimulate growth, increase in aggregate expenditure lead to increase in aggregate demand.

DeGrasse (1993) argues that military expenditure generates contract awards which generate jobs and increase purchasing power of workers, the increased purchasing power will lead to more demand and increase in demand lead to economic growth. Hirnissa and Habibullah (2008) examined the relationship between military expenditure and economic growth for ASEAN-5 countries (Malaysia, Singapore, Thailand, Indonesia and Philippine). They employed ARDL bounds testing procedure suggested by Pesaran (2001) and dynamic OLS (DOLS) proposed by Stock and Watson (1993) to test the robustness of the causal effect and long-run relationships between military expenditure and economic growth using annual data for the period 1965 to 2006. They found there are only three (Indonesia, Thailand, Singapore) out of five countries analyzed exhibit long run relationship between military expenditure and economic growth. While for the case of Singapore, the causality is bidirectional, for Indonesia and Thailand, it is unidirectional from military expenditure to economic growth, and for the remaining countries (Malaysia and Philippines), no meaningful relationship could be detected. Habibullah, Law, Siong-Hook and Dayang-Afizzah (2008) examined the relationship between military expenditure and economic growth in selected Asian countries for the period 1989 to 2004 with panel cointegration test and panel error correction model. The result of panel cointegration suggested that there was long-run relationship between military expenditures and economic growth. Finally, panel error-correction model showed that military expenditures and economic growth is not related in the Asian countries. The study of Brempong (1989) in 39 Sabsaharan Africa countries during 1973 to 1983, and the conclusions from the econometric analysis (3sls) are that: The total effect of military expenditure on economic growth is significantly negative, military expenditure influences economic growth through its effects on investment rate and the supply of skilled labor to the civilian economy, and military expenditure hadn't any significant direct effect on economic growth. Kwadwo (1994) employed Granger causality test using annual time series data for each of the 77 countries to analyze the presence and direction of causality between military expenditure and economic growth, test results indicated that the relationship between the two variables cannot be generalized across countries.

ARDL Approach

In this study, we employ recently developed ARDL-bounds testing approach to examine the long-run cointegration relation-ship between variables. The ARDL modeling approach was originally introduced by Pesaran and Shin (1999) and later extended by Pesaran and Smith (2001).

An ARDL model is a general dynamic specification, which uses the lags of the dependent variable and the lagged and contemporaneous values of the independent variables, through which the short-run effects can be directly estimated, and the long-run equilibrium relationship can be indirectly estimated.

The ARDL cointegration approach has numerous advantages in comparison with other cointegration methods. Unlike other cointegration techniques, the ARDL does not impose a restrictive assumption that all the variables under study must be integrated of the same order. In other words, the ARDL approach can be applied regardless of whether the underlying regressors are integrated of order one $I(0)$, order zero $I(0)$ or fractionally integrated. While other cointegration techniques are sensitive to the size of the sample, the ARDL test is suitable even if the sample size is small. Also the ARDL technique generally provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous (Odhiambo, 2009).

The Bound Testing Approach

The bound test is a new approach to the problem of testing the existence of a long-run level relationship between a dependent variable and a set of regressors, when it is not known with certainty whether the underlying regressors are trend or first-difference stationary. The proposed tests are based on standard F-statistics and t-statistics used to test the significance of the lagged levels of the variables in a first-difference regression. The asymptotic distributions of these statistics are non-standard under the null hypothesis that there exists no level relationship between the dependent variable and the included regressors, irrespective of whether the regressors are $I(0)$ or $I(1)$. Two sets of asymptotic critical values are provided: One set assuming that all the regressors are $I(1)$, and another set assuming that they are all $I(0)$. These two sets of critical values provide a band covering all possible classifications of the regressors into $I(0)$, $I(1)$ or mutually cointegrated (Pesaran & Shin, 1999).

The bounds procedure has several advantages over alternatives such as the Engle and Granger (1987) two-step residual-based procedure for testing the null of no cointegration and the system-based reduced rank regression approach pioneered by Johansen (Narayan, 2005).

Model and Data

As mentioned above, we employ ARDL-bounds testing approach to examine the long-run cointegration relation-ship between military expenditure and economic growth in this study. Following Hirnissa, Habibullah and Baharom (2008), the ARDL unrestricted error correction model (UECM) model use in the present study can be expressed as follows:

Model 1:

$$\Delta \mathrm{LMX_t} = \alpha_0 + \alpha_1 LMX_{t-1} + \alpha_2 LGDP_{t-1} + \sum_{i=1}^{m} \alpha_{3,i}\, \Delta LMX_{t-i} + \sum_{i=0}^{n} \alpha_{4,i} \Delta LGDP_{t-i} + \varepsilon_t \quad (1)$$

$$\Delta \mathrm{LGDP_t} = \beta_0 + \beta_1 LGDP_{t-1} + \beta_2 LMX_{t-1} + \sum_{i=1}^{m} \beta_{3,i}\, \Delta LMX_{t-i} + \sum_{i=0}^{n} \beta_{4,i} \Delta LGDP_{t-i} + \mu_t \quad (2)$$

Model 2:

$$\Delta \mathrm{LMX_t} = \theta_0 + \theta_1 LMX_{t-1} + \theta_2 LGDPK_{t-1} + \sum_{i=1}^{m} \theta_{3,i}\, \Delta LMX_{t-i} + \sum_{i=0}^{n} \theta_{4,i} \Delta LGDPK_{t-i} + \gamma_t \quad (3)$$

$$\Delta \mathrm{LGDPK_t} = \delta_0 + \delta_1 LGDPK_{t-1} + \delta_2 LMX_{t-1} + \sum_{i=1}^{m} \delta_{3,i}\, \Delta LMX_{t-i} + \sum_{i=0}^{n} \delta_{4,i} \Delta LGDPK_{t-i} + \omega_t \quad (4)$$

MX is the ratio of military expenditure to GDP, GDP is real gross domestic product, and *GDPK* is real GDP per capita (all variables transformed into natural logarithm).

In equation (1), the null hypothesis of no cointegration between military expenditure and economic growth is:

$$\begin{cases} H_o: \alpha_1 = \alpha_2 = 0 \text{ (no long-run relationship)} \\ H_a: \alpha_1 \neq \alpha_2 \neq 0 \text{ (A long-run relationship)} \end{cases}$$

Similarly for equation (2):

$$\begin{cases} H_o: \beta_1 = \beta_2 = 0 \text{ (no long-run relationship)} \\ H_a: \beta_1 \neq \beta_2 \neq 0 \text{ (A long-run relationship)} \end{cases}$$

So on, we can examine this hypothesis for other equations.

If the computed test statistic exceeds the upper critical value, then there is evidence of a long run relationship, if below the lower critical values, we cannot reject the null hypothesis of no cointegration, and if it lies between these two bound, inferences is inconclusive.

We use annual data on GDP and Military expenditure for four Asian countries from 1988 to 2006. These countries are Japan, South Korea, Saudi Arabia and Iran. Japan and Korea are developed, and Iran and Saudi Arabia are developing countries. The data was obtained from WDI (world development indicators).

Empirical Results

Before examine ARDL bound test, we use Augmented Dickey-Fuller (ADF) tests to determine the order of integration of GDP and military expenditure series for each country.

The ADF tests results are reported in Table 1.

Table 1

ADF Unit Root Test Results

Country	Variable	ADF (level)			ADF (first difference)		
		t-statistic	Critical value	lag	*t*-statistic	Critical value	lag
Iran	LMX	-2.50	-3.69	0	-4.03	-3.05	0
	LGDP	-5.27	-3.71	1	-	-	-
	LGDPK	-3.17	-3.08	3	-	-	-
Saudi Arabia	LMX	-2.79	-3.71	1	-4.20	-3.06	1
	LGDP	-0.11	-3.04	0	-3.22	-3.05	0
	LGDPK	-2.84	-3.05	1	-3.44	-3.05	0
South Korea	LMX	-0.9	-3.06	0	-5.11	-3.71	0
	LGDP	-1.65	-3.04	0	-3.88	-3.05	0
	LGDPK	-1.45	-3.04	0	-4.03	-3.05	0
Malaysia	LMX	-1.91	-3.06	2	-5.56	-3.05	0
	LGDP	-2.14	-3.04	0	-3.32	-3.05	0
	LGDPK	-1.95	-304	0	-3.43	-3.05	0

Note. Statistically significant at 5%.

Unit root test hypothesis:

$$\begin{cases} H_o: \text{non-stationary} \\ H_a: \text{stationary} \end{cases}$$

ADF tests are reported in Table 1, in levels of series are run with constant.

In first difference, we are run with constant for non-stationary series. The null hypothesis of unit root cannot be rejected at the 5% level of significance if absolute t-statistic value be less than absolute critical value.

The results show that the LMX is non-stationary in level for all countries and become stationary in first difference and LGDP and LGDPK are stationary in level for Iran, but for other countries, these variables are non-stationary in level and are stationary in first difference, these results investigate at 5% level.

After we determined integration of variable, we proceed the testing of cointegration by using the ARDL bound testing. The cointegration analyze under this bound test involves the comparison of the critical value and *F*-statistic. We consider two model and four equation that expressed previously (previous section), in equation (1) dependent variable is LMX and independent variable is LGDP, and in equation (2) dependent variable is

LGDP and LMX is independent. In second model, we employ LGDPK (GDP per capita) instead of LGDP, the bound testing results are shown in Table 2 to Table 5.

When the dependent variable is military expenditure and independent variable is LGDP display meaningful relationship, in South Korea because *F*-statistic more than upper bound, and for other countries (Iran, Saudi Arabia and Malaysia), no significant relationship could be detected. In Table 3, LGDP is the dependent variable and military expenditure is independent, for this equation, no significant relationship exists for any one of these countries. In Table 4, we investigate the bound testing approach for equation (3), in this equation, military expenditure is the dependent variable and LGDPK is independent variable, the results show that South Korea and Malaysia are cointegrate.

Finally, in Table 5, we present the result of equation (4), in this equation, LGDPK is dependent variable and military expenditure is independent, a significant relationship don't exist for any one of these countries.

According to the results, we can conclude that South Korea have a unidirectional relationship from LGDP and LGDPK to military expenditure and Malaysia have a unidirectional relationship from LGDPK to military expenditure, but Iran and Saudi Arabia don't have any meaningful relationship between variables.

Table 2

Bound Testing Results: Dependent Variable is Military Expenditure and Independent Variable is LGDP

Country	*F*-statistic
Iran	2.30
Saudi Arabia	4.40
South Korea	14.12
Malaysia	7.07

Notes. 95% lower bound = 6.0034; 95% upper bound = 7.2156.

Table 3

Bound Testing Results: LGDP is the Dependent Variable and Military Expenditure is Independent

Country	*F*-statistic
Iran	1.97
Saudi Arabia	0.45
South Korea	4.30
Malaysia	3.40

Notes. 95% lower bound = 6.0034; 95% upper bound = 7.2156.

Table 4

Bound Testing Results: Military Expenditure is the Dependent Variable and LGDPK is Independent Variable

Country	*F*-statistic
Iran	1.66
Saudi Arabia	1.76
South Korea	15.35
Malaysia	8.26

Notes. 95% lower bound = 6.0034; 95% upper bound = 7.2156.

Table 5

Bound Testing Results: LGDPK is Dependent Variable and Military Expenditure is Independent

Country	*F*-statistic
Iran	2.16
Saudi Arabia	3.65
South Korea	4.40
Malaysia	3.15

Notes. 95% lower bound = 6.0034; 95% upper bound = 7.2156.

Toda and Yamamoto (1995) procedure based on VAR system and a Wald test statistic. Unlike other methods, this approach can use without the order of integration, non-cointegrated or cointegration properties of the variables. At first, we determine the optimal lag length based on Akaike Information Criteria (AIC) and SBIC. After determine lag length (k) we estimate ($k + d_{max}$)th-order VAR, where d_{max} is the maximum order of integration. We show the result of Toda and Yamamoto approach in following:

According to AIC and SBIC, the number of optimal lag are 2 (k = 2) for Iran, Saudi Arabia and South Korea, if unit root test d_{max} = 1 therefore the order of VAR is 3. But in Malaysia optimal lag is one in first model and two in second model therefore the order of VAR is 2 for first and 3 in second model.

The results of Toda and Yamamoto causality (see Table 6) show that Iran and Saudi Arabia don't have any causality relationship. South Korea has a Granger causality from LGDP and LGDPK to LM, and don't have any causality from LM to LGDP and LGDPK. Finally, for Malaysia no Granger causality running in any direction between LM and LGDP, but we find unidirectional Causality from LGDPK to LM.

Table 6

The Results of Toda and Yamamoto Approach

Country	Direction of causality		Wald test (χ^2)	Prob.
	From	To		
Iran	LGDP	LM	3.98	0.26
	LM	LGDP	6.008	0.11
	LGDPK	LM	3.35	0.34
	LM	LGDPK	6.48	0.09
Saudi Arabia	LGDP	LM	5.07	0.07
	LM	LGDP	2.01	0.36
	LGDPK	LM	0.60	0.73
	LM	LGDPK	2.20	0.33
South Korea	LGDP	LM	8.25	0.04
	LM	LGDP	0.49	0.92
	LGDPK	LM	8.84	0.03
	LM	LGDPK	0.45	0.92
Malaysia	LGDP	LM	4.09	0.12
	LM	LGDP	4.51	0.10
	LGDPK	LM	13.77	0.0032
	LM	LGDPK	5.19	0.15

Conclusion

This paper examines the relationship between military expenditure and economic growth for 4 Asian Countries (Iran, Saudi Arabia, South Korea and Malaysia), Iran and Saudi Arabia are developing countries and South Korea and Malaysia are industrialized countries. We used annual data from 1988 to 2006.

We used two approaches in this paper, the first procedure is autoregressive distributed lag (ARDL) bounds testing presented by Pesaran and Shin (1999) and later extended by Pesaran et al. (2001), for examining the long-run relationship between military expenditure and economic growth. Second approach that we modified version of the Granger causality test proposed by Toda and Yamamoto (1995).

At first, we employed ADF test for investigating the stationary and non-stationary of series.

The result suggests military expenditure and economic growth, but they are non-stationary in level for all countries and in first difference they were stationary except for Iran that economic growth was stationary in level.

The result of ARDL bound testing approach showed that South Korea have a unidirectional relationship from LGDP and LGDPK to military expenditure and Malaysia have a unidirectional relationship from LGDPK to military expenditure, but Iran and Saudi Arabia don't have any meaningful relationship between variables .

In Toda and Yamamoto approach, we found that South Korea have a Granger causality from LGDP and LGDPK to LM, and don't have any causality from LM to LGDP and LGDPK. In Malaysia, no Granger causality running between LM and LGDP in any direction but we found unidirectional Causality from LGDPK to LM. But we couldn't find any causality relationship in Iran and Saudi Arabia.

In comparison with ARDL bound testing approach and Toda and Yamamoto, we found that these results of this methods were similar.

In comparison the results of developing countries (Iran, Saudi Arabia) and industrial countries (South Korea and Malaysia), we can say that there aren't meaningful relationship between military expenditure and economic growth in developing countries. But in industrial countries, we found unidirectional or bidirectional relationship between military expenditure and economic growth.

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