DOES MILITARY EXPENDITURE INFLUENCE ECONOMIC GROWTH IN DEVELOPING COUNTRIES? A COINTEGRATION ANALYSIS

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ABSTRACT

This study is an attempt to reexamine the causal ordering between the two variables in the developing countries. The study investigates unit root, cointegration and exogeneity tests between military expenditure and economic growth in 14 developing countries for the period 1981-2006 considering panel data analysis. Results reported herein suggest that military expenditure is an exogenous variable and this variable influences economic growth in these countries.

Keywords: Military expenditure, Economic growth, Unit root, Cointegration, Exogeneity test, Panel data analysis.

INTRODUCTION:

After Benoit's (1973, 1978) work, number of researchers empirically examine the effect of military expenditure (milex) on economic growth considering milex as an exogenous variable. There is no consensus among researchers about the effect of milex on the economy. Defense economists mainly try to identify the channels through which military expenditure affects the rate of economic growth by concentrating on spin-off and crowding-out effects. Researchers who find positive relationship between milex and economic growth suggest the presence of spin-off effect of milex. They claim that military as an organized force help in the process of modernization, provide technical skills, educational training, and create infrastructure necessary to economic development. They also argue that this spin-off effect may occur by creating effective demand and increasing productivity through technological advancement. Empirical evidence for this argument is provided by, among others Benoit (1973, 1978), Ward et al. (1991), Sezgin (1997, 2000), Yildirim and Sezgin (2002), Alexander (1995), Kennedy (1974), Dixon and Moon (1986), Chletsos and Kollias (1995), Dunne and Nikolaidou (2001), Yildirim et al. (2005). Again, researchers who find negative relationship between milex and economic growth suggest the presence of crowding-out effect of milex. They claim that milex may retard economic growth by crowding-out civilian consumption, more productive civilian investment, health, and education expenditure and infrastructure development and creates a balance of payments problem. Support for this proposition has been provided by, among others, Lebovic and Ishaq (1987), Mintz and Huang (1990), Scheetz (1991), Ward and Davis (1992), Assery (1996), Dunne and Vougas (1999), Dunne et al. (2002), Galvin (2003), Deger and Smith (1983), Deger and Sen (1983), Lim (1983), Faini et al. (1984), Antonakis (1999).
If milex is not an exogenous variable, estimation of OLS in this respect will give biased and inconsistent results. Joerding (1986) first challenges this view and contends that milex may be endogenous variable rather exogenous. Therefore, economic growth may be causally prior to milex. A country with high growth rates may wish to strength itself against internal or external threats by increased military expenditure. Again, it is equally possible that countries with high growth rates may divert resources from defense into other productive uses (Kollias, 1997). There may be four possible causal ordering between milex and economic growth: bi-directional causality between milex and economic growth, unidirectional causality from growth to milex or vice versa and the absence of any causal relationship. This study is an attempt to reexamine the causal ordering between the two variables in the developing countries.

LITERATURE REVIEW:

The very first research regarding the causal ordering between milex and economic growth begin with the study of Joerding (1986) who finds milex as an endogenous variable. After his work, number of researchers for example, Dakurah et al. (2001), Castille et al. (2001), Dunne et al. (2001), Madden and Haslehurst (1995), Kusi (1994), Nadir (1993), Heo (1998), Chowdhury (1991), LaCivita and Frederiksen (1991) analyze the causal ordering using various econometric techniques. But there is no consensus among researchers about the existence of causal ordering between the variables or, when it exists, its nature and direction. Uni-directional (from milex to growth or from growth to milex), bi-directional and no-causality have been reported. Kollias et al. (2004) argue that on the basis of the generated evidence and its lack of consistency, one may reach the conclusion that this relationship cannot be generalized across countries and over time since, among other things, it depends on the level of socio-economic development of the country (or countries) involved, the sample period as well as the methodology employed. A short presentation of articles issued on the causal relationship between military expenditure and economic growth are given below:

Table- 1: A Short Presentation of Articles Issued on the Causal Relationship between Milex and Economic Growth

Authors	Date of pub	Time Period	Region	Direction of Causality	Concluding Remarks
Jording .W	1986	1962 to1977 from SIPRI 1967to1976 from ACDA	DCs (57)	D ⟶ G	Military spending is not a strongly exogenous variable, relative to economic growth. Further research should proceed by formulating and estimating dynamic or simultaneous equation model of developing countries.

Chowdhury A. R.	1991	1961 to 1987	DCs (55)	No Causality (30 Countries) D → G Negative (15 Countries) G → D Negative (7 Countries) D ↔ G (3 Countries)	The actual relationship between milex and economic growth may vary from one country to another due to the use of different sample periods, and to differences in the socio-economic structure and the type of government in each of these countries.
LaCivita C. J. and Frederiksen P. C.	1991	1952 to 1982	DCs (21)	Joerding Type Model: No Causality (12 countries) D → G (3 countries) G → D (4 countries) D ↔ G (2 countries) Hsiao Type Model: No Causality (4 countries) D → G (3 countries) G → D (4 countries) D ↔ G (10 countries)	Neither defense nor economic growth can be considered as exogenously determined variables. Researchers should use a simultaneous equation model and also use separate model for each country to investigate any relationship between the variables.
Dunne, P. and Vougas, D.	1999	1964 to 1996	South Africa	D → G (Negative)	Military burden of the apartheid regime did have a bad effect on the economy.
Dakurah et al.	2001	1975 to 1995	DCs (62)	No Causality (18 Countries) D → GNP (13 Countries) GNP → D (10 Countries) D ↔ GNP (7 Countries)	In many countries, milex and economic growth are not closely related. Lack of strong statistical evidence of a causal relationship between milex and economic growth in LDCs should be resolved by using longer data periods.
Al-Yousif, Y. K.	2002	1975-1998	6 Gulf Countries	No Causality (1 Country) D → G positive (2 Countries) D → G Negative (2 Countries) D ↔ G (1 Country)	Milex with economic relationship cannot be generalized across countries.
Abu-Bader, S. and Abu-Qarn, A. S.	2003	1975 to1998, 1967 to 1998, 1973 to1998.	Egypt Israel Syria	D → G (Negative)	Milex is found to be exogenous variable. Reallocating resources from military to civilian spending may not result in increased growth unless the civilian allocation favors productive activities.

Kollias et al.	2004	1964 to1999	Cyprus	D $\leftrightarrow$ G	On the basics of this analysis, it is not possible to determine the exact nature of milex and economic growth relationship.
Karagol, E. and Palaz S.	2004	1955 to2000	Turkey	D $\rightarrow$ G (Negative)	The existence of causality in the defense expenditure output relationship may be due to the resources being misallocated or wasted on defense expenditures.
Yildirim, J. and Ocal, N.	2006	1949 to 2003	India And Pakistan	D $\leftrightarrow$ G (India) No Causality (Pakistan)	Arms race between India and Pakistan for the time under consideration is present. This arms race may be responsible for the retarded economic growth in India in the long run but negative impact for the Pakistani economy due to its relatively small size compared to India.
Kollias et al.	2007	1961 to 2000	15 European Countries	D $\leftrightarrow$ G (Positive) in the long run D $\rightarrow$ G(Positive) in short run	Based on a Common European Security and Defense policy (CESPP)/ Increases in the defense budgets by the European states. Required to support and develop an independent EU defense capability, may also induce growth for the European Economy.

METHODS OF ESTIMATION:

In order to investigate whether milex or economic growth variables are exogenous and also to examine causal ordering between the two variables it can be employed Larsen et al. (2001) panel cointegration testing procedure. In order to identify causal ordering between the variables, the study must find out first whether the two variables are integrated of order 1 (i.e., each is individually non-stationary). If the two variables are I (1) individually and co-integrated the two variables must be Granger cause with each other. Maddala and Wu (1999) non-parametric panel unit root test is applied to identify stationary nature of the variables. This test dominates the widely used alternative t-bar test developed by Im et al. (1997) in the sense that the former has smaller size distortions and is robust to varying specifications of the underling ADF (Augmented Dickey Fuller) regressions. The testing procedure is as follows. First, it is performed standard ADF tests for unit root in the variable of interest for each country separately and obtained the probability values denoted by π_i .The ADF test is based on an estimate of the following regression.

$$\Delta x_t = a_0 + \beta x_{t-1} + \sum_{j=1}^{p} \delta_j \Delta x_{t-j} + \varepsilon_t$$

Where a_0 is a drift; p is a large enough lag length to ensure that ε_t is a white noise process. Then it can be computed the Maddala and Wu panel unit root test that is asymptotically distributed as χ^2 with 2N degrees of freedom. This is given in equation.

$$\lambda = -2\sum_{i=1}^{N} \ln(\pi_i) \sim \chi^2(2N), \text{ Where } \pi_i = \text{the probability values of the ADF test.}$$

In order to investigate the presence of a unique cointegrating vector in the panel Larsen et al. (2001) panel cointegation is performed. They present a Maximum Likelihood–based panel test for the cointregration rank in heterogeneous panels. They propose a standardized LR- bar test based on the mean of the individual rank trace statistic of Johansen (1995). The panel data set consists of N cross –sections observed over T time periods, where 'i' is the index for the cross-section, t represents the index for the time dimension and j=1..... P is number of variables in each cross-section. The following heterogeneous VAR (k_i) model,

$$Yit = \sum_{K=1}^{k_i} \pi_{ik} Y_{i},_{t-k} + \in_{it}, \qquad i = 1.........N$$

is considered for each cross-section under the assumptions that $\in_{it}$ is Gaussian white noise with a non-singular matrix $\in_{it} \sim N_p(0, \Omega_i)$, and the initial conditions $Y_{i,-k_i+1,..........,}Y_{i,0}$ are fixed. The lag length of the VAR for each country is chosen on the basis of Schwartz Bayesian Information Criterion (SBIC). One shortcoming of this model is that it allows neither an intercept nor a time trend in the VAR model.

Larsen et al. (2001) considers the null hypothesis that all of the N cross-section has at most r co-integrating relationships among the p variables. Then the null hypothesis for the panel co integration test looks like

$H_o : rank(\pi_i) = r_i \leq r$ for all $i = 1,........,N$

Where $H_1 : rank(\pi_i) = p$ for all $i = 1,............,N$

Larsen et al. (2001) panel co integration rank trace statistic, denoted by Y_{LR}, is obtained by calculating the average of N individual trace statistics LR_{NT} and then standardizing it:

$$Y_{LR} = \frac{\sqrt{N}\left[LR_{NT} - E(Z_K)\right]}{\sqrt{Var(Z_K)}} \sim N(0,1)$$

Where, $E(Z_K)$ is the mean and $Var(Z_K)$ is the variance of the asymptotic trace statistic Z_K.

For identifying causal ordering between the variables cointegration analysis is needed but it cannot answer the question of ordering. Hence, the study tests whether the corresponding variables in the co-integrating equations are weakly exogenous. Hypothesis of this kind result in test statistics that are asymptotically χ^2 distributed. If it is assumed that the test statistics are independent, the sum is also χ^2 distributed with N degrees of freedom. The study also identifies causal ordering by cointegration equations.

DATA ANALYSIS AND FINDINGS:

In 2006, 149 out of 208 countries are classified as developing countries according to World Bank definition. On the basis of this classification, 149 countries are classified as developing nations. In this study, countries having less than 30,000 military personnel are included. Because, a low income country having less than 30,000 military personnel may be termed as ornamental for a sovereign state. The countries that have greater than or equal to 30,000 military personnel during the period 1981-2006 and whose data are available are chosen for the study. It is observed that only 37[1] developing countries' data are available and whose military personnel are at least 30,000 during this period. Therefore, 37 countries are considered for this study. In order to examine causal ordering between milex and GDP growth of 37 developing countries, Maddala and Wu (1999) non-parametric panel unit root test for levels and first difference are performed that are reported in table-2. Milex and GDP data are collected from web site of Stockholm International Peace Research Institute (SIPRI) and United Nations Statistics Division (UNSD) respectively. Maddala and Wu (1999) panel unit root test satisfies stationary at first differences for both variables but all variables are not considered for cointegration analysis. Because the variables of two countries (Syria and Lebanon), individually indicate stationary at levels. Again, variables of 10 countries (India, Mongolia, Nepal, Pakistan, Colombia, ElSalvador, Thailand, Chile, Hungary and South Africa) do not satisfy individually stationary at first differences. Therefore, remaining 25 countries that are considered for co integration analysis that also satisfies Maddala and Wu (1999) panel unit root test at first differences. The next step is to investigate the presence of a unique co integration vector in the panel. This is done using the Larsson et al. (2001) panel co integration testing procedure. The lag length of the VAR for each country is chosen on the basis of Schwartz Bayesian Information Criterion (SBIC). Trace statistics for individual countries of remaining 25 countries reject the null hypothesis of no co integration for Bangladesh, Uganda, Albania, Ecuador, Egypt, Jordan, Morocco, Sri Lanka, Mexico and Poland.

However, the estimated results indicate no one common co-integrating vector among the variables in the panel. Consequently, there appears to be evidence of no long-run equilibrium relationship between military expenditure and economic growth. However, if Bulgaria is excluded from the cointegration analysis, the remaining 24 countries results reject the null of one common cointegration in the pool, which is shown in table-3. Consequently, there appears to be evidence of a long-run equilibrium relationship between milex and GDPg. However, this finding does not answer the question of ordering between the variables. Hence, the study tests whether the corresponding variables in the co integration equation are weakly exogenous. Hypothesis of this kind result in test statistics that are asymptotically χ^2 distributed. The results are presented in the last two columns of table-2 and find that military expenditure is strongly exogenous for all countries, except for Uganda, Egypt, Guatemala and Sri Lanka. If it is assumed that these test statistics are independent across countries, the sum is also χ^2 distributed with 24 degrees of freedom (Larsson et al., 2001). Therefore, this study confirms 24 country's data where milex is clearly an exogenous variable in the panel. However in our earlier study, it finds negative relationship between milex and economic growth and here the present study finds that milex is an exogenous variable that justify our earlier results where it is considered milex as an exogenous variable.

Table-2: Results of Maddala and Wu Panel Unit Root Test of GDP Growth and Milex for Levels and Ist Differences

	Milex	**GDPg**
λ (Levels)	49.1993	327.0529***
λ (Ist Differences)	300.9470***	593.8556***
c.v. (5%) =	90.53	90.53
c.v. (1%) =	100.43	100.43

Notes: λ s are the natural logarithmic probability values of the ADF (1) test (with constant but without trend) for individual variables and countries. *** denotes significance at 1% level.

Table-3: Results of Larsson et al. (2001) Panel Cointegration Test (Excluding Bulgaria)

Cointegration test					**Exogeneity test**	
Country	lag	r=0	r=1	r	H0:Milex	H0:GDPg
Bangladesh	1	14.2279**	0.4235	1	3.2053**	0.6094
Burundi	1	11.5863	1.3127	0	2.9631**	0.8359
Chad	1	19.6686*	3.3719**	2	17.8491*	0.0669
Nigeria	1	18.6430*	2.9275**	2	1.9348	0.0974
Rwanda	1	12.7955	2.0145	0	0.6254	0.0748
Uganda	1	15.6317**	0.0312	1	10.1049*	9.1594*
Albania	1	18.7651*	1.7936	1	2.6223**	0.6829
Algeria	1	12.8276	0.3540	0	5.2787*	0.0378
Ecuador	1	18.0758*	0.9379	1	11.6805*	0.6314
Egypt	1	14.0960**	0.1995	1	7.7894*	2.7292**
Guatemala	1	18.0342*	5.6275*	2	6.7476*	3.0418**
Indonesia	1	9.4209	0.2469	0	8.6254*	0.4348
Iran	1	12.5686	0.6908	0	4.9639*	0.0190
Jordan	1	15.4347**	0.0103	1	13.1186*	0.0535
Morocco	1	17.2177*	0.3716	1	16.4510*	0.0161
Philippines	2	12.3116	0.0271	1	15.3687*	2.4391
Sri Lanka	1	14.3742**	0.8537	1	1.7409	4.5624*
Tunisia	1	40.7464*	3.3012**	2	24.7929*	1.6379
Malaysia	1	9.9176	0.0421	0	3.8851*	0.3973
Mexico	1	17.8974*	1.3347	1	10.2924*	0.0817
Oman	1	6.6584	0.2006	0	2.7968**	2.5444
Poland	1	14.6753**	0.2842	1	11.1497*	0.5289
Romania	1	17.9532*	5.1704*	2	5.9872*	0.1351
Venezuela	1	31.3103*	7.1843*	2	4.5483*	0.1217
Sum		**394.8378**	**38.7117**		**197.3220***	**34.8126**
Avg(TR)		**16.4516**	**1.6130**			
E(Zk)		**6.0860**	**1.1370**			
Var(Zk)		**10.5350**	**2.2120**			

Ylr	**15.6452***	**1.5679**			
$H_0 : Milex$ exog				**197.3220***	
$H_0 : GDPg$ exog					**34.8126**

Notes: The lag-length of the VAR for each country is chosen on the basis of SBIC. Trace test statistic (with unrestricted intercepts and no trends in the vector autoregression) are reported for individual countries. The 5% critical values are 15.4947 for r=0 (against the alternative r$\geq$ 1 and 3.8414 for r$\leq$1 (against the alternative r=2). The critical values for $E(Z_k)$ and var(Z_k) are obtained from Larsson et al.(2001, Table 1). The panel rank test has a critical value 1.645. While the panel exogeneity tests have a critical value 42.9798 and 36.4151 at 1% and 5% level of significance respectively. M indicates for Milex and G for GDPg. *, ** denote significance at 1% and 5% respectively.

CONCLUSION:

In the defense economics literatures, in most cases, in order to investigate the growth effect of milex, it is assumed that milex is an exogenous variable. But there is a procedure to identify causal ordering between the variables. This study investigates unit root, co-integration and exogeneity tests between milex and GDP growth in 14 developing countries for the period 1981-2006 considering panel data analysis. Employing Larsen's (2001) panel cointegration testing procedure and exogeneity tests the study finds that milex is an exogenous variable and this variable influences on economic growth in these countries. As a result, the findings of the analysis of the study are consistent with much of the related literatures.

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