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RESEARCH ARTICLE

MODELING THE DEFENSE-GROWTH NEXUS IN DEVELOPING COUNTRIES, EVIDENCE FROM PANEL DATA MODEL

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Abstract

The defense-growth nexus is investigated empirically using longitudinal data for 64 developing countries. Using recently developed econometric methods involving panel data regressions, evidence of a level-dependent effect of military expenditure on GDP growth is found: A positive and significant externality effect of defense spending prevails for relatively high levels of defense spending and becomes positive for sample countries.

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Introduction:-

Military expenditure and economic growth relation has been widely debated among researchers and economists in the last four decades. On the one hand, some researchers suggested that massive infusion of resources into the military sector had crowded-out resources for the (supposedly more productive) ‘‘civilian’’ sector. On the other hand, it was concluded that the military spending could be a productive sector such as, for example, human capital formation, infrastructure, and technological progress.

As Deger and Sen (1995) noted that, from a purely economic point of view, the military expenditure would lead to unproductive expenditure category. Therefore, researchers deemed its impact on output growth to be negative until the seminal contribution by Benoit (1973, 1978) who found that growth-inducing effect of defense expenditure. Since Benoit the researchers have concentrated and the methodologies applied have changed dramatically:
In the beginning of the nineteenth most of the contributions to the defense-growth argument were time-series studies. More recently, however, cross section studies became more popular since they overcome the heterogeneity problem and take into account the historical and institutional information unique for each country (Dunne & Nikolaidou, 1999).

This paper contributes to the existing literature in several aspects: We are investigating the defense- growth relationship for developing countries:-
Due to the fact that military spending’s increased significantly during the conflict and civil war, an obvious question is how defense contributed to economic growth performance. In contrast to previous studies, we use recently developed econometric methods which take into account that the impact of defense expenditure on economic growth could be positive. For the case of developing countries, we found that there is indeed a level-dependent impact of defense spending on economic wellbeing, with high levels of military spending being conducive to growth.

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Moreover, we believe that the econometric methodology exposed in this paper could be a suitable tool for studying a wider set of questions in relation with economic growth.

The plan for the remainder of the paper is as follows. Section 2 introduces general aspects of the defense-growth nexus. Section 3 outlines data and methodology. Section 4 investigates the defense-growth nexus in Developing countries using a panel data approach. Section 5 concludes.

Growth And Defense Spending:-

Since the seminal contribution by Benoit's study (1973, 1978), many studies have investigated to evaluate the impact of defense expenditures on economic growth. Economists attribute the diversity of results to the lack of consensus on how defense expenditures influence economic growth (see, e.g., Deger & Sen, 1995). Theoretically, military expenditure can impact the economy in a number of ways with both negative and positive effects on economic growth.

The defense spending could take skilled labor away from civilian sector, but it could also provide training for workers, especially in developing countries. It could crowd out resources for investment and consumption, but also provide positive externalities for the civilian sector, such as infrastructure or technology spillover. It can not only lead to destructive wars and stipulate civil strife, but may also maintain peace and provide a secure investment climate.

As mentioned earlier, empirical studies mainly concerning the overall effect of military differ significantly for instance Deger and Sen (1995), Ram (1995), and Dunne (1996) provided an extensive reviews of the literature showing that empirical evidence usually tend to vary across countries and over time and that results are sensitive to the underlying theoretical framework. Firstly, their results indicate that there is no positive impact of military expenditure on economic growth. However, as Ram (1995) notes, most papers that indicated an adverse impact of defense on investment or savings display only a partial view, as potential (positive) externality impacts of the military are not explicitly taken into consideration.

Our aim is to contribute to the existing literature by investigating the relationship between military spending and economic growth and applying cross-sectional panel data. Thus, we have investigated the impact of defense for a cross country with using a theoretical framework and allowing the effect of military spending on economic growth. This methodology allows us to establish a panel data which could be a useful quantitative instrument to set up economic targets for military spending in a post-conflict environment.

Methodology And Data:-

The Data:-

In order to examine the military-growth relationship in the 64 developing countries over the period 2002-2010 and a balanced panel of cross section data was constructed. The data set is balanced and the same time periods are available for all cross section units. The data are taken from the SIPRI Yearbooks for military expenditure (Stockholm International Peace Research Institute, various years) and the data on GDP and population are drawn from the World Development Indicator (WDI).

Table I:- variables descriptions: Annual data: (2002-2010; N=64)

Variable	Description	Source
ME	Military expenditure	SIPRI (2014)
RGDPC	Real Gross domestic product per Capita	WDI (2014)
POP	Population	WDI (2014)
Albania,Algeria,Angola,Argentina,Benin,Bolivia,Botswana,Burkina,Faso,Cambodia,Cameroon,Central,African,Chad,Chile,China,Colombia,Congo,Cuba,Dominican,Ecuador,El,Salvador,Guinea,Ethiopia,Fiji,Gabon,Gambia, Guatemala,Haiti,India,Indonesia,Iran,Iraq,Jordan,Kenya,Laos,Lebanon,Madagascar,Malawi,Malaysia,Mali,Malta,Mongolia,Morocco,Mozambique,Nepal,Niger,Nigeria,Pakistan,Panama,PapuaGuinea,Paraguay,Peru,Rwanda,SaudiArabia,Senegal, Sierra Leone, South Africa, Sri Lanka, Sudan, Syria, Tanzania, Thailand, Togo, Tunisia, Uganda		

Econometric Methodology:-

Fixed Effect versus Random Effect Models:-

In our Panel data models we have examined and concentrated on fixed and random effects model. The core difference between fixed and random effect models lies in the role of dummy variables. If dummies are considered as a part of the intercept, this is a fixed effect model. In addition, in a random effect model, the dummies act as an error term. Furthermore, a fixed group effect model examines group differences in intercepts, assuming the same slopes and constant variance across entities or subjects. Since a group (individual specific) effect is time invariant and considered a part of the intercept, ui is allowed to be correlated to other regresors. Fixed effect models use least squares dummy variable (LSDV) and within effect estimation methods. Ordinary least squares (OLS) regressions with dummies, in fact, are fixed effect models.

Table 1.1:- Fixed Effect and Random Effects Models

	Fixed Effect Model	Random Effects Model
Functional form	$Y_U = (\alpha + U_t) + X_u\beta + V_{ut}$	$Y_U = \alpha + X_u\beta + (U_t + V_{ut})$
Intercepts	Varying across groups and times	Constant
Error variance	Constant	Varying across groups and times
Slopes	Constant	Constant
Estimation	LSDV, within effect method	GLS, FGLS
Hypothesis test	Internal F test	Breusch-Pagan LM test

A random effect model, by contrast, estimates variance components for groups (or times) and error, assuming the same intercepts and slopes. *ui* is a part of the errors and thus should not be correlated to any regressor; otherwise, a core OLS assumption is violated. The difference among groups (or time periods) lies in their variance of the error term, not in their intercepts. Moreover, a random effect model is estimated by generalized least squares (GLS) when the matrix, a variance structure among groups, is known. The feasible generalized least squares (FGLS) method is used to estimate the variance structure when is not known. A typical example is the group wise heteroscedastic regression model (Greene 2003). There are various estimation methods for FGLS including the maximum likelihood method and simulation (Baltagi and Cheng 1994).

Fixed effects are tested by the (incremental) F test, while random effects are examined by the Lagrange Multiplier (LM) test (Breusch and Pagan 1980). If the null hypothesis is not rejected, the pooled OLS regression is favored. The Hausman specification test (Hausman 1978) compares fixed effect and random effect models. If the null hypothesis that the individual effects are uncorrelated with the other regressors in the model is not rejected, a random effect model is better than its fixed counterpart. In addition, The Hausman specification test compares the fixed versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model (Hausman 1978). If correlated (H0 is rejected), a random effect model produces biased estimators, violating one of the Gauss-Markov assumptions; so a fixed effect model is preferred. Hausman’s essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero (Greene 2003).

$$m = (b_{Robust} - b_{Efficient}) + \sum^{n} -1 \;\; (b_{Robust} + b_{Efficient}) \;\; x^2\,(k),$$

$$\text{Where, } \sum \;\; = Var\,(b_{Robust} - b_{Efficient}) = Var\,(b_{Robust} - \text{Var } b_{Efficient})$$

Is the difference in the estimated covariance matrix of the parameter estimates between the LSDV model (robust) and the random effects model (efficient). It is notable that an intercept and dummy variables SHOULD be excluded in computation.

The Empirical Result:-

Our sample countries include 64 less developed nations for which data are available for over period 2002–2010. We have reported for the whole sample period with the standard panel data estimates for pooled regression model, cross section estimates, and random effects models REM, between and within the fixed effects models. In addition, we shall use the systems GMM approach (SGMM) of Blundell and Bond (1998) in which the specifications in the first-step GMM, second-step GMM with robust SE of the variables are estimated simultaneously. Estimates with these alternative methods are illustrated in Table II. Two sets of subsample estimates with REM and SGMM are reported in Table III and Table IV.

In order to specify whether a fixed and random effects model are appropriate for our study we performed the Hausman test which is distributed as x^2, where the degrees of freedom are equal to the number of regressors. The results illustrate that the fixed effects model is rejected, and this finding is consistent with Murdoch et al. (1997) since random effect models are considered more appropriate than fixed effect models. Thus, the fixed effects model is not necessary in our case. Parameter estimates from the random effect and fixed effect are presented in Table II and Table III for the 60 less developed countries. The results obtained, similar to Smith and Dunne (2001); who found a positive and significant correlation between economic growth and military expenditure.

Furthermore, we have employed Pooled Regression Model based on balanced data-set, to investigate the correlation between military expenditure and economic growth in the context of different political and welfare less developed nations.

The panel regression model estimation results of this study, presented in Table IV, and it illustrates that there is a positive relationship between military expenditure, economic growth and population for the rest of the sample countries, and it's statistically significant, it means that, when economic growth, it motivates military sector to spend more on it, and also population is directly related to economic growth, meaning that when population increase, it rises military expenditure in the developing countries . All diagnostics for the models in each table is satisfactory. Generally, GDP and population are positively related with military spending in this study, and all variables are statistically significant at 1%, level. The results illustrate that as economic growth (GDP) and population are increase military expenditures as a percentage of government expenditures are increased as well. Furthermore, this finding suggests that military spending plays a significant role in the less developed nations despite of many problems such as civil war, conflicts and border tensions, and this result supported by earlier works done by Benoit (1973&1978) for 44 developing nations. Moreover, our findings are also confirmed and supported by Ali's (2007) findings in the developing countries. Moreover, these net positive relationships support the belief that military spending and economic growth are related through an expansion of aggregate demand in less developed countries. Furthermore, investment in infrastructure and human capital development in LDC economies operating below full employment thus, it has positive Benoit-type spillover impacts from military expenditures. There is less evidence to suggest that military spending in developing nations negatively related to economic growth. The positive impacts that arise when relationship runs from economic growth to military spending imply that many LDCs are still at a stage where military expenditures are constrained by low income and will grow along with the economy. They are not yet in a position to have defense expenditures grow less than proportionally with economic growth.

Table II:- Random Effects Results: Dependent variable is ME.

Variable	*Coefficient*	*T ratio*
Constant	-1670.051	0.000*
Ln RGDP	.7306903	0.000*
Ln POP	.00004	0.000*
Hausman Random effect (RGDPC)	.7814164	-
Hausman Random effect (POP)	.0000437	
N	576	
Countries	64	
Min obs	9	
Max obs	9	
Av obs	9.0	
R-sq within	0.1404	
R-sq between	0.7907	
R-sq overall	0.6729	

*, **, *** denote significance at 1%, 5% and 1**0**%, respectively. Values in parentheses are heteroscedaticity consistent *t*-statistics and values in brackets are *p*-values.

Table III:- Fixed Effects Results Dependent variable is ME.

Variable	*Coefficient*	*T ratio*
Constant	-24767.47	0.000*
Ln RGDPC	.5638539	0.000*
Ln POP	.0004123	0.000*
Hausman fixed (RGDPC)	.5635426	
Hausman fixed (POP)	.0004134	
N	576	-
Countries	64	-
Min obs	9	
Max obs	9	
Av obs	9.0	
R-sq within group	0.3788	
R-sq between group	0.7423	
R-sq overall group	0.6242	

*, **, *** denote significance at 1%, 5% and 1**0**%, respectively. Values in parentheses are heteroscedaticity consistent *t*-statistics and values in brackets are *p*-values.

Table IV:- Results of Pooled Regression Models: Dependent variable is ME. (Sample period: 2002 -2010)

Variable	Coefficient	Std. Err	T ratio	Conf. Interval
CONSTANT	-1670.051	337.5972	0.000*	-23`33.13
Ln RGDPCit-1	.7306903	.0733075	0.000*	.586706
Ln POP1t	.00004	1.19e-06	0.000*	.0000376
N	64			
T	9			

The variables are defined as follows: ME = Military expenditure; RGDPC = real GDP per capita (in US dollars; POP = Population. Figures in the parentheses are t-statistics. (*) indicate significance at *1%*. Time dummies were jointly significant and are not reported here to save space**.**

Concluding Remarks:-

Using a panel data approach, this paper has investigated to overcome some of the shortcomings of previous studies. Within this framework, we have provided new evidence on the growth-defense relationship for the developing countries. We have found that military spending does generate positive externalities, that the defense sector is productive than the civilian sector and that military spending has a positive effect on economic growth after it has surpassed.

Thus, the empirical estimations support the positive relationship between defense spending and economic growth, and they are consensus of Kollias (1997) and Ali (2012). Furthermore, proper regression model and more advanced econometric methodologies do improve empirical results in this article which could make contributions to the defense economics literature.

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