Military Spending, Growth, Development and Conflict

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Abstract:

This paper makes a contribution to the debate on the economic effects of military spending using a large cross country panel data set for 1988-2006. As well as providing a relatively up to date analysis, sub groups are created that allow the analysis to focus on groups of countries at different income levels and Sub Saharan Africa (SSA), an area which has seen a large number of damaging conflicts. Estimating the empirical growth model suggested in Dunne et al (2005) gives results that show variation across the subgroups, with the general picture of significant negative short run effect and insignificant long run effect of military burden on per capita GDP growth, not consistent across the different income groups. In addition, breaking down the SSA group into those involved in conflict and those that are not, provides some further intriguing findings that suggest the value of further work on the impact of conflict on growth.

Keywords: Military expenditure; economic growth; conflict; development
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1. Introduction

The economic effects of military spending continues to be the subject of considerable debate with a lack of any consensus in the literature. It continues to be an important focus for research as it is an expenditure by governments that has influence beyond the resources it takes up, especially when it leads to or facilitates conflicts. While most countries need some level of security to deal with internal and external threats, there are opportunity costs, as the money could be used for other purposes that might improve welfare. With the end of the Cold War there were considerable reductions in military expenditure, although not consistently across all regions and with no obvious economic problems, but in more recent years the declining trend has bottomed out and military expenditures are increasing. This is true across all income groups. While the lowest income group has seen the highest growth in military spending since 2000, military expenditure as a share of GDP remained lower for this income group relative to the others (SIPRI, 2008). While there have been a few major international conflicts and internal conflict has been a major concern for the developing world, the major pressures to increase military spending have not been the result of obvious strategic needs, but of internal pressures by vested interests.

This paper considers the economic effects of military spending using a large unbalanced panel of countries, for the period 1988-2006, and investigates the heterogeneity of results across income groups. The next section reviews the existing literature for developing countries, followed by the development of a growth model based on Dunne et al (2005), which includes military sending and overcomes some of the limitations of earlier models. This model is then estimated using the cross country data, in the following section, with the results for various groupings of countries also being considered. Sub-Saharan Africa is then considered, a region which despite reductions in the number of conflicts is still affected by them. The final section presents some conclusions.

2. Military Spending and Growth

In analysing the relation between military spending and development, applied work is usually restricted to economic growth because of the problems of defining and measuring development. Developing a theoretical model is important for any empirical study, but much of economic theory does not have an explicit role for military spending as a distinctive economic activity. However, this has not prevented the development of theoretical analyses as discussed in Dunne & Coulomb (2008). In empirical work the fact that there is no agreed theory of growth among economists, means that there is no standard framework that military spending can be fitted into. Clearly, in developing countries military spending, conflict, economic capacity (education, governance, institutions, natural resources) all interact to influence growth. Indeed, many poor countries, even those with civil wars, spend relatively little on the military. In particular many African countries have low military burdens, but there are other obstacles to growth (Collier, 2007). The theoretical work has allowed the identification of a number of channels through which military spending can impact the economy, through labour, capital, technology, external

relations, socio political effects, debt, conflicts etc (see Dunne and Uye, 2009). The relative importance and sign of these effects and the overall impact on growth can only be ascertained by empirical analysis.

An important issue in empirical work is the identification problem that results from the fact that we observe military spending and growth changing and both are influenced by security threats. If the economic determinants of growth are constant, but there are variations in the security threat, a negative relationship between military expenditure and output will be observed. On the other hand, if the threat is constant but the economic variables are changing, a positive relationship between military expenditure and output will be observed. This can be used to explain some country experiences with different combinations of growth and military expenditure. It also suggests caution in interpreting the results of empirical studies (Smith, 2000).

Clearly all of the channels mentioned will interact and their influence will vary depending on the countries under examination. For example, a relatively advanced developing country, such as one of the Asian 'tigers' will have concerns over the industrial impact of its involvement in arms production, the technology and foreign direct investment benefits versus the opportunity cost, while a poorer African economy may be more concerned with the conflict trap it finds itself in.

In the empirical literature, the debate on the economic effects of military spending started with the contribution of Benoit (1973, 1978) which purported to show that military expenditure and development went hand in hand. This led to considerable research activity using econometric analysis to overcome the deficiencies, most of which has tended not to support Benoit, but there is still no consensus view (Dunne and Uye, 2009). The post-Cold war era led to important changes in the nature of conflicts. The end of proxywars (conflicts sponsored by the Cold War protagonists) and superpower involvement in local wars did not reduce the number of conflicts, but did reduce their intensity, and saw a dominance of civil or intra state wars. The nature of wars clearly changed with a blurred distinction between war and organised crime, and while local, the wars tended to have a transnational connection (Kaldor, 2006). There are fewer real military battles than in the past, but skirmishes and attacks on civilians increased. This might suggest a change in the economic impact of conflict.

Previous surveys of the military spending growth literature include Chan (1986), who found a lack of consistency in the results, Ram (1995) who reviewed 29 studies, concluding that there is little evidence of a positive effect of defence outlays on growth, but that it was also difficult to say that the evidence supported a negative effect. Dunne (1996) covering 54 studies concluded that military spending had at best no effect on growth and was likely to have a negative effect and Smith (2000) concluded that the large literature did not indicate any robust empirical regularity, positive or negative, though he suggested there is a small negative effect in the long run, but one that requires considerably more sophistication to find. Smaldone (2006) in his review of Africa considers military spending relationships to be heterogeneous, elusive and complex, but feels that variations can be explained by intervening variables. The effects can be both positive and negative but are usually not

pronounced, although the negative effects tend to be wider and deeper in Africa and most severe in countries experiencing legitimacy/security crisis and economic/budgetary constraints. Dunne and Uye (2009) in a survey of 102 studies on the economic effects of military spending, report that almost 39% of the cross country studies and 35% of the case studies find a negative effect of military spending on growth, with only around 20% finding positive for both types of studies. Models allowing for a demand side, and hence the possibility of crowding out investment, tend to find negative effects, unless there is some reallocation to other forms of government spending, while those with only a supply side find positive, or positive but insignificant effects. That the supply side models find a positive effect is not a surprise as the model is inherently structured to find such a result (Brauer, 2002). Given this, the fact that over 40% of the studies find unclear results could be interpreted as providing further evidence against there being a positive impact of military spending on the economy.

It is also worth noting that the military burden, the share of military spending in GDP is relatively low in most developing countries (less than 2% for low income countries) relative to other components of GDP, such as health and education. As a result one might not expect to find a statistically significant effect on the path of national income, when there are so many other influences. Aside from when countries are engaged in conflict one might not expect to find significant impacts of arms transfers and military spending, which makes it interesting when studies do.

3. Developing a Growth Model with Military Spending

The deficiencies of the Feder Ram model presented in Dunne et al (2005) lead us to consider an alternative route. Specifically, we develop a model of the effect of military spending on growth performance based on the augmented Solow growth model with Harrod-neutral technical progress. This follows Knight, Loayza and Villanueva (1996;1993) and a key assumption is that the military spending share m = M/Y affects factor productivity via a levels effect on the efficiency parameter which controls labour-augmenting technical change. The starting point for the model is the aggregate neoclassical production function featuring labour-augmenting technological progress

$$(1) \qquad Y(t) = K(t)^{\alpha}[A(t)L(t)]^{1-\alpha}$$

where Y denotes aggregate real income, K is the real capital stock, L is labour, and the technology parameter A evolves according to

$$(2) \qquad A(t) = A_o e^{gt} m(t)^{\theta},$$

where g is the exogenous rate of Harrod-neutral technical progress and m is an index of military expenditure such as the share of defence spending in GDP.

Together with the standard Solow model assumptions (constant saving rate s; constant labour force growth rate n; constant rate of capital depreciation d), the dynamics of capital accumulation are described by

$$(3) \qquad \dot{k}_e = sk_e^{\alpha} - (g+n+d)k_e \;\Leftrightarrow \frac{\partial \ln k_e}{\partial t} = se^{(\alpha-1)\ln k_e} - (g+n+d),$$

where k_e:=K/[AL] denotes the effective capital-labour ratio and α is the constant capital-output elasticity.

The steady-state level of k_e is

$$(4) \qquad k_e^* = \left[\frac{s}{g+n+d}\right]^{1/(1-\alpha)}.$$

Linearizing (3) via a truncated Taylor series expansion around the steady state[1] and using (4), we get

$$(5) \qquad \frac{\partial \ln k_e}{\partial t} = (\alpha-1)(g+n+d)[\ln k_e(t) - \ln k_e^*]$$

and since ln ye:= ln [Y/(AL)] = αln k_e,

$$(6) \quad \frac{\partial \ln y_e}{\partial t} = (\alpha-1)(g+n+d)[\ln y_e(t) - \ln y_e^*]$$

whereby the steady-state level of output per effective labour unit is

$$(7) \qquad y_e^* = \left[\frac{s}{g+n+d}\right]^{\alpha/(1-\alpha)}.$$

Equation (6) approximates the transitory dynamics of output per effective labour unit in a neighbourhood of the steady state. In order to operationalize (6) for empirical work, we integrate (6) forward from t-1 to t and get

$$(8) \qquad \ln y_e(t) = e^z \ln y_e(t-1) + (1-e^z)\ln y_e^* \;,\; z \equiv (\alpha-1)(n+g+d).$$

Using (2), (7) and (8), y_e is related to observable per capita income y = Y/L via

[1] Re-writing (3) in the form du/dt = f(u), u:=ln ke, the linearized form is f(u*) + f'(u*)[u(t)-u*].

$$\ln y(t) = e^{z} \ln y(t-1) + (1-e^{z})\left\{\ln A_o + \frac{\alpha}{1-\alpha}[\ln s - \ln(n+g+d)]\right\}. \quad (9)$$
$$+\theta \ln m(t) - e^{z}\theta \ln m(t-1) + (t-(t-1)e^{z})g$$

Equation (9) suggests the dynamic panel data model

$$\ln y_{i,t} = \gamma \ln y_{i,t-1} + \sum_{j=1}^{4} \beta_j \ln x_{j,i,t} + \eta_t + \mu_i + \nu \quad i=1,2,...,N;\ t=1,2,...T \quad (10)$$

where x_1= s = gross investment/GDP, x_2 = n+g+d = labour force growth rate plus (g+d) =the constant 0.05, x_3 = m = military expenditure/GDP, $x_4 = m_{t-1;}$ η_t time specific effects and μ_i group specific effects. Thus, we follow Knight et al (1993) and Islam (1995) in treating s, n as variant across countries and time, while g and d are taken to be uniform time-invariant constants.

4. Empirical Analysis

A major problem in estimating growth models has been the lack of independent exogenous variation in the data. One way of overcoming this has been by pooling cross section and time series data for a relatively homogenous group of countries (Murdoch et al, 1997). There is a problem that the cross section and time series parameter may be measuring different thing, the former the long run and the latter the short run effects. The pooled relation is then a weighted average of the two. Growth equations have been most successful in cross sections, because of the difficulties of distinguishing the cyclical demand side effects from medium term supply side growth effects.

Panel data methods provide a variety of approaches to attempt to deal with some of these issues, with pooling being the simplest form and fixed effect and random coefficient estimators providing more flexible approaches. The fixed effects estimator allows the intercept to differ across countries, which ignores all information in the cross sectional relation. Time fixed effects can also be allowed for separately or together in a two way fixed effect model. In dynamic models of the form:

$$y_{jt} = \alpha_j + \beta x_{jt} + \lambda x_{jt-1} + u_{jt}$$

the fixed effect estimator is not efficient, because of lagged dependent variable bias, which biases OLS downwards. It is, however, consistent and for large samples the bias is small. If the parameters differ over groups there is a further heterogeneity bias, which can be dealt with by estimating each equation individually and taking an average of the individual estimates (Pesaran and Smith, 1995). The data available in this study is not long enough to use large-N large-T methods, so we use a Fixed-Effects Model, but introduce dynamics. While there is downwards lagged dependent variable bias, the bias is likely to be small and when computing the long run coefficients the biases are likely to offset each other. Taking equation (10')

$$\ln y_{i,t} = \gamma \ln y_{i,t-1} + \sum_{j=1}^{5} \beta_j \ln x_{j,i,t} + \eta_t + \mu_i + \nu \qquad i=1,2,...,N;\ t=1,2,...T$$

Where:
y = yp = GDP per capita
x_1= iy = gross investment/GDP,
x_2 = my = military expenditure/GDP,
x_4 = ngd = n+g+d = labour force growth rate + 0.05,
x_5 = tr = trend

Estimating a reparameterised general first order dynamic model gave the results in Table 1, where all variables are in logs, Δ represents the change in the variable, and the dependent variable is Δlyp. The results for all available countries in column 1 show a relatively well defined empirical model with signs as expected and a clear negative effect of the change in military burden, but not the lagged level. This suggests evidence of short run negative effects of military spending, but not long run. Considering only the non-developed countries (low and middle income) reduces the sample but gives surprisingly little change in the coefficient estimates.

Table 1. Regression Results for Fixed Effects Model

Variable	All countries n=126	Non-developed n=96
Δliy	0.085 (10.9)	0.080 (8.7)
Δlmy	-0.016 (3.0)	-0.014 (2.2)
lngd	-0.022 (2.3)	-0.022 (2.0)
lyp1	-0.132 (13.0)	-0.153 (11.9)
liy1	0.034 (6.6)	0.033 (5.6)
lmy1	-0.002 (0.4)	-0.0002 (0.0)
trend	0.004 (12.5)	0.004 (11.6)
Constant	-6.522 (11.7)	-7.608 (10.9)
N	1784	1308
Rsq within	0.189	0.202
Rsq between	0.020	0.075

Notes: absolute t ratios in parentheses

While it is a useful result, to find only short run effects of military expenditure in the post Cold War period, it is possible that these aggregate groups hide considerable heterogeneity. As argued, the effect of military spending may well be very different for the poorest countries relative to the richest and to consider such differences the countries were divided into four income groups, based on World Bank assessment, giving the results in Table 2. As expected there are differences and the growth model is generally

well specified, though the investment share terms are insignificant for the low income countries and lngd insignificant for the lower middle group. As regards military burden, the difference term is significant and negative for all except the upper middle group and the lagged level is significant and negative only for the low income group –although the lagged level is positive for the high income countries and significant at the 6% level. This implies that there are clear significant short and long run negative effects of military spending only for the low income countries.

Table 2. Regression Results by Income Group: Fixed Effects

Variable	Low	Lower Middle	Upper Middle	High
	n=24	n=35	n=31	n=35
Δliy	0.005 (0.3)	0.089 (6.0)	0.158 (9.7)	0.128 (10.0)
Δlmy	-0.041 (3.2)	-0.026 (2.2)	0.001 (0.1)	-0.030 (2.7)
lngd	-0.072 (3.8)	-0.005 (0.2)	0.068 (2.4)	-0.020 (2.0)
lyp1	-0.192 (6.6)	-0.126 (7.5)	-0.194 (8.5)	-0.067 (4.7)
liy1	-0.008 (0.7)	0.052 (4.4)	0.065 (7.3)	0.054 (5.8)
lmy1	-0.024 (2.4)	0.010 (1.1)	-0.000 (0.0)	0.012 (1.9)
trend	0.004 (5.3)	0.004 (7.3)	0.007 (8.9)	0.002 (5.0)
Constant	-6.955 (4.8)	-7.510 (6.9)	-11.196 (8.5)	-3.440 (4.8)
N	315	478	435	539
Rsq within	0.256	0.231	0.375	0.234
Rsq between	0.100	0.044	0.048	0.329

Notes: absolute t ratios in parentheses. Income groupings based on World Bank list of economies (Jan 2011). High income group included both OECD and non OECD.

One possible reason for this is the degree of conflict, particularly civil conflict that poor countries have had. This is particularly the case for the Sub Saharan African region, where a high proportion of countries have experienced major conflict. Using the Smaldone (2003) categorisation of countries that have experienced major conflicts gave the results in Table 3. The results show a significant short run negative effect for military burden, but no significant long run effect. Breaking down this group into countries that have not experienced major conflict and those which have, left 8 countries in the latter group. The no conflict group had a significant negative coefficient estimate for the change in log military burden, but not for the lagged log level, and the conflict group had neither terms significant.

Table 3. Regression Results for Fixed Effects Model: SSA

Variable	Total n=35	No Conflict n=27	Conflict n=8
Δliy	0.032 (2.6)	0.039 (2.9)	-0.018 (0.6)
Δlmy	-0.022 (2.5)	-0.021 (2.2)	0.001 (0.0)
lngd	-0.062 (4.1)	-0.050 (1.6)	-0.082 (4.4)
lyp1	-0.121(5.8)	-0.108 (4.6)	-0.246 (5.3)
liy1	0.012(1.4)	0.001 (0.1)	0.044 (2.0)
lmy1	-0.009 (1.3)	-0.002 (0.3)	-0.002 (0.2)
trend	0.002 (2.9)	0.001 (1.0)	0.006 (4.9)
Constant	-2.392 (2.4)	-0.539 (0.5)	-10.868 (4.5)
N	468	351	117
Rsq within	0.126	0.115	0.376
Rsq between	0.031	0.198	0.182

Notes: absolute t ratios in parentheses
Long run coefficient:

These results are surprising as the no conflict group shows marked differences, has only one levels variable significant, lyp1, while for the group of countries in conflict it is the difference variables that are insignificant. This does seem to suggest that there is only a short run adjustment process for the no conflict group and only a long run relationship for the conflict one. This is an intriguing result. While the size of the conflict group means care must be taken in drawing any strong conclusions, it does suggest that considering the impact of conflict on economic growth might be an interesting avenue for future research.

7. Conclusions

Military spending is an expenditure by governments that has influence beyond the resources it takes up, especially when it leads to or facilitates conflict. Its economic impact is therefore of considerable concern. This paper has provided an analysis of military spending and economic growth for a large group of countries for the period 1988 to 2006 and is one of the few that deal with the post Cold War period. It has also used the modelling framework suggested in Dunne et al (2006) which overcomes some of the shortcomings of earlier empirical analysis. Using a dynamic first order model and fixed effects panel data estimation method, gave very interesting results. Firstly, for all countries there was evidence of short run negative effects of military spending, but not long run. When the countries were broken down into 4 income groups there were clear differences, with the log military burden difference term significant and negative for all except the upper middle group and the lagged level significant and negative only for the low income group. Military spending would appear to have been more damaging to the poorer countries over this period.

Focussing on Sub-Saharan Africa, gave the opportunity to consider the possible effect of conflict. The SSA results suggested a significant short run effect of military spending on growth for countries, but this is not evident in the long run. Estimates for SSA countries that had been involved in conflict showed no effect of military spending on growth. This is an interesting finding, but further investigation is required to confirm it, given the relatively small number of countries in the conflict group.

Overall, he results here do imply that there is little or no evidence for a positive effect on economic growth and that it is more likely to have a negative effect, or at best no significant impact at all.

Appendix A

The data set contains data for 170 countries for period 1988 to 2006

Region codes: Africa (North Africa = 11; Sub-Saharan = 12); America (Caribbean = 21; Central America = 22; North America = 23; South America = 24); Asia and Oceania (Central Asia = 31; East Asia = 32; South Asia = 33; Oceania = 34); Europe = 4; Middle East = 5
Developed Dummy; Dummy variable 0 if a country is a developed country, 1 otherwise.
Milex constant; This variable is from SIPRI which is military expenditure by region and country, in constant (2005) US$ m., 1988-2006
Milex of GDP; This variable is also from SIPRI which is military expenditure by region and country, as percentage of gross domestic product, 1988-2005.
All the other variables in dataset are taken from World Bank: World Development Indicators April (2008).
Population; Total population of the country
GDP; Data are in constant 2000 U.S. dollars
Investment; Gross fixed capital formation constant 2000 US dollars (formerly gross domestic fixed investment).
Labour; All people who supply labour for the production of goods and services during a specified period.

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