

Military Spending: Is the Peace Dividend Real or Illusory

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Abstract

This paper investigates the relationship between defense spending and real per capita gross domestic product for the G-7 nations during the years 1963-1990. Using a two-way, fixed-effects regression model, time series and cross sections are pooled. Per capita real GDP is assumed to be a function of per capita military spending, per capita government spending for nonmilitary purposes, per capita capital stock, per capita investment, mean years of secondary education, percentage of the population between the ages of 15 and 65, and population growth rate. Results from the fixed effects model indicate a statistically significant, inverse relationship between defense spending and per capita GDP. Results also tend to verify the importance of investment, human capital, and size of the labor force relative to total population.

I. Introduction

With the demise of the Soviet Union and the end of the Cold War, the U.S. began reducing military spending. This reduction corresponded to an unprecedented period of economic growth. Recently political discussions have turned toward the “necessity” of repairing a “neglected” military. Military preparedness may well be an important component of social welfare, but any government spending program should be evaluated with an awareness of its

relationship to economic performance. In this regard, military spending has had a somewhat checkered background. Previous studies of the relationship between defense spending and economic growth have revealed mixed results both for industrialized nations and for developing nations. Some studies argue that defense spending initiates basic research and development programs, creates new technologies, and, consequently, fosters economic growth. Other studies contend that defense spending crowds out private investment resulting in a net decline in economic performance. Most of these studies were necessarily conducted with data that was gathered prior to the end of the Cold War. This study incorporates more modern data in a statistical framework that combines both time series and cross sectional observations.

In investigating the relationship between defense spending and GDP, the post World War II period offers a rich data sample that has seen defense spending in industrialized nations with market economies come almost full circle. At the end of World War II, the emergence of the Cold War saw the beginnings of the arms race and the growth in defense spending among those nations belonging to NATO and the Warsaw Pact, in general, and in the United States and the Soviet Union, in particular. In the 1980s, the Reagan administration embarked on a significant defense build up. The eventual disintegration of the Soviet Union ushered in the supposed era of the peace dividend, and defense spending in industrialized economies did decline. This time period also witnessed the return of Germany and Japan to their former positions as global economic powers. Arguments have been made that the economic growth these two countries experienced--countries whose economies were in shambles after World War II and countries whose future defense spending was restricted by the treaties they signed after the war--was

subsidized by the defense spending of the United States. Another aspect of the dissolution of the Soviet Union is that the U.S. is left as the sole remaining military super power. Political rumblings in the U.S. seem to indicate that an interest has once again developed in expanding military expenditures. Consequently, this paper uses a two-way, fixed-effects regression model to investigate the effect of military spending on economic performance.

A brief literature review of the relationship between defense expenditures and economic performance is provided in the next section. Part three provides an explanation of the statistical model used in the estimation procedures along with a description of the data. Results are analyzed in the fourth section, which is followed by some tentative conclusions and recommendations for additional work.

II. Literature Review

The impact of defense spending on investment

Past papers on the impact of an industrialized nation's defense spending on its economy have analyzed how military spending affects investment, employment and economic growth.¹ Studies have concluded that, in the case of developed nations, investment and military expenditures are substitutes (Kennedy 1983, p. 198). Smith (1977, 1978, 1980, and 1983) argues that workers resist cuts in private consumption and public welfare. Given an exchange rate and a level of capacity utilization, the remainder of the nation's output is divided between defense spending and investment. Smith argues that higher levels of military spending would necessarily

¹For a recent study of the relationship between military expenditures and economic growth in developing nations, see Chowdhury (1991).

imply reduced investment. In a study of 15 countries between 1960 and 1970, Smith found that investment and defense spending were negatively correlated (-0.73). Lindgren (1984) points out that most studies are in agreement on the negative correlation between defense spending and investment spending for industrialized, market economies.

The impact of defense spending on employment

Regarding the impact of military expenditures on employment, the Marxist critique of the 1960s was that defense spending was a necessary, albeit wasteful, policy to stabilize and expand capitalism (Baran and Sweezy 1968). They argued that raising defense spending could solve the problems of underconsumption and the unemployment associated with it. Furthermore, capitalism would resort to such spending in an effort to reduce class conflict. The hypothesis that increased military spending indirectly creates employment in the armaments industry and directly creates more jobs in the armed forces does not necessarily need to rely on the tenants of Marxist economics for support. Indeed, one of the primary concerns regarding disarmament at the end of the Cold War was its hypothesized relationship to rising unemployment.

In spite of this intuitive relationship, Chester (1978), Smith (1978), and deGrasse (1983) could not find a statistically significant relationship between military expenditures and unemployment. In his survey article of the literature, Lindgren concludes that “the relationship between military expenditures and employment seems too complex to capture by correlation or regression methods” (Lindgren, 1984, p.381). Recent studies confirm these earlier findings. Dunne and Smith (1990) find no Granger causality between the share of defense spending and the unemployment rate in nine of 11 countries in the OECD. Using data from 1962 to 1988, Paul

(1996) tested various economic hypotheses about the relationship between unemployment and defense and non-defense spending in 18 OECD countries. However, Paul was unable to find a uniform relationship between these variables across the various nations.

The Impact of Defense Spending On GDP

Given the long-accepted, theoretical direct relationship between investment and economic growth, if defense spending has a negative impact on investment, then it would seem reasonable that defense spending would have an adverse impact on economic growth. This was exactly the findings of two studies published in the seventies, Szymanski (1973) and Lee (1973). Some studies attribute the negative effect of defense spending on economic growth to reduced investment.² Another study argues that defense spending restricts export growth and economic growth because military expenditures compete for the same resources used in the production of exports.³

However, other studies were unable to find any stable relationship between military spending and economic growth.⁴ Chester (1978) found that military spending and economic growth were positively related. A direct relationship between defense spending and economic growth was found by Ahmed (1986) in a study of the UK. Weede (1983) found evidence that supported his hypothesis that higher rates of participation in the armed services lead to more economic growth. His argument was that service in the military leads to human capital formation that is beneficial to economic growth. In his 1984 review essay that synthesizes past

²See Smith (1977 and 1978), Smith and Georgiou (1983) and Cappelen, *et al* (1984).

³See Rotschild (1973).

⁴See Nardinelli and Ackerman (1976), Faini *et al.* (1984), and de Grasse (1983).

articles analyzing of the impact of military spending on the economies of industrialized nations, Lindgren (1984, p. 380) writes that the studies of the impact of defense spending on economic growth are not as conclusive as those of investment. Nevertheless, the overwhelming conclusion seems to be that military spending is not positively associated with economic growth but that additional research is needed to clarify the issue. In terms of past modeling attempts, Lindgren (1984, p. 376) notes that many studies used statistical techniques whose methods varied and whose steps were not clearly described. These articles usually lacked the development of a formal theoretical model on which to base econometric estimations. In examining the relationship between defense spending and economic growth, Blackaby and Ohlson (1982, p. 291) noted that instead of “trying to provide a reasonable statistical structure” most of these past attempts were “armchair theorists who conduct statistical exercises.” While this paper extends the data sample used in past articles, and analyzes the economic performance of several industrialized nations over time, it must be left to the reader to ascertain whether the current authors have succumbed to the affliction of “armchair theorizing.”

III. The Econometric Model and Data

The two-way fixed effects model

To analyze the relationship between defense spending and economic growth in each of the countries belonging to the G-7, annual data between 1964 and 1990 was used in a “two way” fixed and random effects model that pools cross sections and time series. The specific form of the fixed effects model estimated was

$$Y_{it} = \alpha_0 + \alpha_i + \lambda_t + \beta X_{it} + \varepsilon_{it}.$$

Y_{it} is per capita real GDP in country i observed in time period t . X_{it} represents a vector of independent variables hypothetically related to GDP. The symbol, α_i ($i = 1, \dots, 7$), represents a set of binary (dummy) variables used to capture country-specific effects while the symbol, λ_t ($t = 1964, \dots, 1990$), represents another set of binary variables used to capture time-specific effects.⁵ Of course, ξ_{it} is the random error associated with each observation for country i in time t .

The two-way random effects model

The two-way, random-effects model assumes that the group effects (countries) and time effects (years) impact the random error of the regression. The model becomes:

$$Y_{it} = \alpha_0 + \beta X_{it} + \varepsilon_{it} + u_i + w_t.$$

Here u_i represents the error term associated with the random group effects, and w_t represents the error term associated with the random time effects. Once again X_{it} represents an array of variables used to explain GDP.

The Data

Annual raw data for all the variables in both models were obtained from various issues of the government publication World Military Expenditures and Arms Transfers. This report is published every two or three years by the U.S. Arms Control and Disarmament Agency. The 1964-1995 data series is the longest period of data that this agency reports. To augment these

⁵Because the estimation procedure includes an overall constant, as well as a group effect for every group and a time effect for every time period, it is necessary to impose the restriction $\sum \alpha_i = \sum \lambda_t = 0$ to eliminate the problem of perfect multicollinearity.

variables a data set created by Nehru and Dhareshwa (1993) was downloaded from the World Bank's web site. This data set provides several variables that are not usually available (human capital variables for example) from ordinary sources. Unfortunately, the time periods of available data change from country to country and from variable to variable. Thus, the latest usable annual data available from this source was 1990.

Table 1 provides a list of the variables used in the estimation routines. The variables fall into three categories: physical capital, labor force, and government spending indicators. The only valid, available physical capital variable was investment (INVEST). Consequently, its per capita value was used both in its current form and in its lagged form. Three labor force variables were selected. The average number of years of secondary education (EDUCATE) attained by the population, the ratio of the population between the ages of 15 and 65 to the total population (LFORCE), and the difference between total population and its lagged value in log form (POPGROWTH). Two variable were used to represent the government spending category, per capita military spending and per capita central government spending less military spending.

IV. Estimation Results

The estimation results for the two-way, fixed-effects model are reported in Table 2 and Table 3.⁶ Table 2 lists the estimated coefficients and t-scores for the variables included in the model. Most of the results were as expected. The estimated coefficient for INVEST is positive and significant at the 5% level. The estimated coefficient for the lagged investment term

⁶The estimated coefficients for the large number of dummy variables in the model are not included in this paper. Those results will be provided to the interested reader.

(INVEST[-1]) is also positive but not quite significant for a two-tailed test. The human capital variable--EDUCATE--also has a positive and significant coefficient. Also, as expected, LFORCE--the percentage of the population between ages 15 and 64--had a positive and significant impact on GDP. The coefficient for the remaining population variable--POPGROWTH--had the expected negative sign but was insignificant at any conventionally accepted level of significance. The estimated coefficient for government spending less military spending--GOVERNMENT--was positive but insignificant. None of these results were unexpected or at odds with most other published studies. Of course, the most interesting result produced by this estimation procedure was the negative and significant coefficient for the military spending variable--DEFENSE. In fact, according to the estimates a one percent increase in military spending reduces per capita GDP by \$3,695--not an insignificant amount.

Specification tests

The appropriateness of the two-way, fixed-effects model was tested in several ways. First, likelihood ratio tests were used to investigate the significance of applying various restrictions (group effects, time effects, and classical regression fit) to the model. These tests result from assuming five alternative possible models. These five alternatives are:

1. Per capita GDP = f(constant term only)
2. Per capita GDP = f(group effects only)
3. Per capita GDP = f(constant, regressors)
4. Per capita GDP = f(constant, regressors, group effects)
5. Per capita GDP = f(constant, regressors, group effects, time effects)

The restrictions and relevant Chi-squared statistics are provided in Table 3. All the restrictions except the time effects restriction are statistically significant at the one percent level. So, there is

no statistical difference between the two-way, fixed effects model with both time and group effects and the one-way fixed effects model with only group (country) effects.

So, the results of a one-way, fixed-effects model are presented in Table 4. The results are very similar to those produced by the two-way procedure. One difference is that EDUCATE retains a positive coefficient but that coefficient is no longer significantly different from zero. Also, the coefficient for government spending takes a negative sign and becomes significant. There is virtually no change in the estimated coefficient for military spending. It is still negative and significant.

One final specification test was performed. A Hausman test was used to provide some evidence on the choice between a fixed-effects and random-effects estimator. The calculated Chi-squared value was 43.25 (See Table 2). With seven degrees of freedom, this score easily meets the requirements of a one-percent test of significance. Consequently, for this set of data a fixed-effects model is the best choice.

V. Conclusions

This paper indicates that an inverse relationship between per capita GDP and military expenditures existed in the G-7 countries between 1964 and 1990. The implication is that there is a real economic cost to maintaining a significant military presence and that cost is in reduced levels of per capita GDP. Society faces a distinct tradeoff between perceived national security needs, international prestige, and domestic economic performance.

Several enhancements could possibly add some weight to the conclusions of this research. First, the data set could be expanded to include all the OECD nations. A broader sample might

give a different picture of the relationship between defense spending and economic growth among both the industrialized and the developing nations. If the time portion of the data set could be extended it might be possible to test for coefficient stability over time. Finally, the most difficult question to explore is that of the theoretical cause of the inverse relationship between defense spending and economic performance? Is this inverse relationship due to diminished investment, reduced export growth, reduced efficiency in the labor market, or inappropriate physical and human capital formation? Without doubt many of these questions will be further illuminated by future researches.

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Table 1
List of Variables

Variable	Definition
PCGDP	Gross Domestic Product Per capita
INVEST	Log of the dollar value of investment per capita
DEFENSE	Log of defense expenditures per capita
GOVERNMENT	Log of the difference between per capita government spending and per capita defense spending
EDUCATE	Log of the average number of years of secondary education
LFORCE	Log of the ratio of the working age (15-64) population to the total population
POPGROWTH	Difference between the log of total population and its lagged value

Table 2

Estimation Results for the Two-Way, Fixed-Effects Model
 (dependent variable: per-capita GDP)
 ([-1] indicates a one period lag)

Variable	Coefficient	t-ratio
Constant	-19030.25	-2.17**
INVEST	3892.55	2.46**
INVEST[-1]	2490.51	1.37
DEFENSE[-1]	-3695.19	-2.58**
EDUCATE	2386.97	1.92***
GOVERNMENT[-1]	313.27	0.26
POPGROWTH	-51089.22	-1.09
LFORCE	10494.06	3.11*
R ²	0.98	
Hausman	43.25*	
n	168	

* Significant at the 1% level for a two-tailed test.

** Significant at the 5% level for a two-tailed test.

*** Significant at the 10% level for a two-tailed test

Table 3

Likelihood Ratio Tests on Alternative Specifications of the Fixed-Effects Model

Description	H ₀	H _A	Chi-squared statistic	degrees of freedom	P-value
No group effects	Model 1	Model 2	522.66	6	0.0000
No regression fit of Y on X's	Model 1	Model 3	452.87	7	0.0000
No group effects or regression fit	Model 1	Model 4	628.74	13	0.0000
Group effects but no regression fit	Model 2	Model 4	106.08	7	0.0000
Regression fit but no group effects	Model 3	Model 4	175.86	6	0.0000
Regression fit and group effects but no time effects	Model 4	Model 5	12.86	23	0.9850
Regression fit but no time or group effects	Model 3	Model 5	188.73	30	0.0000

Table 4

Estimation Results for the One-Way, Fixed-Effects Model
 (group effects included, time effects omitted)
 (dependent variable: per-capita GDP)
 ([-1] indicates a one period lag)

Variable	Coefficient	t-ratio
INVEST	3937.16	4.04*
INVEST[-1]	2298.09	1.96*
DEFENSE[-1]	-2426.43	-3.51*
EDUCATE	690.05	0.96
GOVERNMENT[-1]	-1339.40	-1.83***
POPGROWTH	-38133.22	-0.92
LFORCE	11057.09	4.42*
R ²	0.98	
n	168	

* Significant at the 1% level for a two-tailed test.

** Significant at the 5% level for a two-tailed test.

*** Significant at the 10% level for a two-tailed test