The Opportunity Cost of Super Power Status: The Tradeoff Between Defense Spending and Economic Prosperity

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Abstract

This paper investigates the relationship between defense spending and economic growth for the G-7 nations during the years 1964-1965. Using a two-way, fixed effects regression model, time series and cross-sections are pooled. The percentage change in real GDP is assumed to be a function of the percentage of GDP devoted to military spending and the percentage change in population. Results indicate a statistically significant, inverse relationship between defense spending and economic growth. If the percentage of GDP spent on defense spending increases by one percentage point, economic growth decreases by almost 1.3 percentage points. F-tests indicate the two-way, fixed effects model is superior to both the one-way, fixed effects model or the random effects model.

I. Introduction

With the demise of the Soviet Union and the end of the Cold War, a postmortem on the effects of defense spending on a country's economic growth is both appropriate and necessary. Previous studies of the relationship between defense spending and economic growth have revealed mixed results both for industrialized nations and developing nations. Some argue defense spending initiates research and development programs, creates new technologies, and increases economic growth. Others contend that defense spending crowds out private investment, and results in a net decline in economic growth. Most of these studies were

conducted before the end of the Cold War, which points out the need for a new study which incorporates more recent data.

In investigating the relationship between defense spending and economic growth, 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. The 1980s are characterized by the Reagan defense build up. But the breakup of the Soviet Union ushered in the era of the peace dividend, and defense spending in industrialized economies have declined. This time period also witnessed the return of Germany and Japan as global economic powers. Some would argue that the economic growth that 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. Now that the Soviet Union and the accompanying Cold War are no longer present, some note that the U.S. is the sole remaining super power. Given that super power status is a function of defense spending, this paper is the initial part of an ongoing research project which attempts to measure the opportunity cost of being a super power with data that includes recent history.

Combining time series data from 1964 to 1995, this study pools data from the seven countries belonging to the G-7 industrialized nations: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. Using a two-factor, fixed-effects regression model, the results indicate that, on average, if one of these countries increased its percentage of GDP spent

on defense by one percentage point, say from 6 percent to 7 percent, the percentage change in real GDP will fall by 1.27 percentage points, say from 4.27 percent to 3 percent.

The second section of this paper briefly reviews the literature regarding the impact of defense spending on a country's economic growth. The statistical model and the data are discussed in the paper's third section, while the results are analyzed in the fourth section of the paper. Conclusions and suggestions for future research are mentioned in the fifth and final section of the paper.

II. The 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, 1983) argues that workers resist declines in private consumption and public welfare. Given the exchange rate and capacity utilization, the remainder of the nation's output is divided between defense spending and investment. Smith argues that higher military expenditures would necessarily imply less investment. In a study of 15 countries between 1960 and 1970, Smith found that investment and defense spending have a negative correlation of -0.73. Lindgren (1984) points out that most studies concur that the levels of defense spending and investment spending in industrialized market economies are inversely correlated.

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 would argue that underconsumption and the unemployment associated with it would be diminished with increased defense spending, and capitalism would resort to such spending to reduce class conflict. However, the hypothesis that increased military spending should indirectly create increased employment in the armaments industry and directly create more jobs in the armed forces seems intuitive even to those would disagree the tenants of Marxist economics. One concern about the alleged peace dividend after the end of the Cold War was that disarmament will create unemployment. Indeed, the recent soft labor markets in California and Connecticut have been blamed on reduced defense spending.

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 out 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 economic growth

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 in the UK was found by Ahmed (1986). Weede (1983) found evidence that supported his hypothesis that higher rates of participation in the armed services lead to more economic growth. The argument here was that service in the military leads to human capital formation that is beneficial for economic growth. In his 1984 review essay that synthesizes past 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 higher military expenditures is not associated with economic growth but that more research is needed such as [ones that] will take different phases in the business cycle into account.

In terms of past modeling attempts, Lindgren (1984, p. 376) notes that many of these previous studies used statistical techniques whose methods varied and whose steps were not clearly described. These articles usually lacked the development of formal theoretical model on which to base an econometric model. 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 after the end of the Cold War, to the charge of being "armchair theorists" that lack a theoretical model, the current version of this paper is guilty as charged.

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 1995 was used in a "two way" fixed and random effects model that pools cross-sections and time series. The fixed effects model estimated was

$$Y_{it} = \alpha_0 + \alpha_i + \gamma_t + \beta_1 X_{1it} + \beta_2 X_{2it} + \epsilon_{it} \qquad (1)$$

where Y_{it} is the percentage change in real GDP in country i observed from the previous year (time t-1) to the current year (time t), X_{1it} is amount of current defense spending in country i expressed as a percentage of country i's current GDP, and X_{2it} is the percentage change percentage of population in country i observed from the previous year (time t-1) to the current

year (time t).[5] The α_i (i = 1, … , 7) are binary (dummy) variables that capture country specific effects while the γ_t (t = 1964, … , 1995) are other binary variables that capture specific time effects that are assumed to impact each of the seven country in the same way.[6] Of course, ϵ_{it} is the random error associated with each observation for country i in time t. Given the direct relationship between population growth and real GDP growth, β_2 is expected to be positive. The sign of β_1 is the one of primary interest.

The two-way random effects model

Instead of estimating fixed coefficients for the group effects and the time effects that shift the regression line's intercept, the two-way random effects model assumes that both the group and time effects impact the random error of the regression. The model becomes

$$Y_{it} = \alpha_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \epsilon_{it} + u_i + w_t \; . \qquad (2)$$

Here u_i is the random group effect each observation, and w_t is the random time effect on each observation.

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.

IV. Estimation Results

Results for the two-way fixed effects model

The estimation results for the two-way, fixed effects model are reported in Tables 1 and 2. Table 1 lists the estimates and the standard errors for the overall constant (α_0), the coefficient

associated with percentage of defense spending (β_1), and the coefficient associated with the percentage change in annual population (β_2). The estimates and standard errors of all the group effects (α_i) and the time effects (γ_t) are reported in Table 2.

In Table 1, the estimated parameter associated with the level of defense spending as a percentage of GDP is -1.272 which is statistically different from zero at the one-percent level. This implies that, controlling for group and time effects, the percentage change in real GDP is inversely related to the percentage of GDP spent on military expenditures. Thus, this more recent sample indicates that in the G-7 nations, the opportunity cost of increased military expenditures is foregone economic growth. The coefficient on the percentage change in the population is almost statistically significant at the five-percent level (its p value is 0.051, using a one-tail test).

Specification tests

In determining whether the two-way, fixed effects model is the appropriate model, Table 3 reports the F-tests of the linear restrictions on parameters that would be associated with alternative models. Model 3 listed in Table 3 only has an overall constant and the two regressors - - the percentage of GDP spent on defense and the percentage change in population - - as explanatory variables. The results of the one-way, fixed effects model that includes the overall constant, the two regressors, and only group effects is reported as model 4. The full two-way, fixed effects model that includes the overall constant, the two regressors, and both group and time effects is reported as model 5. Notice that the regressors themselves don't have much explanatory power. Model 3, the regression model that only has these regressors as explanatory

variables, has a low R^2 of .02. But once these regressors are combined with the fixed group and time effects in Model 5, R^2 increases to .66.

Notice also in Table 3 that the two-way, fixed effects model that includes group and time effects is superior to the one-way fixed effects model that only includes group effects. The hypothesis that all the coefficients on the time effects are equal to zero is rejected at the one-percent level as its F-test is equal to 9.161. The full two-way, fixed effects model also seems superior to the regression model that only has the overall constant and the two regressors as explanatory variables. Given an F-test of 9.252 the hypothesis that all the group effect and time effect coefficients are simultaneously equal to zero is also rejected at the one-percent level. Table 3 also indicates that the one-way, fixed effects model (model 4) is also superior to the regression that only an overall constant and the two regressors, model 3. The F-test is 4.097 and this implies that the hypothesis that all the coefficients on the group effects are simultaneously equal to zero can also be rejected at the one-percent level.

Results from the random effects model

The results of the random effects model (equation 2) are listed in Table 4. The random effects model also indicates an inverse relationship between defense spending and economic growth. The coefficient is -0.616 which is statistically different from zero at the one-percent level. Hausman's chi-squared test indicates that the two-way, fixed effects model is superior to the random effects model.[7] The test statistic is equal to 8.49 with a pvalue of 0.014.

V. Conclusions

This paper indicates that an inverse relationship between economic growth and military expenditures existed in the G-7 countries between 1964 and 1995. The implication is that the

opportunity cost of being a super power or the "world's policeman" is relatively less growth in GDP. Society faces a trade off between perceived national security needs, international prestige, and domestic economic growth.

This initial pass at the data indicates future research needed to tackle questions left unanswered in this paper. First, the data set should be expanded to include all the OECD nations. This broader sample may give a different picture of the relationship between defense spending and economic growth among the industrialized nations. Chow tests need to be performed to indicate whether the regression parameters are stable over time. Specification tests need to be performed to determine whether the model should include other explanatory variables such as interest rates, changes in technology, and changes in the capital stock. The final and harder question to answer is that if defense spending and economic growth is inversely related, what is the theoretical cause? Is this inverse relationship due to diminished investment, reduced export growth, reduced efficiency in the labor market, or inappropriate physical and human capital formation? Hopefully, some of these questions will be answered with future work in this area.

Footnotes

1. For a recent study of the relationship between military expenditures and economic growth in developing nations, see Chowdhury (1991).
2. See Smith (1977 and 1978), Smith and Georgiou (1983) and Cappelen, *et al* (1984).
3. See Rotschild (1973).
4. See Nardinelli and Ackerman (1976), Faini *et al.* (1984), and de Grasse (1983).
5. Models that included the lagged percentage of defense spending rather than current percentage of defense spending obtained similar results. Results are available upon request.
6. To eliminate the problem of perfect multicollinearity where both the time and group effect binary variables both sum to one, the model is estimated by imposing the restriction that $\Sigma\alpha_i = \Sigma\gamma_t = 0$.
7. See Hausman (1978).

Table 1

Regression Results: Fixed Effects Model

Dependent Variable: Percentage Δ in Real GDP

	Estimate	Standard Error
Overall Constant	7.625‡	0.959
Defense/GDP Percent	-1.272‡‡	0.279
Percentage Δ in Population	0.117†	0.072
R^2	0.66	
$F_{(40, 183)}$	9.01††	

‡ Statistically significant at the one-percent level using a two-tail test (p value = 0.00)

‡‡ Statistically significant at the one-percent level using a two-tail test (p value = 0.00)

† Statistically greater than zero at the ten-percent level using a one-tail test (p value = 0.051)

†† Significant at the one-percent level (p value = 0.00)

Table 2
Group and Time Effects - - Fixed Effect Model

Group Effects			Time Effects		
Group	Estimate	Standard Error	Year	Estimate	Standard Error
Canada	-1.588**	0.668	1964	4.711*	1.114
France	0.719	0.518	1965	2.411**	1.077
Germany	-0.639	0.455	1966	3.522*	1.079
Italy	-1.762	0.651	1967	2.570**	1.099
Japan	-1.007	1.122	1968	3.937*	1.064
U.K.	0.766	0.764	1969	2.958*	1.037
U.S.	3.082**	1.248	1970	1.593	1.027
			1971	0.693	1.024
			1972	1.840***	1.024
			1973	4.018*	1.025
			1974	-2.387**	1.025
			1975	-4.149*	1.025
			1976	1.407	1.030
			1977	-0.696	1.030
			1978	0.305	1.032
			1979	0.119	1.034
			1980	-2.212**	1.027
			1981	-2.311**	1.025
			1982	-3.305*	1.024
			1983	-0.705	1.025
			1984	0.682	1.024
			1985	0.056	1.025
			1986	-0.570	1.024
			1987	0.072	1.024
			1988	0.993	1.027
			1989	-0.280	1.030
			1990	-1.984***	1.103
			1991	-2.941*	1.031
			1992	-2.875*	1.039
			1993	-3.634*	1.048
			1994	-1.425	1.066
			1995	-2.412**	1.095

*, **, and *** denote that the estimate is statistically different from zero at the one-percent, five-percent, and ten-percent levels, respectively. All tests are two-tail tests.

Table 3
F-tests for Alternative Models
Fixed Effects Model

Model	Model Description	R^2
1	Constant Term Only	0.000
2	Group Effects Only	0.115
3	Regressors and Overall Constant	0.021
4	Regressors, Overall Constant, Group Effects	0.143
5	Regressors, Overall Constant, Group & Time	0.663

H_0	H_A	F-Tests	
Model 2	Model 1	$F_{(6, 216)}$	4.722
Model 3	Model 1	$F_{(2,221)}$	4.898
Model 4	Model 1	$F_{(8,216)}$	4.044
Model 4	Model 2	$F_{(2,216)}$	66.795
Model 4	Model 3	$F_{(6,216)}$	4.097
Model 5	Model 4	$F_{(3,184)}$	9.161
Model 5	Model 3	$F_{(38,184)}$	9.225

All F-tests are significant at the one-percent level.

Table 4
Random Effects Model
Dependent Variable: Percentage Change in Real GDP

	Estimate	Standard Error
Constant	5.388*	0.755
Defense/GDP Percent	-0.616*	0.163
Percentage Δ in Population	0.132**	0.071
R^2	0.002	
Var(e)	3.482	
Var(u)	0.791	
Var(w)	5.007	
Hausman Test Statistic	8.490**	

* indicates statistical significance at the one-percent level (two-tail test). ** indicates significance at the five-percent level (one-tail test).

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