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Defense Expenditures and Economic Growth in Development Countries:

Some Further Empirical Evidence*

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I. Introduction

The effect that defense spending has on economic development has long intrigued economists since it is generally assumed that the opportunity costs of defense expenditures are extremely high in terms of the alternative uses for these resources in the environment of most developing countries. Despite the importance of the relationship between defense and development, there was a noticeable lack of any empirical studies in the literature until the 1970's. While we review the relevant literature in the following section, it is fair to say that at the moment there is still no general agreement on the role defense spending plays in economic development.

This paper examines the defense-growth controversy by hypothesizing that the impact of added defense expenditures may be either positive or negative and will depend on the resource constraints faced by individual developing nations. Specifically, it is

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hypothesized that developing countries which are relatively resource constrained tend to reduce high growth development expenditures to maintain defense programs. On the other hand, countries which are relatively resource unconstrained can afford high growth development programs concomitant with maintaining or even increasing defense expenditures. Thus, we should expect to find a negative relationship between defense and economic growth in the poorer countries and the opposite in the richer countries. A sample of 90 developing countries is used to test this hypothesis for the period 1970-78. Defense spending was found to be positively associated and statistically significant for those countries classified as resource rich. The effect of defense on growth in the poor countries appears to be neutral.

In the following sections we first examine the relevant literature. Second, a model of defense spending and growth is presented which explicitly takes into account resource constraints typically faced by developing countries. Third, we discuss the methodology employed in the paper together with the empirical results. Finally, some conclusions are presented and some areas for future research are suggested.

II. Review of the Literature

While Benoit's primary purpose was to examine the effect of economic aid on the growth of Gross Domestic Product (GDP), he also calculated some simple correlation coefficients between defense spending as a percent of GDP and GDP growth.[1] Although the correlation coefficient was positive and "... strong enough ... for there to be 1000-to-1 chance against it being accidental," Benoit admitted the results might be technically "spurious."[2] To correct for this possibility, Benoit estimated a multiple regression equation using a sample of 33 developing countries where the real growth of GDP minus the real growth of defense expenditures was the dependent variable, and investment, receipts of bilateral aid, and defense expenditures (all as a percent of GDP) were the three independent variables. Benoit hypothesized the signs of the estimated coefficients to be positive.

1 See Emile Benoit (1973), See also Emile Benoit (1978), pp. 271-280, and Emile Benoit (1972), pp. 2-10.

An examination of the results "...showed the defense burden to have been a significant determinant of growth in the 1960-65 period but not for the longer period of 1950-65."[3] Recognizing that the data for the longer period was probably more accurate and despite a positive coefficient of the defense variable, Benoit concluded that:

> ...the residual positive correlation between the defense burden and the growth rate and its t-value appeared to be too weak to justify regarding the defense burden as a significant determinant of the growth rate. The correlation between them appeared likely therefore to have been spurious — an artifact reflecting the action of the investment and foreign aid variables.[4]

Furthermore, Benoit questioned the direction of causality between defense and growth. While recognizing that countries which have enjoyed a rapid growth might "...indulge themselves in the luxury of elaborate defense programs," he concluded that growth rates were a very weak determinant of defense levels and that "...the direct interaction...seems to run primarily from defense burdens to growth rather than vice-versa."[5]

Benoit's initial results were confirmed by Kennedy.[6] In his analysis, Kennedy examined a large number of developing countries and concluded that "the growth rate for GDP of individual countries did not seem to have been affected by their defense allocations."[7] Subsequently Kaidor[8] found a "strong association" between industrialization and arms expenditures based on an interpretation of U. S. Arms Control and Disarmament Agency data. Her admittedly "crude examination" led her to "pick out groups of countries representing extreme situations."[9] The groups that were examined were made up of countries with high rates of growth and spending rates, and counties which experienced the worst of both worlds. A year later, in a critical review of Kaldor's work, Amsden noted:

3 Benoit (1978), p. 274.
4 Benoit (1978), p. 274.
5 Benoit (1978), p. 275. This assumption on the direction of causality is adopted in this paper.
6 G. Kennedy (1974).
7 G. Kennedy (1974), p. 188.
8 Mary Kaldor (1976), pp. 459-482.

> Given this diversity, it is even more incomprehensible how Kaldor arrives at her conclusion of a "strong association" between industrialzation and arms expenditures...Certainly the most elementary statistical analysis of the data...on military burden (1972) and rates of growth of GNP *per capita*...does not reveal *any* positive association between the two variables, strong or otherwise.[10]

The simple correlation coefficient for Kaldor's sample of 40 underdeveloped countries was -0.18.

McKinley and Cohen's statistical study[11] on the economic performance of military regimes in the Third World countries published shortly after Kaldor's article found that"...in aggregate, military regimes do not perform significantly differently than civilian regimes."[12] Although military regimes perform "slightly better" than their predecessor civilian regimes, this association according to the authors "is not sufficiently strong to support the image of the military as a major force for economic development...it is equally clear that the simple equation of the military regime as an obstacle to development is quite erroneous."[13] In other words, it is necessary to penetrate beneath the political superstructure to understand economic development.

In this vein, Dabelko and McCormick attempt to assess the impact of changes in military spending on expenditures for public education and public health.[14] The analysis grouped countries on the basis of the general form of government in the country: personalist, centrist, and polyarchic. The major findings were (1) that significant opportunity costs exist for education and health in every country in the sample, (2) that the level of development has little or no impact on these opportunity costs, and (3) that personalist regimes tend to have higher opportunity costs of defense that do centrist or polyarchic regimes. For recent years, Dabelko and McCormick found that centrist regimes have lowered their opportunity costs for education and health while the opposite is true for polyarchic regimes.[15] However, these patterns were very weak in a statistical sense. Most regression equations contained coefficients that were not statistically significant at the 95 percent confidence level, and R^R values that were for the most part under 0.20.

10 Amsden (1977), p. 757.
11 McKinley and Cohen (1976), pp. 291-310.
12 McKinley and Cohen (1976), p. 309.
13 McKinley and Cohen (1976).

Smith, using mid-1960's data for a sample of fifteen of the more developed nations, found that the correlation coefficient between defense spending and growth -0.54. Smith suggested that the negative sign occurred since defense spending and investment represent mutually conflicting claims on resources.[16]

This paper suggests that these rather mixed results have occurred because the financial resource constraints which countries face have so far been excluded from the analyses. In the following section, a model is presented which explicitly incorporates this missing factor.

III. A Model of Defense Spending and Economic Growth in Developing Countries.

One can argue that under certain circumstances defense spending can help growth while under a different set of circumstances it can hinder growth. Indeed, both propositions are likely to be true for the same country at different points in time.

On the positive side, defense spending may contribute to growth of the civilian economy by:

> ...(1) feeding, clothing, and housing a number of people who would otherwise have to be fed, housed and clothed by the civilian economy ...(2) providing education and medical care as well as vocational and technical training...(3) engaging in a variety of public-works — roads, dams, river improvements, airports, communication networks, etc. — that may in part serve civilian uses; and (4) engaging in scientific and technical specialities...which would otherwise have be performed by civilian personnel.[17]

On the negative side there are at least three different types of possible effects.[18] The first, named the "income shift" by Benoit, is that increased defense expenditures will reduce the civilian GDP and will thus tend to decrease growth proportionately. Second, it is possible that defense spending adversly affects growth since the

16 R. P. Smith (1977), pp. 61-76.
17 Emile Benoit (1978).

government sector for the most part exhibits "negligible rates of measurable productivity increases."[19] Finally, growth can suffer since increased spending on defense uses resources which could have been better employed as civilian investment.

While these arguments make intuitive sense, the crucial determinant is the country's financial resource constraint. A country which is severly resource constrained (faces some combination of lagging taxes, reduced private and government savings, reduced borrowing power overseas, export shortfalls, etc. for example), will probably face budget cuts. In order to maintain defense programs the high-growth development programs will be sacrificed. This is likely for two reasons. First, it is usually more politically acceptable to curtail capital investments (on infrastructure, for example) than expenditures on the current account. Second, given that a well-established military establishment already exists, there will be the obvious pressure to maintain the *status quo*. These special interest groups might include high ranking officers, military contractors, and certain political groups. As budgets are reduced, the military share is frozen and the brunt of the deflationary policy is borne by development projects which we assume are relatively productive. In short, defense expenditures are likely to be asymmetric — difficult to cut back but easily expanded. Thus, for resource constrained countries we should expect a negative relationship between defense spending and economic growth.

The opposite is likely to hold for countries with a relative abundance of financial resources — an elastic suply of tax revenues, a high inflow of foreign exchange, and the like. These countries can more easily afford the capital investment programs necessary for economic growth while maintaining, or even increasing defense programs.

If this thesis is correct, one can see why previous authors have failed to find any consistent relationship between economic growth and defense. Using a model based on resource constraints however, it is easy to see why developing countries with identical levels of defense spending can experience very different growth levels: richer countries are apparently able to invest in development programs while, on the other hand, poorer countries have had to sacrifice these programs to pay for defense.

An appropriate function to test for the effect of defense on growth can be expressed in the following way:

$$GNPG = f(IG, AVMILGNP), \quad (1)$$

where GNPG is the average annual growth rate of per capita GNP, IG is the average annual growth rate of investment, and AVMILGNP is defense spending expressed as a percent of GNP. The hypothesized rate of change $\frac{\partial f}{\partial IG}$ is > 0. The hypothesized rate of change $\frac{\partial f}{\partial AVMIL\ GNP}$ according to the thesis as outlined above cannot be specified *a priori* but will depend on the resource constraints faced by the indivudual country: the rate of change should be positive for the richer countries and negative for the poorer group of countries.

The equation to be estimated can be expressed in linear form as:

$$GNPG_i = a + b_1 IGA_i + b_2 IGB_i + b_3 AVMILGNP + \epsilon_i; \quad (2)$$

where i represents the individual country, and ϵ is the error term which is assumed to have the traditional statistical assumptions. IGA and IGB are the average annual growth rates of investment for the 1960-70 and 1970-78 periods, respectively, GNPG is the average annual growth rate in *per capita* GNP between 1960 and 1978, and AVMILGNP is the average level of defense spending expressed as a percent of GNP (in constant dollars) for the years 1967, 1970 and 1975.[20] The sample of countries consists of the 85 countries listed by the World Bank in the *1980 World Development Report* whose 1978 *per capita* GNP was less than $3,000, as well as the five capital-surplus oil exporting countries.[21]

IV. Empirical Results

As a first step, a least-squares estimate of equation (2) was calculated for the entire group of countries to see if there was any overall relationship between defense and growth. The result was

20 All data except that for AVMILGNP came from the International Bank for Reconstruction and development/The World Bank, World Development Report (1980) The defense data was compiled from individual country reports published in U.S. Arms

as follows:[22]

$$GNPG = 0.56 + 0.17IGA + 0.06IGB + 10.76AVMILGNP; \quad (3)$$
$$(4.82)^{***} \quad (2.33)^{**} \quad (1.41)$$
$$R^2 = .48$$

The sings of the estimated coefficients are as hypothesized in the model, and in the case of IGA and IGB are significantly different from zero at the 99 percent level and the 95 percent level of confidence, respectively. This result indicates the importance for the group as a whole of the growth in investment as a determinant of economic growth. While the coefficient of defense spending coefficient is positive, it is not significantly different from zero at the 90 percent level of confidence, indicating no overall discernible relationship between defense and economic growth.

Since the hypothesized relationship between defense and economic growth depends on financial resource constraints, the sample countries were separated into either a resource constrained or non-resourced constrained group by means of a cluster analysis. While a large number of conceivable proxy measures could be used to indicate the relative abundance or scarcity of financial resources, the selection of those used in the cluster analysis was based largely on the availability and comparability of data among countries. In this respect, four variables were chosen which appear in *1980 World Development Report*, namely, the ratios of gross domestic investment to GDP in 1960 and 1978, and the ratios of gross domestic savings to GDP in 1960 and 1978.[23] These measures reflect not only direct resource availability (savings) but also the existence of an efficient financial system to use the resources effectively (investment). Three groups were identified in the cluster analysis (Table 1). Group I, the relatively resource unconstrained group, consisted of 22 countries and Group II, the relatively resource constrained group, consisted of 51 countries.

22 Throughout this paper, *t*-values appear in parentheses under the estimated coefficients; *** indicates significance at the 99% level of confidence, ** indicates significance at the 95% level of confidence, and * indicates significance at the 90% level of confidence. Although there is little multicollinearity between the independent variables (the correlation coefficient between IGA and IGB is 0.16, between IGA and AVMILGNP 0.33, and between IGB and AVMILGNP 0.45), we have purposefully employed a computing procedure which "forces" AVMILGNP to enter the regression equation as the last variable. Since our reported *t*-values are calculated as the square-root of the partial F-value (which is calculated incrementally), we can examine the marginal contribution of defense after the

Table 1

MEAN VALUES, INVESTMENT AND SAVINGS TO GROSS DOMESTIC PRODUCT RATIOS, 1960 AND 1978

GROUP	Gross Domestic Investment as a % of Gross Domestic Product		Gross Domestic Savings as a % of Gross Domestic Product	
	1960	1978	1960	1978
GROUP I (n = 22)	24.6	28.0	21.4	25.8
GROUP II (n = 51)	13.0	19.5	10.0	12.2
GROUP III (n = 1, Lesotho)	2.0	30.0	-25.0	-71.0

Note: Countries in Group I are: Trinidad, S. Africa, Malaysia, Iran, Zambia, Venezuela, Yugoslavia, Colombia, Mexico, Argentina, Zimbabwe, Brazil, Ivory Coast, Ecuador, Philippines, Taiwan, Peru, Jamaica, Liberia, Algeria, Congo, Mauritania.

Countries in Group II are: Turkey, Sri Lanka, Portugal, Costa Rica, Senegal, El Salvador, Niger, Burma, Bolivia, Morocco, Tanzania, Zaire, Central African Republic, Afghanistan, Chile, Ethiopia, Uruguay, Angola, Ghana, Uganda, Benin, Chad, Upper Volta, Pakistan, Mali, Somalia, Sudan, Rwanda, Panama, Nicaragua, Honduras, Thailand, Paraguay, India, Kenya, Cameroon, Dominican Republic, Tunisia, Guatemala, Indonesia, Guinea, Madagascar, Papua New Guinea, Korea, Nigeria, Malawi, Togo, Haiti, Burundi, Mozambique, and Egypt.

Group III, consisted soley of Lesotho. As Table 1 indicates, the mean values of the four variables are significantly different between the groups. In addition, the grouping by and large is intuitively satisfactory. However, sixteen countries did not have the required data for the cluster analysis.[24] Four of the sixteen countries — Saudi Arabia, Kuwait, Libya and Iraq — were included in the resource rich group as they were capital-surplus oil exporting countries. The remaining eleven countries were excluded from the analysis. Lesotho was included in Group II for purposes of the analysis.

24 The countries were Saudi Arabia, Kuwait, Libya, Iraq, Cambodia, North Yemen,

The next step to test the hypothesis was to estimate the within-group regression equations. The extimated equations by group are as follows:[25]

$$\text{GROUP I} \quad GDPG = 1.38 + \underset{(0.29)}{0.02}IGA + \underset{(1.90)*}{0.08}IGB + \underset{(3.54)***}{38.71}AVMILGNP; \; R^2 = .70 \qquad (4)$$

$$\text{GROUP II} \quad GDPG = 0.14 + \underset{(6.63)***}{0.24}IGA + \underset{(2.22)**}{0.05}IGB - \underset{(-0.19)}{1.52}AVMILGNP; \; R^2 = .62 \qquad (5)$$

The most striking result is that for Group I the coefficient of the defense variable is positive and statistically significant at the 99% level of confidence. This result supports the original hypothesis as set forth above as to the positive role that defense spending may play for countries in this group. While the sign of the estimated coefficient of AVMILGNP is negative for Group II countries, it is not significantly different from zero. In this respect, the hypothesized negative relationship between defense spending and economic growth is tentatively rejected. Possibly the result obtained may be due to the increasingly complex nature of defense expenditures during the 1970's. In other words, it is suggested that defense spending in the 1970's tended to be used more and more for sophisticated weapons and technology. Perhaps this type of expenditure did not hinder growth so dramatically as may have been the case had the same expenditures been used on routine maintenance for the existing stock of hardware or the purchase of relatively outdated equipment — i.e. the opportunity costs were not as high in terms of other alternatives. Obviously, the composition of defense spending and its different effects of growth is an area for further fruitful research.

Another major result from the analysis is that the estimated coefficients for IGA and IGB are both positive and statistically significant (at the 99% and 95% levels respectively) for the countries in Group II. For these countries, investment takes on an

[25] For Group I, the correlation coefficient between AVMILGNP and IGA was 0.85, ...

added significance in determining economic growth since savings rates are a relatively small proportion of GDP. Hence, the rate of return of any marginal increments to the capital stock is large. Furthermore, the low savings and investment rates for the group as a whole tend to be associated with relatively poor export performances. As Bruton has demonstrated,[26] countries with relatively low rates of export growth, when combined with an import substitution strategy (characteristic of many countries in the group), tend to experience low over-all increases in productivity — an alternative source of economic growth. Presumably the high private rate of return on capital investments (due possibly to an overvalued exchange rate which makes importation of machinery attractive) together with shortages of other resources (such as an educated labor force) leads to the substitution of physical capital for human capital. In this way, most increases in economic growth are embodied in new capital equipment.

In the more open and non-resource constrained countries of Group I, the estimated coefficients for IGA and IGB are both positive but only statistically different from zero at the 90% level of confidence in the case of IGB. This result is not too surprising. Again, as Bruton noted, one is likely to find other sources of growth — such as disembodied technical change or increases in labor productivity through education — to be as equally important in the growth process in Group I countries as is any change in capital investment.[27] In short, the flexibility in choices among sources of growth in the countries of Group I has facilitated the substitution of disembodied productivity increases for capital formation *per se* as a major source of growth.

V. Summary and Conclusions

The purpose of this paper has been to examine the relationship between defense expenditures and economic growth. Previous studies on the subject which have appeared in the literature have for the most part arrived at contradictory results. We hypothesize that the relationship between defense and growth will be positive and statistically significant for countries that are relatively resource

unconstrained and the opposite for countries that are relatively resource constrained. A model was developed with the average annual growth rate of per capita GNP as the dependent variable and the average annual growth rate of investment and defense spending as a percent of GNP as the independent variables.

A cluster analysis was used to group the countries on the basis of resource constraints. Investment as a percent of GDP and savings as a percent of GDP were used as variables in the cluster analysis to reflect resource constraints. Two distinct groups were identified and were intuitively satisfactory.

Linear regression equations were estimated for each group. The most striking result, and one that supports our hypothesis, is that the coefficient of the defense variable was positive and statistically significant at the 99 percent level for the richer group. While the coefficient for the defense variable for the poorer group was negative (as hypothesized), it was not statistically different from zero. It was suggested that this might be the result of the composition of defense spending during the period under consideration.

The other main finding was that the coefficients of the investment variables were positive and statistically significant for Group II countries. This result supports Bruton's contention that for the poor developing countries the significant source of economic growth will be changes in capital investment. For the relatively richer group of countries only the growth rate of investment in 1970-78 was statistically significant. This indicates that there are alternative sources of growth for these countries — changes in productivity or disembodied technical change, for example.

Thus, the main finding of this paper is that defense expenditures do not compete excessively for scarce resources in countries which are relatively resource unconstrained. As a result of their other positive aspects (education, linkages with industry, etc.) defense expenditures can play an important and positive role in determining economic growth. Countries suffering from a relative lack of resources experience no statistically discernible effect on economic growth from defense spending.

Areas for future research might include a disaggregation of defense expenditures (where data permit) to compare the effect on growth from capital spending versus expenditures for operations

relative contribution over time of other government expenditures (such as health and social services) to economic growth. Hopefully from this work a general theory of defense expenditures and economic growth will emerge.

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