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Studies of the effect that defense spending has had on economic growth in less-developed countries have produced rather mixed results. We contend that this is because these studies have failed to take into account the relative financial constraints faced by individual countries. In an extension of the seminal work by Emile Benoit on defense spending and its effect on economic growth,[1] we hypothesize that relatively poor countries tend to cut back high-growth development expenditures in favor of maintaining defense programs, while relatively rich countries are much less likely to abandon development expenditures given a constant level of defense preparedness. Thus, we should expect a negative relationship between defense and growth in the poorer countries, but a positive relationship in the richer countries.

In this article, we examine the relevant literature, and develop a model of defense and economic growth that explicitly incorporates resource constraints. The results of the cluster analysis that was used to group the sample of countries into a richer and poorer group are presented. Finally, the results of the within-group regressions are pres-

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ented. The estimated equations confirm the hypothesized relationships between defense spending and economic growth.

Review of the Literature

As a first step in his examination of the effect defense spending has on economic growth, Benoit calculated simple correlation coefficients using a sample of 44 developing countries between 1950 and 1965. Although the correlation coefficient was positive and "strong enough . . . for there to be a 1000-to-one chance against it being accidental," he admitted that the result might be technically "spurious."[2] To correct for this possibility, Benoit estimated this multiple regression equation:

$$\text{CIVGDP} = f(\text{INV, AID, DEFN}) \qquad [1]$$

CIVGDP is the real growth in GDP minus real growth in defense expenditures[3], INV is the gross capital formulation as a percentage of GDP, AID is the receipts of bilateral aid as a percentage of GDP, and DEFN is defense expenditure as a percentage of GDP. Furthermore, the signs of the coefficients are all hypothesized to be positive.

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."[4] Recognizing that the data for the longer period was probably more accurate, and despite a positive coefficient for 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.[5]

In addition, Benoit questioned the direction of causality between defense and growth. While hypothesizing that countries that 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."[6]

Benoit's findings were confirmed by Kennedy. 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, Kaldor[8] found a "strong association" between industrialization and arms expenditures based on an interpretation of data provided by the U.S. Arms Control and Disarmament Agency (ACDA). Her admittedly "crude examination" of the ACDA data led her to "pick out groups of countries representing extreme situations."[9] The groups examined were made up of countries with high rates of growth in both GDP and military spending, countries with low growth and low spending rates, and countries that experienced the worst of both worlds. A year later, in a critical review of Kaldor's work, Amsden noted the following:

> Given this diversity, it is even more incomprehensible how Kaldor arrives at her conclusion of a "strong association" between industrialization and arms expenditures (the ACDA data she presents in Table 1 in fact contain figures on rates of growth of GNP per capita rather than on rates of industrial growth.) 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 Third World countries published shortly after Kaldor's article found that "aggregate military regimes do not perform significantly differently than civilian regimes." 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 . . . [I]t is equally clear that the simple equation of the military regime as an obstacle to development is quite erroneous."[12] 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.[13] Their analysis grouped countries on the basis of their general forms of government: personalist, centrist, and polyarchic. The major findings of this study were the following: (1) Significant oppor-

tunity costs exist for education and health for every country in the sample; (2) the level of economic development has little or no impact on these opportunity costs; and (3) personalist regimes tend to have higher opportunity costs of defense than do centrist and polyarchic regimes. For recent years, Dabelko and McCormick found that centrist regimes have lowered their opportunity costs of defense for education and health while the opposite is true for polyarchic regimes.[14] However, these patterns were very weak in a statistical sense. Most regressions equations contained coefficients that were not significant at the 95% level of confidence, and R values that were in general under 0.20.

Smith, using mid-1960s data for a sample of 15 more developed nations, found that the growth-defense burden coefficient was -0.54. Smith attributed this to the fact that defense spending and investment represented mutually conflicting claims on resources.[15]

It is our hypothesis that these rather mixed results occurred because the relative financial resource constraints faced by individual countries have been left out of the analyses. In the next section, we present a model that explicitly incorporates this missing factor.

A Model of Defense and Economic Growth in Developing Countries

It is possible to argue that under certain circumstances defense spending can aid growth, while under a different set of conditions defense spending can hinder growth. Furthermore, both propositions are likely to be true at different points in time.

On the positive side, defense expenditures may contribute to growth of the civilian economy as follows:

> (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 specialties . . . which would otherwise have to be performed by civilian personnel.[16]

On the negative side, there are at least three types of possible effects.[17] The first effect, named the "income shift" by Benoit, is that increased

defense spending reduces the civilian GDP, and will thus tend to decrease growth proportionately. Second, it is argued that defense spending adversely affects growth because the government sector in general exhibits "negligible rates of measurable productivity increases."[18] Finally, growth can suffer because increased levels of defense expenditures take over resources that could otherwise have been employed as civilian investment and hence contributed to growth.

While these arguments make intuitive sense, a crucial determinant (as mentioned above) in the relationship is the country's financial resource constraint. A country whose resources are severely constrained will almost always face budget reductions. We suggest that these reductions will often take the form of sacrifices in development projects so that defense programs can be maintained. Not only will this reduction tend to reduce economic growth per se, but as Hirschman's[19] unbalanced growth strategy would indicate (which we tested in the case of Mexico[20]), a concomitant decrease in private investment is likely to occur as potential privately financed projects are cancelled. The shifting of the government's priority away from high-growth development projects and to defense in the face of budget cuts is likely for two reasons. First, governments usually find it more politically expedient to curtail capital investments (on infrastructure for example) instead of expenditures on the current account. Second, given that a defense establishment exists, special interest groups might find it economically advantageous to maintain the status quo. These groups might include high ranking officers, military contractors, and certain politicians. As budgets are reduced, military budgets are frozen and the brunt of the deflationary policy is born by the highly productive development projects. Thus for a resource constrained country we would expect a negative relationship between growth and defense spending.

The reverse is true for countries that have a relative abundance of financial resources. These countries can more easily afford the growth-oriented capital expenditure programs concomitant with maintaining, or even increasing, defense programs.

If this thesis is correct, it is understandable why previous studies have failed to find a consistent relationship between economic growth and defense spending. Using a model based on resource constraints, it is easy to see why two developing countries with identical levels of defense spending can experience markedly different levels of growth. The relatively rich country can afford high growth programs while the poorer country must limit funding levels for the same programs.

Empirical Results

A number of conceivable proxy indicators for the availability of financial resources could be used to test our hypothesis. The selection of variables was based largely on the availability and comparability of data between countries. The main source of data was the World Bank.[21] Nine variables were selected to measure savings, investment productivity, foreign exchange availability, and import availability (Table 1).[22] A priori each variable should have an effect on the defense burden-growth relationship as shown in Table 1.

As an initial step, a cluster analysis[23] was performed using these nine variables for 37 out of Benoit's original 44 countries in sample.[24] Four groups were identified (Table 2). Group I—the resource abundant group—was characterized by high growth in foreign exchange earnings, high import elasticity, a low debt-service ratio, a low incremental capital-output ratio, a high current account deficit/GDP ratio, and a high government expenditure multiplier.

Group II—the resource constrained group—was quite the opposite in nearly every case. This set of countries was characterized by low growth in foreign exchange earnings, a high incremental capital output ratio, a low percentage of exports to GDP, a high debt service ratio, a low current account deficit as a percentage of GDP, a low government expenditure multipler, and low import elasticity. Three countries (Iraq, Burma, and Syria) make up Group III. This group falls between the two previous groups since the mean values are either higher, lower, or in between the values for Groups I and II. The cluster procedure isolated Vietnam into Group IV since this country had a number of extreme values for the nine variables. Inasmuch as the number of observations in Group III and IV is extremely small, we have considered these to be special cases. The analysis presented below concentrates on Groups I and II, the two largest groups.

To determine the probability of having correctly grouped the countries into Groups I and II, a discriminant analysis was performed. The placement from the cluster analysis was used as the basis for the initial classification. Every country was correctly classified at the 100% probability level, except for the Dominican Republic which had a probability of 88% of correct placement.

As a next step—using Benoit's methodology, his data and his time frame (1950-1965)—within-group linear regression equations were estimated in the form specified in equation 1 above. The estimated equations by group are as follows:[25]

Group I

$$\begin{aligned} \text{CIVGDP} = {} & 1.77 + 0.16\ \text{INVEST} + 0.12\ \text{AID} \\ & + 0.22\ \text{DEFN};\ R^2 = 0.89 \\ & (6.11)^{**} \quad (3.07)^{**} \quad (3.77)^{**} \end{aligned} \qquad [2]$$

Group II

$$\begin{aligned} \text{CIVGDP} = {} & 4.72 + 0.15\ \text{INVEST} + 0.19\ \text{AID} \\ & - 1.22\ \text{DEFN};\ R^2 = 0.76 \\ & (1.92) \quad (1.46) \quad (-3.52)^{**} \end{aligned} \qquad [3]$$

The most striking result is that for Group I—the resource abundant group—the coefficient of DEFN is positive and statistically significant at the 99% level of confidence. At the same time, the coefficient of DEFN for Group II—the resource constrained group—is negative and statically significant at the 99% level. Both results lend support to our hypothesis that financial constraints play an important role in the defense-growth relationship.[26] Furthermore, there is a sharp difference between our results and those obtained by Benoit. The regression equation for his sample of 44 countries was as follows:[27]

$$\begin{aligned} \text{CIVGDP} = {} & 1.14 + 0.21\ \text{INVEST} + 0.13\ \text{AID} \\ & + \text{DEFN};\ R^2 = 0.61. \\ & (5.57)^{**} \quad (2.30)^{**} \quad (1.34) \end{aligned} \qquad [4]$$

The coefficient for DEFN in equation 4 is not statistically significant, and the R^2 value is lower than those obtained in either equations 2 or 3.[28]

These results suggest that in relatively nonresource constrained countries that either defense expenditures contribute to growth directly (because of the type of defense spending) or that these countries can maintain development programs (that contribute to growth) while maintaining or even increasing defense programs. On the other hand, in resource constrained countries the results imply that defense expenditures hurt growth. In this case, it is not necessarily the type of defense spending that hurts growth, but rather that defense spending is maintained while highly productive programs are cut back.

Thus it is quite easy to see why previous authors, who grouped on the basis of military regimes, have failed to find any pattern between defense spending and growth. Some authors (notably Dableko and McCor-

TABLE 1

Description of Variables Used in Cluster Analysis and Their Impact on the Growth-Defense Relationship

Variable Description	*Effect of High Value on Defense Growth Relationship*	
Private Saving (SAV)—as a % of Gross Domestic Investment, Average 1960-1973	(–)	A proxy indicator of the government's inability to finance expenditures through tax revenues
Export Growth (EXPGRO)—Average annual growth rate (real), 1960-1973	(+)	Availability of foreign exchange
Exports (EXPGDP)—as a % of current GDP, Average 1960-1973	(+)	Openness of the economy reflecting the availability to transform and to achieve economic efficiency in production
Private Consumption (PCONS)—as a % of current GDP, Average 1960-1973	(+ or –)	May reflect a scarcity in savings for development or a high multiplier effect on economic growth
Incremental Investment to Incremental GDP Ratio (ICOR)—Average 1968-1973	(–)	Low productivity of investment reflecting bottlenecks or government inefficiency in allocation, or a dominant foreign exchange constraint
Civilian Consumption (CIVCON)—as a % of general government total revenue, 1965	(–)	Reflecting a high government expenditure multiplier
Import Elasticity (IMPGDP)—Rate of Growth of current imports to current GDP, 1960-1973	(+)	Availability of foreign resources for expenditure
Deficit in Balance of Payments (DEFGDP)—Balance on current account as % of GDP, 1965	(+)	Ability of the government to have attracted foreign capital in the past to supplement domestic resources
Debit Service (DEBTSV)—External Public Debt Service Ration, 1965	(–)	Constraint on obtaining foreign exchange

SOURCE: International Bank for Reconstruction and Development, *World Tables: 1976* (Washington, DC: International Bank for Reconstruction and Development, 1978).

mick) have suggested that an appropriate classification is the level of development. As a test of this proposition, per capita income was added as a tenth variable to the cluster analysis. The procedure resulted in a very different set of countries in the two larger groups.[29] Regression

TABLE 2
Mean Values of Variables Used in Cluster Analysis, by Group

	Cluster Analysis Variables								
	SAV	*EXPGRO*	*EXGDP*	*PCONS*	*ICOR*	*CIVCON*	*IMPGDP*	*DEFGDP*	*DEBTSV*
*Cluster Analysis Groups**									
GROUP I	56.5	9.5	20.7	68.0	2.2	67.3	1.5	–4.8	7.9
GROUP II	85.2	6.4	23.5	69.4	2.3	38.1	0.0	0.1	3.8
GROUP III	84.8	4.7	14.6	73.3	3.5	85.2	0.9	–1.2	11.0
GROUP IV	53.0	0.8	9.6	79.7	3.9	130.4	5.3	–9.6	2.9

*GROUP I (n = 24): Malaysia, Nigeria, Greece, Spain, Guatemala, El Salvador, Honduras, Taiwan, Thailand, Venezula, South Africa, South Korea, Iran, Yugoslavia, Dominican Republic, Ecuador, Egypt, Costa Rica, Tunisia, Israel, Jordan, Colombia, Chile, Turkey.

GROUP II (n = 9): India, Mexico, Brazil, Argentina, Sudan, Peru, Philippines, Morocco, Tanzania.

GROUP III (n = 3): Iraq, Syria, Burma.

GROUP IV (n = 1): South Vietnam.

equations were estimated for the high income and low income groups and the results were as follows:

High Income Group

$$\text{CIVGDP} = 1.6 + 0.17\ \text{INVEST} + 0.31\ \text{AID} + 0.10\ \text{DEFN};\ R^2 = 0.82 \quad [5]$$
$$(3.1)^{**} \quad (2.7)^{*} \quad (0.7)$$

Low Income Group

$$\text{CIVGDP} = 1.4 + 0.17\ \text{INVEST} + 0.09\ \text{AID} + 0.17\ \text{DEFN};\ R^2 = 0.54 \quad [6]$$
$$(2.1)^{*} \quad (1.3) \quad (1.7)$$

As can be seen, the coefficient of DEFN—while positive—is not statistically significant in either equation, and the R^2 values are lower than for the equations reported above.

Summary, Conclusions, and Areas for Further Research

The purpose of this study has been to extend Benoit's original paper on the relationship between economic growth and defense expenditures in developing countries. In his original study, Benoit found no statistically significant relationship (either positive or negative) between growth and defense for a sample of 44 countries. Subsequent attempts by other economists arrived at contradictory results. We hypothesize that the relationship between growth and defense will be positive and statistically significant for countries that are relatively resource unconstrained while the opposite will be true for resource constrained countries.[30] A cluster analysis to group countries on the basis of resource constraints was performed on Benoit's original sample using nine variables to measure savings, foreign exchange earnings and availability, tax revenues, imports, and availability of capital.

Four distinct groups of countries were identified. Group I consisted of 24 countries and was characterized by a relative abundance of financial resources. On the other hand, Group II, which consisted of nine countries, was relatively resourced constrained. Group III (Burma, Syria, and Iraq) were intermediate to Groups I and II, and Group IV consisted solely of Vietnam.

Using Benoit's methodology, his data, and timeframe, linear regression equations were estimated for Group I and II. Civilian economic growth was the dependent variable, and the investment rate, the receipt

of bilateral aid, and the average annual defense expenditure were the independent variables. The most striking result—one that supports our hypothesis—was that the coefficient of the defense variable was positive and statistically significant at the 99% level for Group I, and negative and statistically significant at the same level of confidence for Group II, the resource constrained group. This result is in marked contrast with that obtained by Benoit. As an additional step, per capita income was included as a tenth variable to the cluster analysis. Two different groups of countries were identified, and the estimated regression equations for these groups yielded coefficients that were not significant for the defense variable.

Thus, the main finding of this article is that defense expenditures in countries that are relatively resource unconstrained compete less for scarce resources. As a result of their other positive aspects (education, linkages with industry, etc.), defense expenditures may play an important and positive role in increasing growth. Countries suffering from a relative lack of foreign exchange and government revenues, on the other hand, experience the reverse. For these countries, defense expenditures apparently siphon funds away from more productive domestic investments with a subsequent detrimental effect on growth.

Stated in these terms, our results have fairly obvious implications. It would, however, be premature to draw any firm conclusions from these results—primarily because of sample size—until further research is completed. One area for further research might be to enlarge the sample size and reexamine the question of defense and economic growth for this or a later period. Other fruitful areas might include a disaggregation of defense expenditures (where data permit) to compare the effects on growth of different types of defense spending; an examination of how much additional growth the unconstrained countries might have achieved had they faced lower (or no) defense expenditures, and a comparison of the relative contributions over time of other government expenditures (such as health and social services) on economic growth. We hope that a general theory of defense expenditures and economic growth will emerge from this work.

Notes

1. Emile Benoit, *Defense and Economic Growth in Developing Countries* (Lexington, MA: Lexington Books, 1973); see also Emile Benoit, "Growth and Defense in Developing Countries," *Economic Development and Cultural Change* 26 (January 1978):

271-280; Emile Benoit, "Growth Effects of Defense in Developing Countries," *International Development Review 14,* (January 1972): 2-10.

2. Benoit, "Growth and Defense in Developing Countries," p. 273.

3. Expressed as a cumulative rate of annual growth between first and last years of the available series.

4. Benoit, "Growth and Defesne in Developing Countries," p. 274.

5. *Ibid.*

6. *Ibid.*, p. 275. This assumption of causality is adopted in this article.

7. G. Kennedy, *The Military in the Third World* (London: Duckworth, 1974), p. 188.

8. Mary Kaldor, "The Military in Development," *World Development* 4 (June 1976): 459-82.

9. Ibid., p. 472.

10. Alice H. Amsden, "Kaldor's 'The Military in Development'—A Comment," *World Development* 5 (August 1977): 757.

11. R. D. McKinley and A. S. Cohen, "The Economic Performance of Military Regimes: A Cross-National Aggregate Study," *British Journal of Political Science* (July 1976): 291-310.

12. *Ibid.*, p. 309.

13. David Dabeldo and James M. McCormick, "Opportunity Cost of Defense: Some Cross-National Evidence," *Journal of Peace Research* 14 (April 1977): 145-54.

14. *Ibid.*, pp. 152-53.

15. R. P. Smith, "Military Expenditure and Capitalism," *Cambridge Journal of Economics* 1 (March 1977): 61-76.

16. Benoit, "Growth and Defense in Developing Countries," pp. 277.

17. For a more detailed discussion on these points see David K. Whynes, *Economics of Third World Military Expenditures* (Austin, Texas: The University of Texas Press, 1979), Chapter 3, and also Richard Jolly, "Objectives and Means for Linking Disarmament to Development," in *Disarmament and World Development*, ed. Richard Jolly, (London: Pergamon Press, 1978), pp. 105-12.

18. Emile Benoit, "Growth Effects of Defense in Developing Countries," p. 3.

19. A. O. Hirschman, *The Strategy of Economic Development* (New Haven, Connecticut: Yale University Press, 1958).

20. Robert Looney and Peter Frederiksen, "The Regional Impact of Infrastructure Investment in Mexico," 15 *Regional Studies*: 285-296.

21. International Bank for Reconstruction and Development, *World Tables: 1976* (Washington, DC: International Bank for Reconstruction of Development, 1978).

22. We recognize that is entirely possible for a country to be "resource constrained" if only one or several of the more critical factors are present.

23. For an excellent discussion of this technique see Michael Anderberg, *Cluster Analysis for Applications* (New York: Academic Press, 1973).

24. Seven countries (Sri Lanka, Indonesia, Ghana, Kenya, Uganda, Pakistan, and Zambia) were excluded from the analysis due to lack of data reported by the World Bank.

25. The t-values appear in parentheses; an asterisk indicates significance at the 95% level, and indicates significance at the 99% level.

26. The equation was also estimated for Group I excluding the Dominican Republic due to its relatively low probability of correct classification. For this group (Group IA, n = 23), the estimated equation is

$$CIVGDP = 1.89 + 0.15INVEST + 0.12AID + 0.23DEFN;\ R^2 = 0.90 \quad [4]$$

$$(6.12)^{**} \quad (3.11)^{**} \ (4.03)^{**}$$

As expected, the R^2 value is slightly higher as is the t-value for the DEFN coefficient.

27. See Benoit, "Growth and Defense in Developing Countries," p. 274.

28. In addition, a test for structural change in the coefficients between the two sample sets was conducted using the procedure outlined by Chow (see Gregory C. Chow, "The Tests of Equality between Sets of Coefficients in two Linear Regressions," *Econometrica* 28 (July 1960): 591-605). The F-test resulted in the rejection of the null hypothesis (at the 99% level of confidence) that the two samples come from the same population. In other words, the two regression lines are not consistent with the same data, and the two groups come from different models or structures. This further statistical test supports the notion that the countries behave in a different manner as indicated in the text.

29. We also clustered the countries using exclusively a broader based set of social indicators from the *World Tables: 1976* (caloric intake, energy use per capita, infant mortality, life expectancy, urbanization, percentage of population in schools, percentage of population in agriculture, and physicians per 1000 inhabitants). Again, our regression results with two groups (higher and lower levels of development) of defense on growth were statistically insignificant.

30. A conflicting view is given in David Wall, "Import Capacity, Imports, and Economic Growth," *Economica* (May 1968): 157-169. Wall concludes that

> the requirement of economic development would be facilitated with increased flows of foreign exchange either in the form of improved export earnings or grants and grant-like aid. I believe however, that UNCTAD over-emphasizes the position of foreign exchange shortages as a constraint in the growth process. I also believe that this over-emphasis derives from its misguided acceptance of a model of economic growth which ascribes the role of engine of growth to industrialization based on imports of machinery and other capital goods [p. 169].

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