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DEFENSE EXPENDITURES AND ECONOMIC PERFORMANCE IN SOUTH ASIA: TESTS OF CAUSALITY AND INTERDEPENDENCE

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INTRODUCTION

The growth in world military expenditure is the supreme paradox of our age. While it is reasonable and prudent for a nation to make provision for security against external threats, one nation's security is likely to be another's insecurity. As a result, particularly in an atmosphere of hostility and suspicion, military expenditure assumes a competitive dynamic. The net result is a reduction in security for all nations. The realization that this bizarre process consumes huge quantities of resources with high opportunity cost in terms of the possibility of achieving higher standards of living is only slightly less disquieting (Treddenick, 1985: 77).

To date, economists have had relatively little to say about the causes and consequences of arms races, particularly those in the Third World. This neglect is surprising in that arms races have to do with resource allocations in a complex and competitive environment.

The purpose of this paper is to add this economic dimension through an examination of the interdependence between arms races and economic allocation in a developing world context. In this regard, India and Pakistan provide an ideal case study because of their interdependence from a geographic, economic, political, and social point of view (Chatterji, 1968: 87). Based on this analysis, several general conclusions follow concerning the causes and costs of the region's long-standing arms race.

REVIEW OF THE LITERATURE

In recent years an increasing number of studies of defense expenditures have used regression models with military expenditure as the dependent variable. These models encompass a variety of different types of data: mainly longitudinal time series for the advanced countries, and cross-country cross-sectional for the developing nations. These studies use a variety of theories about the character of the decision-making process and the

elevance of various military, political, and economic influences perating at domestic, regional, or global levels (Smith, 1989: 346).

Until quite recently, conventional wisdom held that strategic factors dominate year-to-year variations in Third World efense expenditures. Traditionally, strategic variables have ncluded such diverse elements as armed conflicts, arms races, nd alliances. The public good feature of military expenditures ithin alliances represents a major area of research based on he classic work of Olson and Zeckhauser (1966).

Internal influences include economic, bureaucratic, and olitical factors. The most direct economic factors are income nd prices. National income, within fairly broad limits, constrains what a country can afford, while the relative cost of nilitary provision will influence budgetary choices. Indirect conomic factors include the need to stabilize demand, control ublic expenditure, or subsidize industrial research and development. Bureaucratic explanations emphasize "incrementalism," argaining over the budget starting from the status quo. Political influences range from lobbying by the military-industrial omplex and other interest groups to the ideological position of he government (Smith, 1989: 346–47).

Recent empirical studies (Looney, 1989, 1990; Looney and Mehay, 1990) have confirmed the importance of economic variables in structuring budgetary allocations to the military. One ariant of this approach stresses the significance of Military Keynesianism—the use of military expenditures as a counteryclical tool. For example, Griffin, Wallace, and Devine (1982: 4) concluded that in the United States between 1949 and 1976, military outlays [as a percentage of GNP] do appear to be mployed as a counter-cyclical fiscal instrument by the state."

Treddenick's (1985) analysis of Canadian military expenditures demonstrated that economic imperatives often affect the evel and composition of a nation's allocations to defense. In this ontext, defense expenditures are often independent of any ecurity considerations. Here, the real reason for increased nilitary expenditures is to promote economic objectives. However, for political reasons governments justify those expenditures as roviding for national security. Treddenick (1985: 77) concluded hat: "large increases in Canadian defense expenditures have been nfluenced more by economic than security considerations."

More recently, Maizels and Nissanke (1986) examined military spending data for 83 countries. They hypothesized that the

tive importance of each factor is in turn influenced by national, regional, or global conflicts or interactions in the individual country. Using multiple regression analysis, they concluded that (1137):

> Domestic factors, particularly the need perceived by ruling elites to repress internal opposition groups, and external factors, including relations with the global power blocs and the availability of foreign exchange to purchase arms from abroad, also appear to be major determinants of government decisions regarding military expenditures.

Harris (1986) attempted to measure the effect of military expenditures from domestic economic conditions. In doing so, he examined the budgets (since the early 1960s) in five ASEAN countries: Indonesia, Malaysia, Philippines, Singapore, and Thailand. His main findings were (46):

1. A positive correlation existed between defense expenditures in the current year and the government's budgetary position in the previous year.
2. Current defense expenditures have a weak inverse correlation with inflation the previous year.
3. Although there were no correlations between current defense expenditures and the balance of payments in the previous year, the balance of payments affects government revenue, which in turn affects defense spending.

In an extension of the Harris paper, Looney and Frederiksen (1988), using time series data, examined the economic determinants of defense expenditures in ten Latin American countries: Argentina, Peru, Mexico, Venezuela, Chile, Paraguay, Uruguay, Colombia, Brazil, and Ecuador. Testing four alternative models with independent variables specified as current and lagged values of GNP, government expenditure, and military expenditures, they found (468): "a large proportion of variability in defense expenditures can be explained by economic variables; the overall constraint (GDP) and fiscal funding variables. . . ."

In extending Harris's work on the ASEAN countries, Looney and Frederiksen (1990) found three basic patterns: stabiliza-

tion (Singapore), augmentation (Ma

etween countries as to the timing of increased defense allocations. Specifically, Thailand exhibited a weak stabilization pattern. Korean defense expenditure patterns followed a long-run distributed lag function. For Thailand there was a weak stabilization effect. Indonesia represented a special case. Here, crude oil production produced the best measure of resource availability. Still, there was a weak augmentation effect as measured by the expected and unexpected rate of inflation.

Clearly, many countries experience periods during which economic variables constrain or at least modify the volume of resources allocated to defense. However, an alternate interpretation is also plausible—that defense expenditures themselves influence the economic environment and so, future allocations to the military (Looney, 1989c). One also might imagine that the underlying cause of defense allocations would at least in part influence the manner in which they affect the domestic economy (Maizels and Nissanke, 1986). Specifically, expenditures undertaken for Keynesian reasons should *ceteris paribus* impact positively on the economy. Similarly, those undertaken as a response to increased militarization in neighboring countries are much less likely to produce positive economic benefits.

The analysis below attempts to combine these two considerations: (a) the causes, and (b) the consequences of defense. Our purpose is to identify the patterns of causation between Indian and Pakistani defense expenditures. Having established this interrelationship we wish to examine the connection between arms races in the region and national economic performance. In doing so, we will test the five main hypotheses underlying the empirical literature summarized above:

1. *Defense Causes Growth.* The implicit assumption in a number of earlier studies such as Benoit (1973), Rothschild (1977), Frederiksen and Looney (1983, 1983a, 1985), Looney and Frederiksen (1986), Deger and Sen (1983), Leontief and Dutchin (1983), and Lim (1983) is that defense spending occurs prior to and causes economic growth.

2. *Defense is Growth Neutral.* Biswas and Ram's (1986) hypothesis is that defense spending neither helps nor hurts economic growth; the two are independent of each other.

[illegible]'s (1986) argument

fense spending; Harris (1986) and Looney and Frederiksen (1990) argue that the military may systematically receive the extra resources provided by economic growth.

4. *Defense and Growth Are Interrelated.* Rather than one way causality, a feedback mechanism exists between defense and growth.

5. *The Reasons for Defense Expenditures Determine Growth.* This hypothesis argues that the underlying reasons (Maizels and Nissanke, 1986, and Looney, 1988) for military expenditures will influence the manner in which defense affects growth. This implicitly assumes that a country's response to a neighbor's military buildup will have a greater likelihood of retarding growth than will defense expenditures incurred at the country's own discretion.

ALTERNATIVE TESTS FOR CAUSATION

Several statistical tests are available for addressing the issue at hand. To date, the original and most widely used has been the Granger Test.

Granger Test

Granger (1969) defines causality such that X Granger causes (G-C) Y if Y can be predicted more accurately in the sense of mean square error, with the use of past values of X than without using past X. For example, in assessing the relationship (the same basic formulation also applies to the arms race between the countries) between defense and economic performance, LaCivita and Frederiksen (1987) demonstrate that Granger causality can be specified as:

$$GDP_t = \sum_{i=1}^{p} a_i \, GDP_{t-i} + \sum_{j=1}^{q} b_j \, DEF_{t-j} + u_t \qquad (1)$$

$$DEF_t = \sum_{i=1}^{r} c_i \, DEF_{t-i} + \sum_{j=1}^{s} d_j \, GDP_{t-j} + v_t \qquad (2)$$

[illegible] GDP is the Gross Domestic P[illegible]

fense expenditures; p, q, r, and s are lag lengths for each variable in the equation; and u and v represent serially uncorrelated white noise residuals. By assuming that the error terms (u, v) are "nice" we estimate the specified model by the ordinary least squares (OLS) method.[1]

Within the framework of unrestricted and restricted models, a joint F-test is commonly used for causal detection. Here, the F-statistic is:

$$F = \frac{(RSS_x - RSS_u) \,/\, (df_x - df_u)}{RSS_u \,/\, df_u} \qquad (3)$$

where RSS_x and RSS_u are the residual sum of squares of restricted and unrestricted models, respectively; and df_x and df_u are, respectively, the degrees of freedom in restricted and unrestricted models.

To examine Granger-causality between GDP and DEF, we test the following hypotheses: $b_j=0$, j=1. .q and $d_j=0$, j=1. .s. If the former hypothesis is rejected but the latter is not, DEF causes GDP; whereas if the latter is rejected and the former is not, GDP causes DEF. If both are rejected, then there is a feedback between GDP and DEF. Failure to reject either of the two null hypotheses implies independence between these two variables. F-tests are used to test for the presence of Granger-causal relations.

One criticism of this procedure is the possibility of biases due to the omission of independent variables (Guilkey and Salemi, 1982). However Yamada (1985) has shown that it is very costly in terms of degrees of freedom to include more variables and/or more lags in the system when (as in the present case) only a small number of observations are available to test the Granger causality.

The Granger test typically employs the same lag length for all variables. This presents a potential problem. There is no a priori reason to believe that the same lag length is appropriate

[1] If the disturbances of the model were serially correlated, the OLS estimates would be inefficient, although still unbiased, and would distort the causal relations. The existence of serial correlation was checked by using a maximum likelihood correlation for the first-order autocorrelation of the residuals [AR(1)]. The comparison of both OLS and AR(1) results indicated that no significant changes appeared in causal directions. Therefore, we can conclude "roughly" that serial correlation was not serious in this model.

for all variables. In general if the lag length (for example, in equations 1 and 2 above) of either GDP or DEF (or both) is over-specified, the estimates will be unbiased but inefficient. Under-specified lag length of either DEF or GDP (or both) will lead to biased estimates with a smaller variance. One way to avoid this problem is to use Alaike's (1969) minimum final prediction error (FPE) criterion to specify the lag length of the right-hand side variable of an equation. Thornton and Batten (1985) advocate using this criterion as a basis for establishing optimal lag lengths. In arriving at this position they compared the FPE criterion with the Bayesian estimation and Pagano-Hartley criterion and concluded that the FPE criterion was superior. After establishing the appropriate lag lengths, F-tests of the joint significance of the lagged values for each variable can be performed.

Joerding (1986) tested the defense growth hypothesis using Granger causality methods. That is, he tested for the assumed exogeneity of defense budgets. Using a pooled sample containing 15 observations from each of 57 countries, Joerding employed a multivariate model that also included investment and government spending and concluded that defense expenditures are not strongly exogenous. From this he concluded that previous studies in the defense/growth debate appeared flawed.

While Joerding's work provides insight into the nature of the relationship between defense and growth, there are three issues that merit further attention (LaCivita and Frederiksen, forthcoming):

1. Joerding lumps all countries into one sample. This suggests that any causal relationship found by his analysis is common to all countries. In contrast, Frederiksen and Looney, in a review of Benoit's work, show that splitting a pooled sample into separate groups (here based on the level of relative resource constraints) can lead to quite different results.

2. By aggregating the sample, Joerding assumed a common lag structure for all countries in the sample (in his study, four years on the defense and growth variables). It seems reasonable to hypothesize that if a causal relationship does exist (either defense to growth or growth to defense) we could expect the time lag to differ from country to country.

3. Joerding's method for choosing lag length was ad hoc.

The results of Granger causality tests depend critically on the choice of lag length. If the chosen lag length is less than the true lag length, relevant lags may be omitted, causing bias. If the chosen lag is greater than the true lag length, irrelevant lags may be included, causing estimates to be inefficient.

While Joerding chose lag lengths based on preliminary partial autocorrelation methods, there is no a priori reason to assume equal lag lengths for all our sample countries. For example in a study of the Philippines, Frederiksen and LaCivita (1987) found no statistical relationship between growth and defense when including both variables with a lag equal to four in the estimating equation. Adjusting the lag length to two periods, however, produced the result that growth caused defense. Since both lag lengths are arbitrary, it is difficult to select one over the other.

The Hsiao Procedure

To overcome the difficulties noted above, Hsiao developed a systematic method for choosing lag lengths for each variable in an equation. Hsiao's (Hsiao, 1981) method combines Granger causality and Akaike's final prediction error (FPE). This term represents the (asymptotic) mean square prediction error, to determine both the optimum lag for each variable and causal relationships. In a paper examining the problems encountered in choosing lag lengths, Thornton and Batten (1985) found Hsiao's method to be superior both to arbitrary lag length selection and to several other systematic procedures for determining lag length.

The first step in Hsiao's procedure is to perform a series of autoregressive regressions on the dependent variable. In the first regression, the dependent variable assumes a lag of one year. In each succeeding regression, one adds another lag to the dependent variable. That is, we estimate M regressions of the form:

$$GPP_t = a + \sum_{i=1}^{m} b_{t-1}\, GDP_{t-1} + e_i \qquad (4)$$

where the values of m range from 1 to M. For each regression, we compute the FPE in the following manner:

$$FPE_m = \frac{T+m+1}{T-m-1} ESS_m \,/\, T \qquad (5)$$

where T is the sample size, and FPE_m and ESS_m are the final prediction error and the sum of squared errors, respectively. The optimal lag length, m*, is the lag length that produces the lowest FPE. Having determined m*, the next step estimates the equation with the lags on the other variable added sequentially in the same manner used to determine m*. Thus we estimate four regressions of the form:

$$GDP_t = a + \sum_{i=1}^{m*} b_{t-i} + GDP_{t-i} + \sum_{i=1}^{n} c_{t-i}\, DEF_{t-i} + e_i \qquad (6)$$

with n ranging from one to four. Computing the final prediction error for each regression as:

$$FPE_{m*,n} = \frac{T+m*+n+1}{T-m*-n-1} ESS_{m*,n} \,/\, T \qquad (7)$$

we choose the optimal lag length for D, n* as the lag length that produces the lowest FPE. Using the final prediction error to determine lag length is equivalent to using a series of F tests with variable levels of significance.[2]

The first term measures the estimation error, and the second term measures the modelling error. The FPE criterion has a certain optimality property that (Hsiao, 1979: 326) "balances the risk due to bias when a lower order is selected and the risk due to increases in the variance when a higher order is selected." As noted by Judge et al. (1982), an intuitive reason for using the FPE criterion is that longer lags increase the first term but decrease the RSS of the second term, and thus the two opposing forces are balanced optimally when their product reaches its minimum.

Again, using the example of defense and economic performance, four cases are possible: (a) *Defense Causes Growth*—occurring when the prediction error for growth is reduced when defense is added to the equation. In addition, when growth is added to the defense equation, the final prediction error increases; (b) *Growth Causes Defense*—occurring when the prediction error of growth increases when defense is added to the regression equation for growth, and is reduced when growth is added to the regression equation for defense; (c) *Feedback*—occurring when the final prediction error decreases when defense is added

[2] Since F-statistics are redundant in this instance they are not reported here. They are, however, available from the author upon request.

to the growth equation, and the final prediction error decreases when growth is added to the defense equation; and (d) *No Relationship*—occurring when the final prediction error increases when defense is added to the growth equation, and also increases when growth is added to the defense equation. As a caveat, our tests do not necessarily rule out the possibility that contemporaneous causality[3] can exist between the two variables (Gupta, 1987: 196; and Hsiao, 1981: 91).

Of course, the same conventions would hold in examining the causal relationship between Indian and Pakistani defense expenditures. Here we could use the procedures outlined above to assess both the initiating and any follow-on factors characterizing possible arms races between the two countries.

In summary, causality tests are sensitive to lag lengths. The use of shorter lags than actually existed may distort the causal impact of defense expenditures on economic growth (or regional arms races). On the other hand, using relatively long lags may mask any causality between defense expenditures and economic growth. Few studies have used an "atheoretical" methodology that allows data themselves to select appropriate lag lengths. Following Hsiao (1979, 1981), we use Akaike's final prediction error (FPE) to select optimum lag lengths for each variable in each equation.

METHODOLOGY

The data for military expenditures used to carry out the Hsiao tests are from the Stockholm International Peace Research Institute, *SIPRI Yearbook*; United States Arms Control and Disarmament Agency, *World Armaments and Disarmament.* Annual data on Gross Domestic Product and other macroeconomic variables are from various issues of the International Monetary Fund, *International Financial Statistics Yearbook.* When consistent price deflators were not available, the defense burden (the share of defense in GDP) replaced defense expenditures in the estimated equations.

At this point, several considerations remain. First, most economic time series are non-stationary. As shown by Judge et

[3] A number of conceptual problems involving definitions have crept into the causality literature. According to Hicks (1979) if X and Y co-exist, then X is said to cause Y if the non-existence of X implies the non-existence of Y. Hicks developed two major patterns of causality, namely (a) contemporaneous causality and (b) sequen-

al. (1982: 671), "stationary is an important property as it guarantees that there are no fundamental changes in the structure of the process that would render prediction difficult or impossible." To remove all possible non-stationarities, we defined real defense expenditures and real income variables in terms of their rates of growth. The coefficients of these variables regressed on a constant and time were insignificantly different from zero for all countries. Similar regressions of the untransformed levels suggested a trend.

Second, Sims (1972) has provided an alternative estimation procedure. As Feige and Pearce (1979) and others have pointed out, Sims' procedure is equivalent to Granger's once stationarity and invertibility conditions are assumed to be satisfied. Sims' formulation of the test procedure consists in regressing filtered variable Y on past, present, and future values of the other filtered variable, X, and testing jointly for the significance of the coefficients of future X's. We rejected the Sims test for the estimates below because as Gupta (1987: 197) notes: "... the existence of a systematic expectation mechanism of future depending on the past, in practice may lead to problems of interpretation of the coefficients of the future X's."

Third, because military expenditures may simply act as a proxy for government expenditures, separate regressions examined (when available) figures on government consumption and/or public sector capital formation. If the results were significantly different using these other forms of public spending, we concluded that the defense/growth relationship was unique and not spurious.

Finally, as with all econometric tests of this sort, sample size becomes a problem. Clearly, one must place more confidence in the results for the entire time period (usually 1955–1988) than in those for the sub-periods. One consolation is that the small sample performances of the Granger tests are superior to those of alternative causal schemes—the Sims and Modified Sims procedures (Guilkey and Samemi, 1982: 679).

The results of the causality analysis for the regional arms race exhibited several interesting patterns. Of prime importance is the direction of defense expenditure impact on the domestic economy, together with the final prediction error (FPE), and optimal lag.

PAKISTAN

combatants or oil states. Still, several broad trends are apparent:

1. During the mid–1950s, defense expenditures decelerated somewhat following the mobilization after independence. The net result was a contraction in defense as a share of GDP from 6.3% in 1953 to 3.7% in 1962.

2. Beginning in 1963, a fairly rapid expansion took place, with rates of growth reaching 9.7% (1963), 13.9% (1964), 60.8% (1965) and 19% (1966). By 1966, the share of defense expenditures in GDP had reached 6.8 percent.

3. The increase in defense expenditures leveled off over the 1967–1977 decade. As a result, their share of GDP remained about constant, increasing slightly in the early 1970s, but ending at approximately its 1967 level, 5.6 percent.

4. Since 1978, defense expenditures have shown a rapid and continuous expansion, averaging 10.7%, so that, by 1988, they were 7.2% of GDP.

While the conventional wisdom holds that an arms race has existed between Pakistan and India since partition (1947), there is ample evidence that this pattern has been somewhat one-sided, with Indian defense expenditures affecting those in Pakistan, but not vice versa:

1. During the period as a whole (1955–1987), a pattern existed between changes in the two countries' defense burdens. A conventional arms race, however, did not exist. Increases in Indian defense expenditures elicited a positive Pakistani response. However, increases in the Pakistani defense burden actually resulted in a mild contraction in Indian defense efforts (equation 1, Table 1).

2. During the earlier period (1958–1978), increases in Indian defense spending resulted in a strong, positive response from Pakistan. This response occurred with a two-year lag (equation 2, Table 1).

3. Finally, during the twenty-year period from 1967 through 1987, there was no statistically significant relationship between the growth in defense burdens of

A similar analysis using growth in military expenditures found almost the same picture. During the 1958–1987, 1958–1978 and 1960–1980 periods, Indian defense expenditures stimulated (with a three-year lag) a follow-on expansion of Pakistani defense expenditures (equations 4, 5, and 6, Table 1).

As with the growth in the defense burden, increases in the rate of growth of Indian defense expenditures resulted in a decline in the growth of Pakistani defense expenditures. It is clear, therefore, that the recent expansion in Pakistani defense expenditures was not simply a response to stepped-up Indian militarization.

To learn how Pakistani defense expenditures have affected the country's pattern of growth, similar causality tests examined the relationship between defense and various macroeconomic indicators. As a basis of comparison, the analysis examined time periods corresponding roughly to those selected for the Indian/Pakistani arms race analyses.

In general, defense expenditures in Pakistan have impacted differently than non-defense government allocations. This holds for the growth in expenditures (Table 2). This conclusion is not dependent on variable definition—nearly identical results (not shown) occurred for the growth in expenditure share of Gross Domestic Product.

1. Over the entire period, 1958–1988, there was no statistically significant relationship between the growth in either (a) total military expenditures (equation 1, Table 2), or (b) the military burden and the rate of growth of real Gross Domestic Product.

2. For the 1958–1978 period, however, increases in both the defense burden and military expenditures (equation 2, Table 2) impacted negatively on GDP.

3. Finally, for the most recent twenty-year period, the relationship between defense and GDP has shifted. Instead of affecting GDP, defense expenditures have themselves expanded (equation 3, Table 2) with the extra resources provided by the country's steady and rapid economic expansion.

4. In contrast, government allocations to non-military activities have not had an impact on the aggregate economy. Similarly, they seem unaffected by changing economic conditions (equations 4–9, Table 2).

TABLE 1

South Asia Arms Races: Country Causality Tests (Final Prediction Error)

	Defense Variables			
Dependent Independent	Pakistan Pakistan	Pakistan Indian	Indian Indian	Indian Pakistan
Pakistan/India (Growth in Defense Burden)				
1. 1958–1987 (feedback)	152.72 2 years (-) 0.154	113.18 2 years (+) 0.452	171.30 1 year (+) 0.042	166.56 1 year (-) 0.129
2. 1958–1978 (India→Pakistan)	229.65 2 years (-) 0.158	158.46 2 years (+) 0.523	229.34 1 year (+) 0.048	231.36 1 year (-) 0.128
3. 1967–1987 (no relationship)	40.47 2 years (-) 0.443	41.67 1 year (-) 0.481	78.46 1 year (-) 0.041	81.05 1 year (-) 0.062
Pakistan/India (Growth in Defense Expenditures)				
4. 1958–1987 (feedback)	154.34 2 years (-) 0.205	85.41 3 years (+) 0.641	197.82 2 years (+) 0.225	194.38 1 year (-) 0.289
5. 1958–1978 (India→Pakistan)	228.40 2 years (-) 0.215	98.61 3 years (+) 0.749	287.54 2 years (+) 0.241	291.40 1 year (-) 0.303
6. 1967–1987 (India→Pakistan)	49.73 2 years (-) 0.436	31.32 4 years (-) 0.763	63.05 2 years (+) 0.266	68.00 1 year (-) 0.282

Note: All variables are defined in terms of rates of growth. The first entry in each cell is the estimated coefficient, the second is the optimum lag, the third is the relevant sign, and the fourth is the adjusted coefficient of determination.

TABLE 2

Pakistan: Causality Between Government Expenditures and Gross Domestic Product, 1958–1988 (Final Prediction Error)

Dependent Var Independent Var	GDP GDP	GDP GEXP	GEXP GEXP	GEXP GDP
Defense Expenditures/Gross Domestic Product				
1. 1958–1988 (no relationship)	23.85 1 year (-)	24.76 2 years (-)	149.91 2 years (-)	158.71 1 year (+)
2. 1958–1978 (defense→GDP)	16.73 1 year (-)	15.37 2 years (-)	228.40 2 years (-)	251.07 1 year (-)
3. 1968–1988 (GDP→defense)	26.78 1 year (-)	29.40 1 year (-)	31.67 1 year (+)	28.42 1 year (+)
Total Government Expenditures/Gross Domestic Product				
4. 1958–1988 (no relationship)	23.85 1 year (-)	25.37 3 years (+)	142.26 1 year (-)	147.86 2 years (+)
5. 1958–1978 (no relationship)	16.73 1 year (-)	18.23 1 year (-)	189.52 1 year (-)	205.01 2 years (+)
6. 1968–1988 (no relationship)	26.78 1 year (-)	28.81 3 years (+)	65.35 1 year (-)	66.99 2 years (+)
Non-Defense Government Expenditures/Gross Domestic Product				
7. 1958–1988 (no relationship)	23.85 1 year (-)	25.20 1 year (-)	264.70 1 year (-)	278.54 2 years (+)
8. 1958–1978 (no relationship)	16.73 1 year (-)	18.16 1 year (-)	334.45 1 year (-)	352.24 2 years (+)
9. 1968–1988 (no relationship)	26.78 1 year (-)	29.31 1 year (+)	166.62 1 year (-)	172.14 2 years (+)

Note: GDP is the annual growth in Gross Domestic Product; GEXP is the annual growth in government expenditures (defense, total government expenditures, and non-defense expenditures). The first entry in each cell is the estimated coefficient, the second is the optimum lag, and the last is the relevant sign.

From these patterns, it appears that Pakistani defense expenditures impact on the economy as a whole only during periods when the country is responding to an Indian military build-up. During normal periods, defense expenditures appear to respond to changing economic conditions, rather than to cause economic change. It also appears that the fruits of increased economic growth have tended to be shared more with defense than with non-military government programs.

Another pattern of importance involves the relationship between defense and non-defense expenditures. There has been a tendency over time for defense expenditures to lead in the timing of government allocations. That is, when defense expenditures change, a corresponding adjustment also occurs in allocations to non-defense activities. As with the other patterns examined above, this relationship has changed in recent years (Table 3):

1. For the period as a whole, changes in defense expenditures tended to precede those of total government expenditures with about a two-year lag (equation 1, Table 3). For non-defense expenditures, the lag averaged about one year (equation 4, Table 3).

2. This pattern was also present in the earlier (1958–1978) period (equations 2 and 4, Table 3).

3. Still, during the more recent period, there has not been a statistically significant causal relationship between defense and non-defense allocations (equations 3 and 6, Table 3).

These findings are consistent with the pattern found above, where, in the last twenty years or so, increased economic growth has gone in large part to defense, not non-defense, categories as a whole.

Most likely, these patterns reflect the country's two basic fiscal constraints: a narrow tax base and the heavy commitment of expenditures on two current items, defense and debt service. Both of these categories appear to be irreducible and have continued to increase rapidly during a period of increased fiscal constraints. The federal budget itself has two main parts. The ordinary budget includes current expenditure, while the development or annual development plan (ADP) covers capital investment programs. A portion of federal income

Current expenditure accounts for the major part of total expenditure, averaging 65–75 percent in recent years.

Defense expenditure and debt service together accounted for 72.7% of current expenditures in the 1988/89 budget. The proportion of spending devoted to social items is low and apparently being squeezed by the demands of defense and debt service. The debt service burden continues to increase, reaching 36% of current expenditures in the 1988/89 budget. In practice, the government regularly revises the ADP downwards in light of: (a) reduced flows of foreign aid, and (b) local resources.

TABLE 3

Pakistan: Causality Between Defense Expenditures and Government Expenditures, 1958–1988 (Final Prediction Error)

Dependent Var Independent Var	GENDF GENDF	GENDF DEF	DEF DEF	DEF GENDF
Defense Expenditures / Total Government Expenditures				
1. 1958–1988	142.26	94.67	149.91	159.89
(def→gov exp)	1 year	2 years	2 years	1 year
	(-)	(+)	(-)	(+)
2. 1958–1978	189.52	119.40	228.40	251.84
(def→gov exp)	1 year	2 years	2 years	1 year
	(-)	(+)	(-)	(-)
3. 1968–1988	65.54	67.65	31.67	34.71
(no relationship)	1 year	1 year	1 year	1 year
	(-)	(+)	(+)	(+)
Defense Expenditures / Non-Defense Expenditures				
4. 1958–1988	264.70	231.17	149.91	160.01
(def→non-def)	1 year	1 year	2 years	1 year
	(-)	(+)	(-)	(+)
5. 1958–1978	334.45	290.09	228.40	251.59
(def→non-def)	1 year	1 year	2 years	1 year
	(-)	(+)	(-)	(-)
6. 1968–1988	166.63	180.55	31.68	34.71
(no relationship)	1 year	1 year	2 years	1 year
	(-)	(+)	(-)	(-)

Note: GENDF is the annual growth in total government expenditures and non-defense expenditures. DEF is the annual growth in defense expenditures. The first entry in each cell is the estimated coefficient, the second is the optimum lag,

The role of defense expenditures in compounding the government's debt situation is complex and difficult to identify. Changes in defense and total debt (Table 4) show no real relationship over the period from 1958–1978 (equations 1, 2, 4, and 5, Table 4). In more recent years, however, increases in defense and the defense burden appear to be related to the expansion in government debt. Here, the pattern has been one of increases in debt causing (a year later) increases in defense and the defense burden (equations 3 and 6, Table 4). One possible interpretation of this pattern is that the government contracts for funds before

TABLE 4

Pakistan: Causality Between Defense Expenditures and Total Government Debt, 1958–1987 (Final Prediction Error)

Dependent Var Independent Var	DEBT DEBT	DEBT DEF	DEF DEF	DEF DEBT
Defense Expenditures / Total Debt				
1. 1958–1987 (no relationship)	309.05 1 year (-)	321.86 2 years (+)	154.34 2 years (-)	162.48 1 year (-)
2. 1958–1978 (no relationship)	414.21 1 year (-)	440.86 1 year (+)	228.40 2 years (-)	249.83 1 year (-)
3. 1967–1987 (debt→def)	425.00 1 year (-)	458.71 3 years (+)	49.73 1 year (-)	45.81 1 year (-)
Defense Burden / Total Debt				
4. 1958–1987 (no relationship)	309.05 1 year (-)	315.82 1 year (+)	152.72 2 years (-)	163.31 1 year (+)
5. 1958–1978 (no relationship)	414.21 1 year (-)	427.55 1 year (+)	229.65 2 years (-)	252.51 1 year (+)
6. 1967–1987 (debt→def)	425.00 1 year (-)	446.40 1 year (+)	40.47 2 years (-)	40.27 1 year (-)

Note: DEBT is the annual growth in government debt, DEF is the annual growth in

making firm commitments to expand allocations to defense. Specifically, the authorities do not use increases in defense expenditures as the rationale for increased borrowing needs.

The relationship between non-defense expenditures and debt (not shown here) is much more straightforward.

1. For the period as a whole, non-defense expenditures preceded changes in total government debt by about a year.

2. Interestingly enough, increases in non-defense expenditures reduced the expansion in debt. That is, increases in non-defense expenditures had, with a one-year lag, a negative impact on the growth in total real government debt.

3. In recent years (1967–1987), there has been little or no relationship between non-defense expenditures and the growth in public sector debt.

These contrasting patterns of relationship between debt and public sector expenditures reflect, in part, the interaction of Pakistani revenues and expenditures. Again, defense and non-defense expenditures exhibit dissimilar patterns (Table 5):

1. For the period as a whole, increases in revenues facilitated increased defense expenditures. Again, this occurred after a one-year lag (equation 1, Table 5). This pattern also occurred in the 1958–1978 period (equation 2, Table 5).

2. In more recent times (1968–1988), defense expenditures and revenues have become intertwined. Increased defense expenditures expand revenues (with about a four-year lag period). In turn, augmented revenues increase defense expenditures. Here the lag averaged about two years (equation 3, Table 5).

3. Non-defense expenditures have not displayed a causal relationship with revenues over the period as a whole (equations 4 and 5, Table 5). Still, in the last twenty years or so, they have tended to precede revenues (equation 6, Table 5), but were not in turn enhanced by revenue expansion.

4. Aggregating both defense and non-defense into total

TABLE 5

Pakistan: Causality Between
Government Expenditures and Revenues, 1958–1988
(Final Prediction Error)

Dependent Var Independent Var	GEXP GEXP	GEXP GREV	GREV GREV	GREV GEXP
Defense Expenditures / Government Revenues				
1. 1958–1988	161.85	167.41	149.91	143.80
(revenues→def)	1 year	2 years	2 years	1 year
	(-)	(-)	(+)	(+)
2. 1958–1978	243.76	264.44	228.40	223.79
(revenues→def)	4 years	2 years	1 year	1 year
	(-)	(-)	(-)	(+)
3. 1968–1988	82.82	70.49	31.67	28.53
(feedback)	1 year	4 years	1 year	2 years
	(+)	(+)	(+)	(+)
Non-Defense Expenditures / Government Revenues				
4. 1958–1988	161.85	172.65	264.70	280.57
(no relationship)	1 year	1 year	1 year	1 year
	(-)	(+)	(-)	(-)
5. 1958–1978	243.76	268.49	334.45	364.62
(no relationship)	1 year	1 year	1 year	1 year
	(-)	(-)	(-)	(-)
6. 1968–1988	82.82	81.27	166.63	183.35
(non-def→rev)	1 year	1 year	1 year	1 year
	(+)	(+)	(-)	(+)
Total Government Expenditures / Government Revenues				
7. 1958–1988	161.85	172.65	142.26	151.80
(no relationship)	1 year	1 year	1 year	1 year
	(-)	(+)	(-)	(+)
8. 1958–1978	243.76	268.48	189.52	208.74
(no relationship)	1 year	2 years	1 year	1 year
	(-)	(-)	(-)	(+)
9. 1968–1988	82.82	85.20	65.54	71.79
(no relationship)	1 year	1 year	1 year	1 year
	(+)	(+)	(-)	(+)

Note: GEXP is the annual growth in government expenditures (defense, non-defense, and total expenditures). GREV is the annual growth in government revenues. The first entry in each cell is the estimated coefficient, the second is the optimum lag, and the last is the relevant sign.

this fiscal aggregate and revenues (equations 7, 8, and 9, Table 5).

The series of debt/expenditure/revenues findings summarized above is suggestive of the general budgetary process in Pakistan. Specifically, during periods when the government feels it must increase allocations to the military to counter increased Indian militarization, it allocates a larger share of its expanded revenues to the military. The authorities do not contract debt specifically for this purpose, however, perhaps because of the obvious difficulties of securing commercial funding for this type of activity. During these periods, the government confines its borrowing to support an expanded level of non-defense type activities.

In contrast, during periods when defense expenditures occur for reasons other than an increase in the perceived threat from India, the government apparently has the luxury of exploring alternative sources of financing. In the short run, it expands allocations to the military largely from increased revenues. If the magnitude of defense expenditures outruns the financial capacity of the government, the authorities turn to debt financing to complete the defense procurement process.

INDIA

While it is unlikely that Pakistani defense expenditures have had an appreciable effect on those of India, it is still apparent that changes in defense policy and planning in India have usually arisen from the experience of war and perceptions of continuing hostility on the part of its neighbors. Still, the 1970s witnessed a substantial change in the Indian approach to defense planning (Thomas, 1984: 239).

This change occurred when the authorities perceived domestic political unrest as undermining the security of the nation as much as external threats. This belief may have existed in the past, but only in more recent years has the security policy-making organization dealt with such considerations.

Other changes in Indian defense planning have come about through the gradual broadening and growing sophistication of the Indian economic and technological base (Thomas, 1984: 239). Military self-reliance, at least in certain sectors of Indian defense programs—notably the procurement of weapons for the Indian army and the anticipated use of the country's military industries as major foreign exchange earners—increasingly is becoming a factor influencing th

Within this context, Indian defense expenditures have shown remarkable stability over the 1952–1987 period:

1. Defense expenditures had a low of 1.8% of GDP in 1953 and 1956, but their high was only 3.8% (1987).

2. Relatively low defense burdens (averaging around 1.9% of GDP) characterized the 1950s. The rapid rise in defense expenditures in 1962 (38.2%) and 1963 (63.8%) increased the defense burden into the 3 percent range for most of the 1960s. Yet with strong economic growth, the country's defense burden had fallen to 2.9% by 1969.

3. Since 1970, defense expenditures have contracted in real terms in only three years: 1973—12.3%, 1974—6.3%, and 1980—6.2%. In all other years, defense has shown a steady expansion. The result has been an increase of the defense burden from 2.9% in 1970, to 3.8% by 1987.

4. The post–1981 increase in Indian defense expenditures is unusual by historical standards, with defense increasing at somewhat greater rates than the economy as a whole.

By 1980, defense expenditure was $9 billion, and the Indian military establishment wished to continue the newly developed defense trajectory with extensive spending beginning in 1981 (Ward, 1990: 17).

India produces under license most of its own military equipment, including tanks and jet fighters. It produces military goods of sufficient technological quality to be competitive in many newly industrializing or less developed nations. Hard currency earned in this manner enables the country to import more advanced weapons and other military goods. India's desire to maintain or increase its status in the international defense community has an undeniable effect on its military budgeting and policy, in spite of somewhat significant economic constraints.

As with Pakistan, causality tests attempted to establish the direction of linkage between Indian defense expenditures and economic growth. Has defense simply responded to the greater volume of resources provided by an expanding economy, or [illegible] expenditures initiated changes in the

1. For the period as a whole (equation 1, Table 6), defense affected GDP growth rather than vice versa. This impact was positive and occurred with an average lag of approximately two years.

2. The same patterns also characterized two twenty-year sub-periods, 1957–1977 and 1967–1987. In both cases (equations 2 and 3, Table 6), the impact of defense on growth was positive, with growth not significantly influencing the government's allocations to the

TABLE 6

India: Causality Between Defense Expenditures and Gross Domestic Product, 1957–1987 (Final Prediction Error)

Dependent Var Independent Var	GDP GDP	GDP DEF	DEF DEF	DEF GDP
Defense Expenditures/Gross Domestic Product				
1. 1957–1987	24.76	17.59	200.98	214.40
(defense→GDP)	2 years	2 years	2 years	1 year
	(-)	(+)	(+)	(+)
2. 1957–1977	22.96	15.00	302.66	307.04
(defense→GDP)	4 years	1 year	2 years	3 years
	(-)	(+)	(+)	(-)
3. 1967–1987	26.99	19.79	63.06	66.85
(defense→GDP)	1 year	2 years	2 years	1 year
	(-)	(+)	(+)	(+)
Defense Burden/Gross Domestic Product				
4. 1957–1987	24.76	16.88	184.73	196.40
(defense→GDP)	2 years	2 years	1 year	1 year
	(-)	(+)	(+)	(+)
5. 1957–1977	22.96	14.22	254.20	239.31
(feedback)	4 years	1 year	1 year	3 years
	(-)	(+)	(+)	(-)
6. 1967–1987	26.99	20.14	78.47	86.01
(defense→GDP)	1 year	1 year	1 year	1 year
	(-)	(+)	(-)	(+)

Note: DEF is the annual rate of growth of defense expenditures. GDP is the annual rate of growth in the Gross Domestic Product. The first entry in each cell is the estimated coefficient, the second is the optimum lag, and the last is the relevant sign.

military. A minor difference occurred when the defense-to-growth link occurred with only a one-year lag in the earlier, 1957–1977, period.

3. Similar results (equations 4, 5, and 6, Table 6) occurred using the defense burden (the share of defense expenditures in GDP), the only difference being the 1957–1977 period, where a feedback effect occurred from GDP to defense. This feedback had an average lag of three years and was negative.

A somewhat different pattern (not shown) occurred using both total government expenditures and government consumption in place of allocations to defense:

1. For all three time periods, 1957–1987, 1957–1977, and 1967–1987, a feedback effect occurred with total government expenditures, whereby they impact positively, with a long lag, on GDP. In turn, GDP growth affected (negatively) total government expenditures, with a shorter (1–2-year) lag.

2. Similar patterns occurred using government consumption. In this case, as one might imagine, the lags were shorter.

These findings are consistent with those obtained by other researchers. Ward et al. (1990) have developed a formal model of the economy in which the impact of defense expenditures over the period 1950 to 1987 occur within the context of a Mintz-Huang neoclassical growth model. In this model, defense impacts directly on both growth and investment.

Besides government expenditures, both military and non-military, economic growth is also a function of the growth in: (a) investment, and (b) increases in labor productivity. The main findings of Ward et al. indicate that investment and government spending both have a positive impact on growth. Separating government spending into military and non-military, they found that both had a direct, strong, and positive effect on economic growth in the short run. In addition, they concluded that non-military expenditures had about a one-third greater impact on GDP than military expenditures.

The Ward model links new investment to production and government spending—both military and non-military—as well as to the depreciating level of capital stock. This formulation has

military expenditures influence investment, and in the longer run, GDP growth. Their findings suggest that: (a) private consumption in India drives down investment, (b) government spending, both military and non-military, occurs with higher levels of investment, and (c) the capital stock increases investment levels.

It is especially interesting that both military and non-military government expenditures produce favorable effects. These findings suggest that the short-run multiplier of military spending is positive in India, with the spinoff effect providing enhanced economic growth in the longer run.

Indian defense expenditures appear to have a beneficial impact on growth and investment, although historically they have been a very heavy user of foreign exchange. For example, Terhal's (1982) analysis of the 1950–1972 period concluded that the total foreign exchange requirements for defense were equivalent in value to nearly half the Indian imports of machinery and equipment. Terhal found that during the 1960–1970 decade the level of these foreign exchange requirements oscillated between 8% and 42% of the deficit on the balance of payments. During this period they averaged 20% (Terhal, 1982: 256).

This apparent paradox, the positive impact of defense expenditures on growth and investment and the diversion of foreign exchange from non-defense activities, reflect the dynamics of government expenditures and public indebtedness. Using the Granger test to determine the causal direction of government expenditures and public sector debt, it appears (Table 7) that:

1. Defense expenditures appear to have played a direct role in increasing the country's foreign currency denominated debt. This finding holds whether one uses the growth in defense burden expenditure (equation 1, Table 7) or the growth in military expenditures (equation 2, Table 1).

2. For the 1957–1987 period as a whole, increases in defense preceded increases in foreign currency debt with an average lag of about three years (equations 1 and 2, Table 7).

3. A considerably different relationship has developed between total government expenditures and the government's debt. Here, Granger causality

4. Movements in this type of foreign currency denominated debt have tended to lead changes in government expenditures by two years. In addition, the impact on total government expenditures has been negative (equation 3, Table 7).

5. As a basis of comparison, Granger tests examined the linkages between defense and the growth in real gross capital formation (investment) and debt. Here, no relationship occurred with foreign currency denominated debt (equations 4 and 5, Table 7).

TABLE 7

India: Causality Between Expenditures and Government Debt, 1957–1987 (Final Prediction Error)

Dependent Var Independent Var	DEBT DEBT	DEBT DEF	DEF DEF	DEF DEBT
Defense Burden/Foreign Currency Denominated Debt				
1. 1957–1987	267.74	202.76	184.73	195.06
(defense→DEBT)	4 years	3 years	1 year	2 years
	(+)	(+)	(+)	(-)
Defense Expenditures/Foreign Currency Denominated Debt				
2. 1957–1987	267.74	164.84	200.98	214.55
(defense→DEBT)	4 years	3 years	2 years	1 year
	(+)	(+)	(+)	(-)
Total Government Expenditures/Foreign Currency Denominated Debt				
3. 1957–1987	267.74	280.65	107.19	103.76
(DEBT→GOVEXP)	4 years	2 years	4 years	2 years
	(+)	(-)	(-)	(-)
Gross Capital Formation Share of GDP/Foreign Currency Denominated Debt				
4. 1957–1987	267.74	287.87	36.78	38.81
(no relationship)	4 years	1 year	2 years	1 year
	(+)	(+)	(-)	(-)
Gross Capital Formation/Foreign Currency Denominated Debt				
5. 1957–1987	59.82	60.74	36.78	39.16
(no relationship)	4 years	1 year	2 years	1 year
	(+)	(+)	(-)	(-)

Note: DEF is the annual rate of growth of defense expenditures. DEBT is the annual rate of growth in foreign currency denominated debt. The first entry in each cell is th

These findings support the notion that government spending is a high priority for Indian development planners, so long as revenues expand fast enough to keep the so-called debt trap from overtaking macroeconomic conditions. Apparently this pattern is fairly common in the developing world (Looney, 1987a, 1989b).

The findings above and those for Pakistan also suggest that a certain amount of fungibility may exist between debt and revenues in India (and that fungibility is greater than in the case of Pakistan). However, due to problems of measurement (McGuire, 1972) the issue of fungibility is controversial. The apparently higher degree of fungibility in India may arise from the fact that the monitoring costs of international lending institutions are higher there than in Pakistan. In any case, fungibility, together with the high priority given defense spending, allows the military to finance its acquisitions with foreign denominated debt. Through this mechanism, the government finances defense expenditures without necessarily pre-empting the country's foreign exchange earnings from other types of development activity. The impact of defense expenditures on growth can therefore remain positive. Although not identified directly here, this positive impact presumably occurs through short-run direct Keynesian demand linkages (Looney, 1989c) and longer run supply-side spinoff-type effects (Deger and Sen, 1983).

There are apparently limits on how far the government will go in expanding its foreign currency denominated debt to finance military expenditures. In fact, there are several interesting links between India's pattern of military expenditures and the country's development. For many years, India's primary supplier was the Soviet Union. In part this relationship developed due to the Soviets' acceptance of Indian rupees, as well as hard currency as an exchange currency, and the existence of a barter system of payments.

This situation was enhanced for the Soviets during the 1980s as India experienced inflation, leading to a decline in their balance of payments position. First the Indian military was already familiar with Soviet equipment such as the MIG–27 fighter jet. Additionally, the shortage of hard currency in the country meant that exchange in any medium besides the rupee would involve great difficulties with any purchase package proposed by Western European nations or the United

dize the complementarity of defense expenditures and economic progress. Yet, the government seems aware of this, and, in February 1989, the Ministry of Defense increased arms exports to raise funds in hard currency to purchase high technology weapons systems from the West and upgrade the Indian military forces. This promises to be an important trend in the 1990s (Ward, 1990: 17).

CONCLUSIONS

Summing up, Pakistan's defense expenditures do not occur merely in response to Indian militancy. While this may have been true in the early years after independence, there is little evidence that this relationship exists any longer. The analysis above suggests that negative impact of defense on the economy may have stemmed from an overreaction to Indian defense expenditures. The net result was to compress military allocations into too narrow a time frame to allow for an efficient transfer from the civilian sector. The fact that debt increases to cover unanticipated overruns in the defense budget supports this interpretation. In addition, Pakistan's lack of a sizable defense industry sector negated the possibility of any positive military Keynesianism effects that could have provided a short-run stimulus to the economy.

In contrast, India appears to have had much better control over its allocations to defense. There is little evidence that Pakistan forced India into a regional arms race (although we did not test for Chinese defense expenditures), and until recently, Indian defense spending has not really grown much faster than the economy as a whole. These factors may have allowed India's sizable defense industry sector to benefit from military Keynesianism effects while simultaneously remaining below the level consistent with efficient resource absorption. In short, even with three potentially hostile borders and wavering international alliances, India has managed to provide for its national defense at a cost that does not appear to have markedly impeded its economic progress, and may have aided the development of the industrial sector.

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