IMPACT OF MILITARY EXPENDITURES ON ECONOMIC DEVELOPMENT

INTERIM SYNTHESIS REPORT

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EXECUTIVE SUMMARY

The attached Report, coming at a time of heightened interest worldwide in the relationship of military expenditure to economic development, is one of three Phase I project component products, namely an "Interim Synthesis Report," a "Design for Country Case Studies," and annexes appropriate to the above.

The Interim Synthesis Report firstly assesses the deficiencies of available data for analyzing the relationship of security and development in A.I.D.-recipient countries. With respect to one application of immediate relevance to A.I.D., that of the statistical analysis carried out in preparation of the annual Section 620(s) report, shortcomings of data used by A.I.D. are shown to distort the computation of regional norms for military expenditure and the identification of countries that exceed the comparative norms.

The report then goes on to survey virtually the entirety of the literature on security and development, broken down into a review of the empirical evidence on the determinants of military expenditure in developing countries, the economic impacts of military expenditure, and the important differences in the relationships between security and development in developing country sub-groups.

The review in one sentence could be summarized as finding that, in the circumstances of most developing countries, higher defense expenditures, though they may have some positive "spin-off" effects, tend to reduce economic growth by reducing capital formation as resources are diverted from saving and investment. This emergent consensus from the body of empirical investigations conducted over the past two decades appears to have policy implications for the evaluation of military expenditures in A.I.D.'s formulation of country development strategies. Devising procedures to guide A.I.D.'s evaluation of the impacts of military spending, at the A.I.D.-recipient country level, is the purpose of country case studies to be carried out in Phase II.

A major question underlying the report -- how A.I.D. might influence the causes and consequences of military buildups -- awaits the field investigations of Phase II. It would be premature to anticipate those conclusions, even though their import seems to grow by the day as A.I.D. claimants increase their demands at the same time as net resources available for traditional recipients decline; and as a large army of a developing country invades a vulnerable neighbor, reminding the world anew of the shattering long-term consequences of unchecked military buildups.

A companion report on the design of the country case studies reviews the goals and objectives of the proposed field investigations, showing why intensive case study work is the required next step in "getting a handle" on the security/development nexus. It provides a preliminary agenda for country research plans and demonstrates the feasibility of in-country research on military expenditure, on the basis of the experience of the research team in place for Phase II.

In Phase I the Project Director and Senior Social Scientist were assisted by the contributions of the project Statisticians, Professor Robert E. Looney and Miss Bettina Aten, whose statistical analyses appear as Annexes to this Report; by Professor Merilee Grindle and Dr. Michael McLindon, Senior Social Scientists; and by Professor Arpad von Lazar, member of the project Advisory Board. In addition, the project received the exceptional assistance of a student team, which came in two ways. In an advanced graduate seminar on the topic of this Report, taught by Professors West and Thompson, fifteen graduate students of the Fletcher School of Law and Diplomacy prepared essays reviewing and synthesizing substantive dimensions of the literature surveyed in this Report. Each of the students is thanked for outstanding work in preparing his essay. In addition, three Fletcher students, Thomas Kennedy, Steven Noerper, and Bruce Aylward, made extremely important contributions by abstracting the student essays for inclusion in Parts II, III, and IV of the Report. Irene Marr and Martha Brettschneider assisted in the compilation of the bibliography and assembly of data for analysis by the project Statistician.

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PART I.
INTRODUCTION

This Report is one product of a study project on "The Impact of Military Expenditures on Economic Development," undertaken on behalf of the U. S. Agency for International Development by the Fletcher School of Law and Diplomacy, Tufts University. The purpose of the study project is to contribute to an increase in A.I.D.'s understanding of the relationship between military sector activities and economic development, and to devise an analytical framework that can be used by A.I.D. to assess the military-development relationship in A.I.D.-recipient countries.

Phase I of the study project is devoted to preparatory studies and to the design of a conceptual framework and plan of action for country case studies. The case studies, to be conducted during Phase II of the project, will analyze military-development relationships in selected A.I.D.-recipient countries.

The Interim Synthesis Report, a product of Phase I of the project, summarizes the findings of a literature review and presents the results of cross-country statistical analyses undertaken to resolve a few key questions left unanswered in the existing literature.

Literature review. The objective of the literature review is to identify the theories and hypotheses in recent scholarly research into the causes of military expenditures and their impact on various aspects of economic development, and to summarize the empirical evidence in the literature on these issues, highlighting areas of consensus and controversy. More specifically, the literature review is intended to do the following:

(1) Review, analyze and synthesize the research and empirical evidence on the determinants of military expenditures in developing countries, including analysis of the budgetary decision-making process and the importance of such factors as existence of external threats, internal bureaucratic processes, access to resources, etc.

(2) Review, analyze and synthesize the research and empirical evidence on the impacts, both positive and negative, of military expenditures on economic growth in the developing countries.

(3) Assess the important distinctions among country sub-groups with different conditions likely to influence the causes and consequences of military sector expenditures.

Recent scholarly literature on these three topics is reviewed in Parts II., III. and IV. of this Report.

The inclusion of books, research reports and journal articles in this review is necessarily selective and the reader should be aware of the criteria which have guided the process of selection. The literature reviewed in this Report is (almost entirely) confined to items which have been published in the English language during the past two decades. The purpose is to ensure that the user of this Report will, to the extent possible, find the literature cited to be readily accessible. Neither the publication-date nor the language restriction has proved, in practice, to be seriously confining. While a substantial body of writing on these topics has appeared in other languages, for some decades English has quite clearly provided the dominant media for publication in this area of scholarly research. Distinctive contributions in other languages promptly appear in English translation or interpretation.

Other important criteria of selection are the emphasis in this Report on studies which have systematically evaluated empirical evidence and on the work of researchers who have subjected explicit propositions or hypotheses to empirical tests. Statistical analyses of the causes and consequences of military expenditures have grown rapidly in volume and sophistication over the past several decades; this constitutes a clear and important trend in scholarly research on the relationship of security and development. Nonetheless, in selecting studies for review in this Report, we have given empirical orientation and formal testing procedures more than proportional representation.

The reason for this emphasis is because these statistical analyses can suggest types of relationships governing the causes and consequences of military expenditure which can be subjected to case-study evaluation. The chief purpose of this review of the literature is to identify findings which can be incorporated in the design of country case studies, to be conducted during Phase II of this project. The empirical and statistical studies -- both cross-sectional and longitudinal -- are most effective in identifying patterns of association between security and development which should be investigated in more detail in case studies, where the relationships can be subjected to a thoroughgoing historical examination of the economic and political systems in individual countries.

A survey of the literature will show that most of the recent statistical work on the relationship of economic growth and

security expenditures in the Third World has been based on analysis of relationships observed in a cross-section of countries. There are several reasons for this. Researchers have found the cross-section design to be more useful than case studies and longitudinal investigations in seeking to verify patterns applicable to a broad spectrum of countries. Cross-sectional research has also been encouraged by the development, over the past twenty years, of regular data assembly, editing and reporting on military-sector activity in a large number of countries -- a cooperative, international enterprise in data publication which we will inspect in the next section of this Report. This emphasis among investigators on the use of macro-statistical and cross-sectional research methods has led to the increased employment of econometric techniques in studying both the causes and the effects of military expenditures. Econometric methods have become increasingly popular among investigators in this subject area because they permit the adoption of familiar techniques to survey simultaneously many countries and multiple explanatory variables.

For all three of the topics reviewed in this Report, research employing econometric testing models and a variety of related macrostatistical methods is found to be highly influential in fashioning the body of widely-accepted evidence concerning the relationship of security and development in the Third World. This demands attention to the question of the reliability of statistical inferences derived from econometric tests of cross-country experience in this area. In our review of the literature, we underscore the care with which readers should assess the reliability of findings which are based upon macro-statistical methods of empirical investigation, as they have been used in this subject-area. This concern is a reflection of a vigorous and unresolved debate in the literature with respect to the degree of confidence with which readers may accept conclusions about the causes and effects of military expenditures which rest upon evidence obtained from cross-sectional, statistical tests. A broad-ranging critique of the reliability of the research methods which have been employed in this literature may be found in Chapters 3 and 4 of Nicole Ball's recent volume, Security and Economy in the Third World (Ball 1988, 84-157). The parameters of the debate between the critics and defenders of the disputed research methods were defined in an exchange in Orbis, more than a decade ago, between Stephanie Neuman and Dan and Ron Smith (see Neuman 1978; Smith and Smith 1979).

Questions concerning the reliability of research findings derive from problems concerning the data employed in the analysis and from problems respecting the research methodology. Both sets of problems arise in evaluating the findings which we will review in each of the three topic-areas surveyed in this Report -- the determinants of military spending, in Part II., the economic impacts of military expenditure, in Part III., and how these

effects differ in sub-groups of countries, in Part IV. The dimensions of the data and research methodology problems which are common to assessing the reliability of findings in the literature on all three topics are introduced and briefly described in the concluding sections of this Introduction.

Statistical analyses. Provision was made in the design of this project for the conduct of limited cross-country statistical analysis which might be found necessary to resolve key outstanding questions and to build empirical evidence for a consistent theoretical model explaining military-development relationships under a variety of developing country conditions. Two such lines of investigation were conducted to fill gaps in the existing literature and to address issues of central importance in fulfilling the objectives of this project. The statistical analyses on these two questions were carried out by the project Statisticians: Miss Bettina Aten of the Department of Economics, University of Pennsylvania, and Professor Robert E. Looney of the Naval Postgraduate School. The descriptions of their investigations appear as Annexes to this Report.

The first line of investigation concerns the validity and reliability of the estimates of real military expenditures used for cross-country analytical purposes. In a study prepared by Miss Aten a test is conducted, to compare the results of different methods used to convert military expenditures data, originally expressed in local currency at current prices, into a common numeraire (e.g., into real dollars at constant prices).

There has been a long-standing concern about the validity of exchange-rate-converted estimates, and about the reliability of their use in making cross-country comparisons of military expenditures. Until very recently the information on military price levels in many countries has not been available to permit a direct comparison to be made of the effect of using different methods of currency conversion. Employing the results of recent research on military price levels in a large number of countries, Miss Aten explores how much difference it makes, for analytical purposes, whether the "real" expenditures estimates are derived by use by exchange rates or by use of purchasing power parities.

While the results of her study have a wide range of potential applications in the statistical investigation of relationships between security and development, the focus of her analysis in the paper appended to this Report is A.I.D.'s use of defense expenditure estimates to define regional norms and to identify recipient countries which have exceeded the norm for military expenditure, as required for purposes of reporting to Congress by Section 620(s) of the Foreign Assistance Act. Her findings are assessed in the next section of this paper, in the context of the discussion of problems of military expenditure data reliability.

The second line of statistical investigation explores further the evidence that the linkages from military expenditures to economic growth differ for sub-groupings of developing countries. The studies which have demonstrated the differences among country groupings and identified the characteristics of the sub-groups, reviewed in Part IV. of this Report, have employed empirical observations for a cross-section of developing countries in the 1960s and 1970s. In his paper appended to this Report, Professor Looney extends this line of investigation into the decade of the 1980s to show the persistence of the inter-country variation in the military expenditure-economic growth relationship, and to up-date the information on the characteristics of the sub-groups of developing countries.

The immediate utility of Professor Looney's statistical analysis is to confirm the prospect of using a typology of Third World countries -- defined by the characteristics which differentiate the sub-groupings described above -- to serve as criteria for the selection of case-study countries for field investigation during Phase II of this project. The evidence presented by Professor Looney is that these sub-groups, each with a different pattern of relationships between military expenditure and economic growth, have persisted for more than two decades despite very great changes in the economic and political environment in the Third World. His demonstration that the groupings have relatively long-term definition makes it feasible to adopt these group-characteristics as country-selection criteria for field studies in the 1990s. This application of Professor Looney's statistical analysis is described in a companion Report entitled "Design for Country Case Studies."

I.a) RELIABILITY OF RESEARCH RESULTS: PROBLEMS OF DATA

The past two decades have seen a very significant improvement in the availability of quantitative information about the level of military sector activity in a large number of countries. Key indicators of this activity in virtually all countries of the world -- including estimates of military expenditures -- are currently assembled, adjusted to improve international comparability, and reported on a regular basis by the International Monetary Fund, the Stockholm International Peace Research Institute, and the U.S. Arms Control and Disarmament Agency (ACDA). (A description of these sources and of the military expenditures data reported by each appears in Ball 1988, 84-87 and Appendix 2.) The ready availability of this information, and growing confidence in its validity, has spurred the growth of scholarly attention to analysis of the security-development relationship in the Third World; it has contributed importantly to the research emphasis on cross-country analysis and to the trend toward adoption of econometric and other quantitative methods.

RELIABILITY OF EXPENDITURES DATA

Accuracy of observations. The scale and persistence of the international effort to assemble information on military expenditures by a large number of countries and to report the data on a comparable basis, across countries and through time, has been only partially reassuring to users of the data. Skepticism with respect to the reliability of the data is based in large part on the fact that, regardless of the efforts made by international reporting agencies, the primary source for information on defense spending is the national governments and those governments are believed to employ a number of mechanisms to disguise the level of their security expenditures. There are believed to be political and national security motives for under-reporting defense spending. Investigation of the mechanisms used by governments to obscure their security activities, and other internal evidence of inaccuracies in reporting, have nourished the attitude of skepticism among researchers in this field, but have made little headway in estimating the magnitude of the reporting errors. (For a survey of studies on this subject, see Ball 1988, 111-122; see also earlier reports by Brzoska 1981 and Ball 1984.)

Composition of security expenditures. A second source of serious concern about the reliability of available information on military expenditures by many countries, and the usefulness of this information in studies of security-development relationships, is the highly aggregated nature of the reported data. For many countries, the international reporting agencies provide no more than a single figure for defense expenditures in a given year. More detailed information on the composition of military expenditures is available for only a limited number of countries, and reporting categories frequently change from year to year.

This weakness has been the particular target of the United Nations Department of Disarmament Affairs, and of a sequence of Expert Groups which, since 1975, have guided the United Nations' efforts to induce member governments to publish a unified reporting schedule of security expenditures data in a disaggregated form. (See United Nations, Department of Disarmament Affairs, 1983; Ball 1988, 97-111). Adoption of the unified security expenditure reporting system by member governments has been very partial, but there has been a gradual increase in the reporting of disaggregated data and provision of additional information on the composition of military expenditures. (These trends are evident in a recent report on compliance with the U.N. reporting system: United Nations General Assembly document A/41/622 of 25 September 1986.) There is now a sufficient volume of reporting on military expenditures in a disaggregated form to support experimental efforts to compute military expenditure price levels and to estimate the real quantities of military inputs for a substantial cross-section of countries, as described below.

Price levels and methods of conversion. In the absence of information about the composition and the price levels of military expenditures, reliable methods are not available to compare year-to-year changes in real quantities represented by the defense expenditures of a given country, nor to convert local currency data into values expressed in a numeraire or base currency. Data converted to a numeraire are needed to aggregate and compare the various national expenditures in different countries. This inability to present reliable indicators of real quantities corresponding to reported military expenditures, which can be compared through time and across countries, may be the most serious data problem affecting study of the relationships reviewed in this Report. Gradual progress is being made to overcome this critical problem of data reliability.

The need to introduce a reliable conversion methodology for military expenditures has long been recognized by scholars (see, for example, Fontanel 1987; West 1987) and by ACDA, among the major international reporting agencies. A decade ago ACDA included in its annual World Military Expenditures and Arms Transfers report a discussion of the use of exchange rates and purchasing power parities (PPPs) to make international expenditure comparisons. It acknowledged that PPPs are recognized as the most reliable means of converting local currency data into a common denominator in order to make valid expenditure comparisons within countries and among countries for either a particular year or a series of years. Lacking an adequate data base of PPP conversion ratios, ACDA and other reporting agencies have generally used exchange rates, because they have been the only conversion rates available for most countries. However, for many countries exchange rates do not accurately reflect the relative purchasing power of the currency. Moreover, exchange rates do not readily adjust to varying inflation rates in different countries, but tend to move abruptly with currency revaluations or devaluations. Exchange rates are particularly unreliable indicators of purchasing power in developing countries; their use introduces very serious distortions in the estimation of "real" quantities for purposes of international comparisons, aggregation across countries, or the study of real changes through time. (See U.S. Arms Control and Disarmament Agency 1980, 15-17.)

The United Nations Department of Disarmament Affairs is also a strong advocate for the construction of military price indexes and the use of purchasing power parities for the international comparison of military expenditures. (See U.N., Department of Disarmament Affairs, 1986.) Efforts coordinated by the U.N. have produced a critical mass of disaggregated military expenditure data, as noted above, and this has made possible the computation of an initial set of military price levels and real (PPP) military expenditure estimates for a large number of countries.

REAL MILITARY SHARES AND BURDENS FOR SECTION 620(s) REPORTS

Section 620(s) of the Foreign Assistance Act is intended to restrain arms races and proliferation of sophisicated weapons, and to ensure that resources intended for economic development are not diverted to military purposes. The implementation of Section 620(s) requires A.I.D. to examine the pattern of defense expenditures, define regional norms, and identify A.I.D.-recipient countries which have exceeded the norms for military expenditures as compared to other countries regionally and worldwide.

To provide cross-country comparability, statistics are computed of military expenditures expressed as a percentage of gross national product (generally called the "military burden") and of central government expenditures (called the "defense share"). These data are employed in a statistical analysis, comparing the military burden and defense share ratios and rankings, to establish an annual checklist of Section 620(s) countries. A.I.D. reports to Congress, for each country on the checklist, the political, economic and security factors determining whether or not U.S. assistance should be ruled out under Section 620(s) considerations. (See U.S. Agency for International Development May 1989.)

The statistical analysis is used, then, to compute regional norms and to identify the checklist-countries, i.e., the countries in each region with military burdens and defense shares which most greatly exceed the norms.

In recent years, A.I.D. has defined regional and worldwide norms by reference to a panel of 117 countries, which we will refer to as the panel of 620(s) countries. The panel includes all (82) countries receiving U. S. development assistance and economic support funds in FY 1990 or FY 1991 (i.e., the "A.I.D.-recipient" countries) -- except for four small African island-nations, Namibia and the USSR. In addition, the panel includes 41 other (mostly developing) countries in the four A.I.D. regions. For a given reporting year, data are not available to compute statistics for all panel countries; in the most recent Section 620(s) report (with data for 1985) defense shares were recorded for 80 panel countries and military burdens for 84.

The data used by A.I.D. in the statistical analysis are the ACDA (World Military Expenditures and Arms Transfer) estimates for military expenditure, central government expenditure, and gross national product. This set of estimates is expressed in "constant dollars," converted by ACDA from primary data expressed in local currency at current prices by: (1) deflating the current year data by means of the country's implicit GNP deflator (base year = 100), and (2) converting the constant-price data by the exchange rate for the base year. All three variables are deflated by the GNP price level and converted by the exchange rate.

For the purposes of the Section 620(s) report, the use of exchange rates to convert these data to dollars entails all of the deficiencies noted in the discussion, above, and the comparison with an ideal conversion method using purchasing power parities is entirely salient. For valid expenditure comparisons within countries (computation of the defense shares and military burden ratios) and among countries (computation of regional norms and comparison of countries with the norm or each other), for a given year or across years, the use of PPP convertors is indicated. By contrast with use of parity convertors, use of exchange rates does not take into account within-country differences among the price indices for military expenditures, central government expenditures, and GNP -- and the exchange rates do not adequately reflect the relative purchasing power of currencies. (See U.S. Arms Control and Disarmament Agency 1988, 145-6.)

It is clear that use of estimates converted by exchange rates introduces distortion into the Section 620(s) statistical analysis. But how much difference does it make in the designation of regional norms and in the identification of the countries which most exceeded the norms (i.e., the composition of the checklist for Section 620(s) reporting purposes)?

Purchasing power parity estimates for military expenditures, government expenditures, and GDP are available, for most of the panel of 620(s) countries, for the years 1980 and 1985. The basic method of PPP derivation is that of the International Comparison Project of the United Nations (described in the ICP Phase III report: Kravis, Heston and Summers 1982). The GDP and government sector parities were computed in conjunction with the preparation of Penn World Table 4 as reported by Robert Summers and Alan Heston (1988). Military parities were developed for 134 countries by Alan Heston, using the ICP benchmark studies and the disaggregated military expenditure components identified in submissions to the United Nations unified reporting system (a full description appears in Heston 1990).

Using these PPP convertors and the ACDA data base, it is possible to make a direct comparison, for the panel of 620(s) countries, of the 1980 and 1985 expenditures ratios and rankings based on the use of exchange rate convertors (replicating the ACDA computational procedure) and the use of PPPs. Miss Bettina Aten of the University of Pennsylvania, the statistical assistant to Professor Heston in the preparation of the military parities, has made the computations and compared the ratios and rankings, as reported in an annex to this Report.

Her findings show the effect, for 1980 and 1985, of using exchange rate convertors to estimate the defense shares and military burdens of the panel of 620(s) countries, as contrasted with using PPP convertors. She shows that, when exchange rate

convertors are used, the distributions of country defense share and military burden ratios have distinctly different statistical characteristics as compared with the distributions of the same ratios when PPP convertors are used. For example, the distributions of defense share ratios of the 620(s) panel countries in both 1980 and 1985, when exchange rates are used, have a significantly higher mean and median, but much lower indices of positive skewness and kurtosis, as compared with the distribution of defense shares computed by use of parity convertors.

These differences in the distributions of the 620(s) country ratios result in substantially different statistical indicators of military expenditure norms, regionally and worldwide. Use of exchange rate convertors (compared with use of PPPs) results in a significantly higher mean and median defense share in every A.I.D. region. For both the share and burden, use of exchange rate convertors results in rearrangements in the rank ordering of regional norms. In 1985, for example, Asia has the lowest regional norm indicators when parity conversion is used, but much higher ranking relative to other regions when exchange rates are used. Generally, the use of exchange rate convertors consistently understates the mean military burden of African countries, overstates the burden in Asia, and has mixed effects on the indicators of norms for the burden in other regions.

In an experiment to identify the 620(s) panel countries in each A.I.D. region with military expenditure ratios which most exceed the norms, Miss Aten shows that there are significant differences in the list of highest-ranking countries when exchange rate convertors are used, as compared with the list of countries identified when PPP convertors are used. This is the case for both the defense share and the military burden, and for both 1980 and 1985. It obtains both when the highest-ranking countries are selected from the full panel of 620(s) countries, and when the selection is confined to A.I.D.-recipient countries.

The conclusion appears to be that, for the purposes of Section 620(s) reporting, the conversion methodology used makes a significant difference in the outcome of the statistical analysis -- notably, in identifying the countries to appear on the checklist for Section 620(s) reporting purposes. Although this is just one piece of evidence with respect to how much difference it makes, it strongly suggests the advisability of A.I.D. taking national military price levels into account when examining the pattern of defense expenditures in A.I.D.-recipient countries.

I.b) RELIABILITY OF RESEARCH RESULTS: PROBLEMS OF TESTING METHODS

In making statistical inferences from econometric tests a trade-off exists between cross-sectional analysis, which gives general results with little specific applicability, and individual country time-series analysis, which produces highly specific results but little insight into broader principles. Multivariate investigations of the relationship between security and development have pursued both avenues, although the cross-sectional design and use of macrostatistical models has been predominant.

There are serious questions about the appropriate use of econometric methods to evaluate cross-sectional data in some lines of this research, and the reliability of statistical inferences based on these testing methods has been called into question. We will encounter these questions in evaluating the reliability of research results in our review of all three topics surveyed in this Report: the determinants of military expenditure in Part II., the economic effects of defense spending in Part III., and the identification of sub-groupings in Part IV. The common criticism of the use of econometric methods in the security-development literature, generally applicable to all three topics, is described briefly in this section.

PROBLEMS OF ECONOMETRIC TECHNIQUES

Problems of econometric technique experienced by security and development researchers fall into two categories: (1) the specification of the theoretical regression model, and (2) violations of the Classical Assumptions of the Ordinary Least Squares (OLS) regression analysis (see Studenmund and Cassidy 1987 for a concise overview.) The low level of reliability attributed to early work in this field is chiefly a result of the researchers' failure to construct and rigorously test explicit structural models that incorporate the simultaneity of the multiple channels through which military expenditures impact economic growth.

Model specification. Correct specification of a structural model involves choosing independent variables based on theoretical expectations that they are causal determinants of the dependent variable. Regression analysis by itself is only a statistical device providing evidence of correlation. Attempts to uncover relevant variables through step-wise regressions or sequential search based on coefficient t-tests make the results inadmissible as proving causation. These techniques involve repeated regression "runs" which increase the chance of deriving a statistically spurious result. In order to infer economic causation the a priori selection of independent variables must be

combined with rigorous hypothesis testing of the signs of the resulting coefficients.

Two other consequences of poor specification seen in the literature include the omission of relevant variables and inclusion of irrelevant variables. The former causes bias in the estimated coefficients of other independent variables correlated with the omitted variable. The latter lowers the significance of the other independent variables.

The choice of functional form for the regression equation must also be based on available theory on an a priori expectation presented before the actual estimation. Most econometric work reviewed in this Report is linear in the variables. Deviations without explanation must be scrutinized carefully.

OLS assumptions. Violations of the Classical Assumptions prevent the (OLS) regression method from producing the minimum variance, linear, unbiased estimates for the coefficients of the independent variables. Problems of multicollinearity and heteroskedasticity crop up in individual studies reviewed below, but problems of simultaneity are far more pervasive and have proved to be a major hurdle to the attainment of econometric reliability in this field of application.

Simultaneity bias occurs in specifications that fail to account for feedback effects and dual causality between independent variables and the dependent variable. An independent variable that is jointly determined with the dependent variable is an endogenous variable. If the other half of the causal relationship (i.e., the effect of the dependent variable on the independent variable) is excluded from the structural model specified by the researcher, the coefficients of all variables in the equation are subject to potential bias. A similar result is obtained when the interaction is included in the model, but then essentially eliminated by the specification of a reduced form for actual estimation purposes.

In order to allow estimation of multi-equation simultaneous models, regression techniques such as Two- and Three-Stage Least Squares (2SLS and 3SLS) are used. Unfortunately these techniques do not provide results which are as readily interpretable as OLS for a number of reasons, including the continued bias of the coefficients for smaller samples.

Two contentious issues involving simultaneity are raised in the literature: (1) the existence of multiple channels through which military expenditures influence economic growth rates, and (2) the endogeneity of military expenditure with respect to economic growth. Most researchers have agreed that defense spending has a direct and significant impact on economic growth. Only a few have undertaken research acknowledging that military

expenditures may also impact other macroeconomic variables such as savings, investment, and the balance of payments -- which in turn have their own direct relationship with economic growth. (For examples of multiple-channel testing models, see Deger and Smith 1983; Deger 1986)

The omission of structural equations specifying these indirect macroeconomic impacts of military expenditure results in a failure to measure the overall impact of the military burden on growth. Simultaneity bias occurs when single channel/single equation models are used, because growth itself is often jointly determined with these macroeconomic variables.

Imperfect multicollinearity (collinearity) occurs when independent variables, such as bilateral aid and the military burden, are highly correlated yet included in the same regression equation. This results in an increase in the variance of the coefficients, lowering their t-statistics and making results very sensitive to specification errors and the nature of the sample.

Heteroskedasticity often occurs in cross-sectional studies such as those reviewed in this Report. If values diverge widely from one observation to the next, error term variances will differ across the sample and OLS will overstate t-statistics, leading to errors in interpretation of the significance of variables.

Determining causality. The existence of a causal relationship between growth and military expenditure remains a disputed topic. Some analysts (Joerding 1986) have used methods such as Granger Causality to demonstrate that military spending is not exogenous. Others have estimated significant relationships for the level of development expressed by per capita income, but have failed to show the significance of growth rates per se. (Deger 1986) Again, if the military burden is truly endogenous with respect to growth, an equation specifying the determinants of these expenditures must be included in the structural model or a simultaneity bias will be introduced.

Another obstacle to reliable econometric estimates related to questions of causality is the existence of lagged response times in the relationship between the independent and dependent variables. Determining the nature of these relationships using cross-country data averages is extremely difficult. Further research on this topic may have to come from standardized time series analysis once general agreement on a theoretical framework is reached.

APPROPRIATE MODELS FOR EXPLAINING PUBLIC EXPENDITURES

A basis question concerning the appropriateness of econometric techniques to provide satisfactory explanations of changes in public expenditures was first raised in 1961 by Peacock and Wiseman. Given the variations in institutional structure and purpose over time, they posited that econometric modeling techniques are inappropriate for the investigation of the determinants of government expenditure. The underlying assumption of econometric analysis is that all other conditioning factors can be held constant. This assumption is violated if significant legal, social and political discontinuities, called "displacement effects," exist during the sampled time period. (Peacock and Wiseman 1961)

One solution to this dilemma is to find consistent groupings of country or time series data in which the variance in institutional factors is minimized. Statistical techniques such as factor analysis allow the reduction of a large number of potentially determining factors to a few significant explanatory factors. Once underlying structural differences have been removed by successful sub-grouping, econometric analysis can correctly assume that the only factors that are in flux and therefore influencing the dependent variable are the chosen independent variables.

Peacock and Wiseman (1979) present this potential solution to their original problem, but hesitate to endorse it fully. They note that this form of analysis only mechanistically constructs a black box. It does not actually provide insight into the social transformation that turns inputs into outputs, or into the process that determines the growth of public expenditures.

PART II.
REVIEW OF RESEARCH AND EMPIRICAL EVIDENCE ON THE DETERMINANTS OF MILITARY EXPENDITURE IN DEVELOPING COUNTRIES

During the past decade a large quantity of literature has been devoted to explaining differences in military expenditures among the developing states. While an array of conflicting hypothesis and findings have been proposed concerning the determinants of military expenditure behavior, there has been growing recognition of the distinct patterns of military spending behavior with regard to: 1) the military's replacement of weapons stocks that have been depleted during armed conflict; 2) the acquisition patterns intrinsic in the replacement of major weapons systems; and 3) the resources applied to the development, routine maintenance and operation of military institutions. The empirical tests of the various hypotheses concerning the determinants of military spending behavior have focused on the level of expenditures for recurrent operations and routine maintenance.

This part of the Report will review the research, key questions and empirical evidence concerning the determinants of military expenditures in Third World countries. This has been divided into five significant research areas: a) geostrategic considerations; b) budgetary politics; c) the influence of arms suppliers; d) financial and economic factors/constraints; and e) multi-variant explanations of military expenditures.

II.a) GEOSTRATEGIC CONSIDERATIONS AND THE SECURITY ENVIRONMENT

This literature postulates the existence of linkages among national security and threat perceptions (both internal and external), defense expenditures and economic development. These relationships are complex and the difficulties in analysis are further complicated by the probable absence of unidirectional causality, which is to say that there may be feedback and reverse effects. (Deger and West 1987)

Both internal and external threats (or the perception thereof) are hypothesized to conduce to larger defense expenditures. Defense spending, in turn, may influence economic growth either positively or negatively.

McKinley contends that a variety of studies are limited by their adherence to purely system-level perspectives or simple ideological /political/ economic interests. The author argues

that interstate conflict is "...a product of a comparative calculation of the rewards and costs accruing to the variety of different means of promoting or protecting some interest." (McKinley 1989, 84) This leads to the contention by many authors that in order to effectively analyze the causes and effects of military expenditures in developing states, it is important to determine the multi-variant influences affecting resource allocation.

A number of analysts have addressed the hypothesis that military spending is determined by geostrategic considerations. Several of the key questions that have been studied are:

1) Does the existence of international conflict/threat perceptions explain levels of military spending? Do military expenditures fluctuate based on different levels of conflict intensity?

2) Do Third World states determine their military expenditure levels in response to their neighbors' military spending?

3) Is military expenditure a response to interstate conflict and if so, does the response itself stimulate further expenditures?

4) Do the arms race models indicate trends that can explain systematic variations of military expenditures across Third World countries and over time?

ARMS-RACE MODELS

One empirically-tested approach used in the literature to explain patterns of inter-country variation in military expenditures have been the "arms-race models". Under this model, military expenditures are influenced by political, psychological and international parameters which emphasize each governments perception of its adversaries and the behavior of its allies and neighbors. Although nearly all of the armed conflicts that have occurred since World War II have been fought in the developing world, much of the arms-race literature has focused principally on the great powers. Nonetheless, some research has been conducted on the developing states. (Hollist 1977)

Arms race theory can be divided into two broad models, namely the arms-using model and the arms-building model. The arms-using model describes how armaments, military forces, or national resources are consumed in armed conflict. This model addresses the arms race question indirectly by assessing what national resources may be required to assure victory, national survival, stability or some other purpose requiring the use of arms. The dependent variable in this model is the surviving amount of military forces or resources available following an armed con-

flict. Moll and Luebbert (1980) criticized this model as being too limited in merely describing how wars are fought rather than how they are prepared for. The Arms-building model addresses this issue by focusing on the resources and effort a nation is utilizing to develop and maintain its defence forces.

The seminal work in arms-building theory is Richardson's (1960) mathematical model. Richardson argued that a rate of change in a nation's armaments could be explained by three factors: 1) external threats; 2) economic burden and fatigue and ; 3) grievance. Richardson's model is based on competitive factors between countries and is known as the "action-reaction" model.

The arms-race literature is no longer limited to Richardson--type "action-reaction" models. During the 1970's the arms--building models became more sophisticated and multi-variant. Research also came to focus on the analyses of arms expenditures. During this period, researchers integrated a range of independent variables. Their models included resource constraints (Choucri and North 1975; Hollist 1977; Ferejohn 1976 among others); budget parameters (Russett 1970; Lucier 1979); prior military expenditures as an indicator of future expenditures (Lucier 1979; Choucril and North 1975; Wallace and Wilson 1978; and Rattinger 1975); and GNP (Choucril and North 1975; Wallace and Wilson 1978; and Ferejohn 1976). In addition to economic and fiscal variables, these authors and others also incorporated political/bureaucratic and organizational factors on the domestic and international level into arms-building models.

Moll and Luebbert (1980) defined four classifications used to analyze the determinants of an arms race. Three of those classifications are illustrated in Table 1 under the "Level of Analysis" heading. The international system level (IS) focuses on such issues as the presence or absence of arms races, stability of arms races, military aid and the role of the superpowers. The nation-state level (NS) focuses on national attributes and behaviors. National trends in areas such as arms expenditures, military personnel and weapon quantities are emphasized. In the political-bureaucratic level (PB), emphasis is placed on domestic bureaucratic institutions and political organizations and their respective influence on defence policy.

Table 1 lists a representative sample of arms-race models developed during the 1970s. Each study is indicated by the system-level classification as noted by Moll and Luebbert (1980) and the analytical relationships which are central to the working of each model. As Table 1 indicates, the models of the majority of analysts utilizing the arms-building perspective were more sophisticated and multi-variant than the arms-using models, as represented by Taylor (1979) . To exemplify, in Table 1 Choucri

TABLE 1.

ARMS RACE MODELS AND MILITARY EXPENDITURES

AUTHORS	PUB. DATE	TIME PERIOD	REGION	LEVEL OF ANALYSIS			ANALYTICAL RELATIONSHIP			
				IS	NS	PB	SOP	PYM	GM	RC
Ostrom	1978	1955-73	US	X	X					
Russett	1970	-	Global				X			
Lucier	1979	1918-38	AS,EUR, NA			X	X			
Choucril & North	1975	1871-1914	EUR	X	X			X	X	X
Wallace & Wilson	1978	1870-1914	EUR	X	X			X	X	
Hollist	1977	c.1976	AS,ME EUR,NA		X					X
Rattinger	1975	-	Global	X	X			X		X
Ferejohn	1976	-	Global						X	X
Taylor	1979	-	Global		X					

Key: (1) All models listed in this table are "arms building" models except Taylor (1979), who presents an "arms using" model.

(2) AS = Asia; EUR = Europe; ME = Middle East; NA = North America

(3) IS = International System Level; NS = Nation-State Level; PB = Political/ Bureaucratic Level

(4) SOP = Changes in budgetary procedures; PYM = Previous year military expend.
GM = Growth in military expenditure; RC = Resource constraints

and North (1975) and Wallace and Wilson (1978) utilized both the international (IS) and national (NS) levels of analysis while integrating within their models three of the four analytical relationships listed in the table. In contrast to these arms-building analysts, Taylor's (1979) arms-using model lacks substantive empirical support, a common weakness in arms-using models.

Although the arms-building models are more sophisticated than the arms-using ones, many analysts have concluded that research efforts in this field do not have a high degree of explanatory power concerning the mobilization of resources over time or cross-country. This is due to the lack of statistical categories matching the conception of arms-use and non-use circumstances.

There has been an extensive range of literature studying arms-race models, of which only a few can be discussed here. A more comprehensive review of this literature can be found in Moll and Luebberts (1980) study.

THREAT PERCEPTION AND INTER-STATE CONFLICT

A critical component of national security behavior and one that is linked to arms race behavior is the proposition that interstate conflict or the perception of a threat correlates to variation in military expenditure levels among Third World countries. In this approach, the military capabilities of neighboring states are often seen as both the source of and response to a perceived threat.

In a recent influential study, McKinley (1989) conducted a cross-section analysis for all Third World countries over the period 1950-1982. The author determined that military expenditure rises in response to interstate conflict and decreases following the cessation of the conflict. This would appear to be the expected finding and to confirm the common-sense interpretation of behavior in "arms-using" circumstances. It can be interpreted as showing weapons-inventory management: a surge of replacement expenditures occur when the inventory is drawn down by hostilities. But McKinley's expenditures data are not disaggregated to show categories of expenditures which can be associated with "arms-building" behavior or the routine maintenance of military establishments. It is not clear whether McKinley's analytical results show any association between interstate conflict and the military expenditures addressed by "arms-building" models of behavior.

In a similar vein to McKinley, Weede (1986) argued that international competition and threats to national security lead to higher military participation ratios and larger military outlays. Weede supported his conclusion with cross-national

regression analysis of data for 31 developing states during the 1970s. Again, the lack of disaggregated military expenditures data make it difficult to determine whether Weede has demonstrated anything more than the working of inventory replacement and materiel replenishment cycles. Confirmation of "arms-using" behavior is not trivial, but it leaves without satisfactory explanation the long-term trends in "arms-building" expenditures of the recent past as well as important dimensions of both inter-country and inter-temporal variations in defense spending.

The literature addressing the hypothesis that military spending is determined by geostrategic considerations is inconclusive. While several writers contend that perceived threats or other indicators of the security environment can account for variance in Third World military expenditures, this has not been conclusively demonstrated empirically. While the arms-race models have become more sophisticated and multi-variant, the empirical testing of these models shows ambiguous results.

Many authors have anticipated the existence of a correlation between geostrategic factors (domestic or international conflict and threat perceptions) and military spending levels. However, the literature to date has been unable to isolate specific expenditures in such as way as to demonstrate the relationship between security considerations or geostrategic events and their associated segment of military expenditures. Total spending and resource allocation levels need to be disaggregated in order to determine the systematic influences affecting military expenditure levels. It is also necessary to distinguish between arms use and non-use circumstances and how the disaggregated military expenditures are influenced under both conditions.

Of particular significance are the linkages between economic and political factors on both the international and domestic level that have been addressed in the arms-race models. The importance of identifying these influences in order adequately to explain cross-country differences in recurrent expenditures, or of variations through time in individual countries, is frequently addressed by authors in each section of this paper.

II.b) POLITICS OF THE BUDGETARY DECISION-MAKING PROCESS

A number of researchers have sought to explain defense spending behavior in terms of bureaucratic and political processes, emphasizing organizational factors and chiefly domestic (economic and political) sources of influence on the scale of defense efforts. This body of research begins with the proposition that the military is a critically important actor in domestic politics in the Third World. Thus, the perspectives and

activities of the military are seen to be principally domestic and the most important influences on the military are hypothesized to be domestic bureaucratic and political interactions. They are considered to be bureaucratic in the sense that the military is involved in defending its institutional interests against those of other, usually governmental, organizations. They are considered to be political in the sense that the military is constantly engaged in defining its relationships and power to political institutions and political forces in the country. In this research international factors such as conflict, arms races, or arms transfers are considered to the extent that they appear to influence the domestic bureaucratic and political activities of the military. Thus, to understand and explain military expenditures, research needs to assess the domestic political activities, bureaucratic politics, and institutional development of the military. (Grindle 1987)

Increasingly, researchers have focused on budget allocations because budgetary data are available and quantifiable. There has also been an assumption that the regime in power has control over government expenditures and that differences in the patterns of budgetary allocations may be ascribed to particular regime characteristics or types. Thus, much research has focused on the relationship between types of regimes and levels of military spending. (For example: Schmitter 1971; Weaver 1973; Zuk and Thompson 1982; Looney 1988; McKinlay 1989)

A familiar intuitive proposition is that when in power the military will allocate more to the defense sector, on the assumption that military officers in power will follow their corporate self-interest. Many analysts have studied the spending behavior of military and civilian regimes and have addressed several key issues, including:

1) Are there systematic differences in spending patterns between civilian and military regimes? Do military regimes allocate more resources to the military then their civilian counterparts?

2) Can regimes be distinguished by the degree of consensus existing between civilian elites and the military?

3) Are there systematic differences in budgetary trade-offs that can be attributed to military vs. civilian regimes?

4) Does military spending increase following a coup d'etat?

5) Are <u>regimes</u> better units of analysis for studying expenditure patterns than <u>countries?</u>

REGIME TYPES AND CHANGES IN REGIME CHARACTERISTICS: INTEREST-GROUP DETERMINANTS OF GOVERNMENT SPENDING

Several studies, as SHOWN on Table 2, have examined defense expenditures following the occurrence of a coup d'etat. These authors have attempted to determine the validity of the hypothesis that military spending is increased following a coup d'etat. (For example: Schmitter 1973; Gyimah-Brempong 1987; Whynes 1979; Zuk and Thompson 1982)

This research indicates that no consensus exists among authors about post-coup military spending. Schmitter (1973), for example, concluded that military coups are associated with changes in military expenditures, but that the direction of change is indeterminate. This is based on a study of post-coup defense spending for 19 Latin American countries over the period 1950--1970. Schmitter's emphasis on Latin America is repeated by the majority of the authors who analyze the relationship between regime type and military allocations, as noted in Table 2. This Latin American emphasis also obtains in the studies that investigate the correlation between military and social welfare expenditures, listed in Table 3. (The information presented in Tables 2 and 3 is largely drawn from Alexander and Eliot Berg's (1988) study for the World Bank.)

In common with other investigators, Zuk and Thompson (1982) found no relationship between the occurrence of coups (shown as the military variable in Table 2) and military expenditures as a proportion of central government expenditures, as the dependent variable. These authors applied a GLS regression procedure (pooling cross-sectional and time series observations) to data for 66 LDCs over the time period 1967-1976. (For each of the studies listed in Tables 2 and 3, the size of the country sample is shown in brackets in the "Region" column, while the period of observation is shown in the column "Time Period.")

The analytical results of this literature are contradictory concerning the relationship between regime type (civilian vs. military regimes) and the level of military spending. These conflicting findings are the result of different methodologies, definition of military regime, and sources of data. An extensive assessment of the literature on the relationship of military expenditure and regime type appears in the Berg and Berg (1988) study.

As indicated in Table 2, several analysts have found a positive correlation between military expenditures and regime type. (Nordlinger 1970; Schmitter 1971; Weaver 1973) The majority have concluded, however, that no relationship exists between regime type and patterns of defense spending. In general, these

TABLE 2.

RELATIONSHIP BETWEEN REGIME TYPE AND DEFENSE EXPENDITURE

AUTHORS	PUB. DATE	TIME PERIOD	REGION	MILITARY VARIABLE	DEPENDENT VARIABLE	FINDINGS: RELATIONSHIP
Nordlinger	1970	1957-62	LDC [74]	Influence	ME/GNP	positive
Schmitter	1971	ca. 1960	LA [20]	Influence	ME/CGE & GNP	weak positive
		1950-67	LA [8]	Influence	ME/GNP	positive
	1973	1945-70	LA [19]	Influence	ME	none
Weaver	1973	1960-70	LA [6]	Presence	ME/GDP	negative
		1961-70	LA [2]	Influence	ME/GDP	positive
Thompson	1973	1946-66	LDC [32]	Coups	change in ME/CGE	positive
Kennedy	1974	1960-70	LDC [41]	Presence	ME/CGE	none
Hayes	1975	1950-67	Brazil	Presence	ME/CGE	none
McKinlay & Cohan	1976	1961-70	Global [101]	Presence	ME/GNP & military size	none
Ames & Goff	1975	1948-68	LA [17]	Influence	ME ME/CGE ME/GNP	none
Tannahill	1976	1948-67	LA [10]	Presence	ME/CGE	none
Dickson	1977	1961-70	LA [10]	Presence	ME	weak positive
Hill	1979	1946-65	LDC [104]	Influence	ME/GDP	positive
Whynes	1979	1959-75	LA [10]	Coups	ME	positive
Pluta	1979	1961-70	LA [10]	Presence	ME & mil. size	inconclusive
Ravenhill	1980	1960-73	AF [33]	Presence	ME	none

TABLE 2. (CONT.)

RELATIONSHIP BETWEEN REGIME TYPE AND DEFENSE EXPENDITURE

AUTHORS	PUB. DATE	TIME PERIOD	REGION	MILITARY VARIABLE	DEPENDENT VARIABLE	FINDINGS: RELATIONSHIP
Zuk & Thompson	1982	1967-76	LDC [66]	Presence	ME	weak positive
				Presence	ME growth rate	none
				Coups	ME/CGE	none
Grindle	1986	1967-80	LA [18]	C-M	ME/CGE	inconclusive
				regime change	ME/CGE	positive
				regime tenure	ME/CGE	positive
Looney	1987	1961-82	Argentina	regime change	ME/CGE	none

Key: (1) LA = Latin America; AF = Africa
Number of country observations in brackets.

(2) Presence = presence of military in top executive positions
Influence = high military influence in the political process
C-M = civil-military relations
Regime tenure = duration of rule by a single regime

(3) ME = military expenditure; CGE = central government expenditure

authors were testing the hypothesis that systemic differences exist in spending patterns attributable to regime type.

Two recent studies by Grindle (1986) and Looney (1988) take a fundamentally different look at the relationship between regime type and defense expenditures.

Looney (1988) attributes the lack evidence concerning the difference between civilian and military regimes in past studies to the problems of measurement in standard indices used to represent the defense burden. His analysis merges two areas of explanation, economic (ability to spend) and political (willingness to spend), and concludes that military regimes tend to develop the military to levels not warranted by size of the national economy. This is accomplished through increased foreign borrowing, mobilization of foreign exchange earnings, and price distortions which facilitate increased defense spending.

Utilizing an aggregate cross-national research design for 18 Latin American countries over the period 1967-1980, Grindle (1986) found that regimes explain more as a unit of analysis than countries do in accounting for variations in defense spending. Her analysis incorporates regime change, regime tenure, and civil-military relations. In her assessment, the budgetary process is influenced by the power and bargaining skills of government competitors who strive to gain a larger share of the budget. The strategies and resources available to the military, which ultimately determine its ability to extract resources for defense purposes, varies due to characteristics of civil-military relations. These relations are determined by the degree of military institutional exclusiveness and the degree of consensus among civil and military elites about the role of the military. Regime change and civil-military relations, rather than regime type. are found to be more useful explanatory factors for variations in defense expenditures.

EVIDENCE OF BUDGETARY TRADE-OFFS

A number of authors have examined the contention that military expenditures involve opportunity costs, causing reductions in social programs to support military outlays. While several authors (Deger 1986; Tannahill 1976; Dickson 1977) contend that a negative correlation exists between military and social expenditures, there remains a paucity of empirical evidence indicating systematic trade-offs.

An inspection of the "social welfare expenditures" column in Table 3 will show that spending on education and health are often used as indicators of a government's commitment to social welfare. Ames and Goff (1975) compared education and defense expenditures in sixteen Latin American countries for the period

1948-1968 and found that both sectors experienced fluctuations in funding based on the level of central government revenues. Verner (1983) concluded that trade-offs are country and time--specific and can not be generalized in cross-country analysis. Verner (1983) and Hess and Mullen (1988) found that both education and military spending have strong constituencies that prevent cuts in either area.

Kennedy (1974) found no significant evidence of budgetary trade-offs between military and non-military regimes in his study of spending patterns in forty-one developing nations during the 1960s. His conclusion that regime change, rather than the nature of the regime, precipitates a reallocation of budget shares, supports Grindle's (1986) findings.

Table 3 provides a summation of the key findings in selected studies on the correlation between military and social welfare allocations. These studies were testing the hypothesis that systematic budgetary trade-offs can be attributed to regime type. As the findings listed in Table 3 indicates, the majority of these studies were unable to establish a systematic correlation through time or across countries. Only one of the studies (Harris et al 1988) found a positive relationship, meaning that as military expenditures were raised, education and health expenditures also increased. Four of the studies found a negative relationship, but only Deger (1986) has significant empirical evidence. Regarding the negative findings of Tannahill (1976); Dickson (1977); and Pluta (1979), Berg and Berg note that "...since the methodology of these [three] studies is a simple comparison of means, the results are questionable, and the issue remains open." (Berg and Berg 1988:24)

Many analysts apparently believed that by focusing on military expenditures the relative political clout of the military could be shown in the budgetary process; they expected to find political influence correlated with regime type. The determination of military expenditures through the political/bureaucratic process was thought to be a particularly clear example of interest group politics, and to demonstrate how resources are mobilized by the public sector.

There is insufficient empirical evidence to confirm a systematic effect across countries attributable to military regime influence on the process of budgetary decision making and the allocation of resources. Recent research indicates that defense allocations are probably influenced more by other variables than by the degree of military influence in the government. It appears that changes in regimes over time in individual countries provide more useful insights into the budgetary decision making process, including the character of systematic trade-offs.

TABLE 3.

CORRELATION OF MILITARY AND SOCIAL WELFARE EXPENDITURES

AUTHORS	PUB. DATE	TIME PERIOD	REGION	SOCIAL WELFARE EXPENDITURES	FINDINGS: RELATIONSHIP TO MILITARY EXPENDITURE
Deger	1986	1967 & 73	LDC [34]	agriculture	negative
Dabelko & McCormick	1977	1950 & 72	LDC [76]	educ. & health	weak negative
Lyttkens & Vedovato	1984	1984	(No empirical data presented; authors used production possibility graphs to estimate opportunity costs)		
Ames & Goff	1975	1948-68	LA [16]	education	none
Kennedy	1974	1960-70	LDC [30]	educ. & health	none
Hess & Mullan	1988	1982-83	LDC [77]	education	none
Peroff & Podolak	1979	1929-74	USA	education	none
Pryor		1950-62	EUR,NA [12]	all welfare	none
Grindle	1987	1970's-80's	LA [3]	all welfare	mixed
Harris et al	1988	1967-83 1980	AS [12] AF,AS [12]	health educ. & health	mixed positive
Tannahill	1976	1948-67	LA [10]	social spending ratio to CGE	negative
DIckson	1977	1961-70	LA [10]	education	negative
Pluta	1979	1961-70	LA [10]	educ. & health	negative

Key: AF = Africa; AS = Asia; EUR = Europe; LA = Latin America; NA = North America

There is also some evidence that budgetary trade-offs may have different characteristics depending on the degree of elite consensus concerning the role of the military. What appears to influence the budgetary process in ways affecting the pattern of functional-expenditure trade-offs, in some recent experience in Latin America, is not the type of regime (in any variant of the classical distinction between military and civilian), but rather the strength of civil and military elite agreement on terms of the "contract" defining the role of the military in society and polity. As this elite consensus wanes or increases in strength, the relative success of the military in mobilizing public resources varies and the pattern of expenditure trade-offs changes.

II.c) EXTERNAL PATRONS: THE INFLUENCE OF DONORS AND SUPPLIERS

External or internal threats can propel developing states into the international arms trade. Unless these countries have the capability to produce major weapon systems themselves, they will be forced to purchase the armaments abroad -- and indeed all developing states to some extent must so do. If the weapons cannot be obtained through a concessionary grant, the recipient will be required to purchase the arms at a cost in use of credit or foreign exchange earnings which may hinder economic growth. Deger & West state that: "Many LDCs have adopted an import-fed growth strategy (rather than an export-led one). This implies that capital formation and output-increase depend crucially on intermediate imported goods such as the latest vintage machinery. If additional defence spending on foreign arms reduces the importation of such intermediates, growth suffers.... The arms trade is therefore a crucial link between national security, external threat and economic growth.' (Deger and West 1987, 11)

The hypothesis that military spending is influenced by the actions and preferences of patrons -- dominant external suppliers of major weapons systems and donors of military assistance -- has introduced a number of related questions which have been explored in the literature. These include the following:

1) Do arms suppliers exercise a dominating influence over the military-sector activity of Third World recipients?

2) Are countries with greater arms imports also those with higher domestic defense spending?

1) Are wealthier and less dependent developing countries more prone to develop a domestic arms industry than poorer states?

Some observers, such as Harkavy (1975), Arlinghaus (1984), and Brzoska (1987), suggest that, as a result of growing competition in the arms trade, the non-arms producing nations have increased leverage in bargaining with the suppliers and their dependency has declined. Conversely, Neuman contends that economic and other constraints among developing states promote dependency upon the suppliers. Although Neuman argues that the superpowers have "substantial" influence on recipients' procurement activities and expenditures, exercised through their control of major arms transfers, she acknowledges that "the evidence is circumstantial." (Neuman 1988, 55)

Both Neuman (1988) and Brzoska (1987) argue that arms transfer activities significantly influence the military procurement practices of purchasers and recipients. Brzoska contends that arms transfer practices are "...largely explained by short-term economic conditions and cyclical procurement factors on the side of the recipients." (Brzoska 1987, 176) Accordingly, as weapons become outdated and economic conditions improve, many developing states can be expected to increase arms imports. This cyclical procurement pattern is evident in the 'boom' years of the 1970s followed by the relative decline in arms transfers during the 1980s. (Brzoska 1987).

Brzoska (1987) found a correlation between national income growth and major weapons imports. Those countries with a per capita GNP of less than $440 substitute imported arms for personnel expenditures while countries at higher GNP levels produce some armaments domestically to substitute for imports. (Brzoska relied on data supplied by SIPRI, the IMF and the World Bank for his analysis.)

Increasing domestic arms production does not necessarily lead to a reduction in imports, as attested by the large domestic production and importation of arms by India and Israel.

Deger and West (1987) note that some developing states may link arms imports and exports by utilizing comparative advantage to produce weapons for export, while relying on the increased foreign exchange earnings generated by sales to import armaments which, for technical or other reasons, their domestic industries are poorly equipped to produce at home.

Looney (1988) studied 104 developing countries over the period 1961-81 and divided them into arms producers and non-arms producers based on whether a country was capable of producing a major weapon system. Looney concluded that, for non-producers, arms imports were closely and positively correlated with overall imports and inversely related to total military expenditures. In contrast, arms producers tended to expand arms imports in association with overall increases in military expenditures, with reductions taking place during periods when total imports in

TABLE 4.

RELATIONSHIP BETWEEN ARMS PRODUCTION AND MILITARY EXPENDITURE

AUTHORS	PUB. DATE	TIME PERIOD	REGION	AP>ME	ME>AP	FINDINGS: DETERMINANTS OF ARMS PRODUCTION
Ayres	1983	c.1977	Turkey	+	+	Cyclical relation, rise in dependency
Ball	1986	1969-85	LDC	+		Pol., econ. factors; threat perception
Ball & Leitenberg	1983	1970-81	Global	+		Domestic econ. factors
Brzoska	1989	1968-88	LDC	+		Drive for independence
Brzoska & Ohlson	1986	1950-84	LDC	+		Global, regional relations
Clare	1987	1981-85	LDC	+		Economic security, independence
Deger	1986	c.1983	LDC	+		Threat perceptions, regional position
Evans	1986	1960-85	LDC	+	+	Cyclical relation; ME fuels market for AP which fuels further ME
Frank	1980	1973-79	LDC	+		Crises, oil income facilitates ME
Goulet	1976	c.1975	LDC	+		Desire for development, independence
Katz	1984 & 1986	1963-80	LDC	+	+	Drive for autonomy coupled with military power bases in LDC.
Looney	1989	1973-88	LDC	+		Economic factors over threat factors; decline in AP fuels decline in ME
Looney	1988	1969-81	LDC	+		ME through AP earnings
Looney	1986	1979-80	LA	+		Domestic pol./bureaucratic influence
Moodie	1979	1965-75	LDC	+		Drive for independence

TABLE 4.

RELATIONSHIP BETWEEN ARMS PRODUCTION AND MILITARY EXPENDITURE

AUTHORS	PUB. DATE	TIME PERIOD	REGION	AP>ME	ME>AP	FINDINGS: DETERMINANTS OF ARMS PRODUCTION
Neuman	1984	1979-80	LDC	+		Economies of scale over ME influence
Peleg	1980	1950-77	LDC	+		ME influence weak
Rosh	1988	1969-78	LDC	+		Security concerns
Rosh	1990	c. 1982	LDC	+		Pol., econ., military mobility
Ross	1987	1973-83	LDC		+	Exaggerated concern; AP minor activity
Wulf	1983	c.1980	LDC	+		Econ., pol., military motives; drive for self-sufficiency

Key: (1) AP = Arms production; ME = Military Expenditure

(2) LA = Latin America

(3) AP>ME = Arms production results in growth of military expenditure
ME>AP = Military expenditure facilitates a growth in arms production

creased. Further, unlike non-producers, these countries increased arms imports with overall expansion of government consumption relative to GDP. Looney concludes that it appears from this analysis that arms producers do not have to make major sacrifices in socioeconomic expenditures to achieve a desired level of security inputs.

Table 4 depicts the relationship between arms production and military expenditures. The majority of authors describe arms production (AP) as a positive determinant of military expenditure (ME). Generally, these authors view arms production as a means of facilitating industrialization (AP>ME). Hence, arms production is considered part of a broader development program and is not determined simply by the level of military expenditure. Political, military and economic factors interact with the relationship between arms production and military expenditure.

In contrast with this view, several authors focus on the importance of a military power base as facilitating both military expenditure and a growth in arms production. (ME>AP)

The prevailing view in this area of study emphasizes arms production as a product of the struggle toward self-sufficiency and as a determinant of military expenditure. However, in the view of a majority of investigators, causation is not unilateral but entails feedbacks and interaction with other factors.

The evidence of empirical studies to date appears to indicate the existence of a binary situation. External patrons can and do have a dominant influence over military sector activity, and military expenditures, in a few developing countries. But significant external patron influence on the level of defense spending cannot be detected in many other countries. The evidence does not support the contention that this kind of external influence can be described as having a systematic effect across all developing countries. In those cases where determinant external influence exists, there is evidence that the mechanics of the recipients' decision-making process may be altered by the introduction of special institutional arrangements (such as extraordinary budgets or special accounting procedures). The purpose of these arrangements is to implement the patron's influence over the recipient's budgetary behavior and change the composition of government spending. Further study of these cases is needed to identify reliable indicators of the degree of influence that a supplier is able to exercise over a recipient's planning and budgetary decision-making process.

II.d) THE INFLUENCE OF FINANCIAL AND ECONOMIC CONSTRAINTS

Recent research indicates that economic variables may provide further insight into the underlying causes of Third World defense expenditures. Early studies of this subject focused on the role of economic factors as determinants of the size and composition of government expenditures as a whole. Many investigators have adopted a version of Wagner's law which asserts that the relative size of the public sector in the national economy has an inherent tendency to grow as per-capita income increases. One postulate is that a contributing factor to growth of the public sector is the increasingly costly requirements of national security and defence. By this reasoning, growth in the resources required for national security is driven by social conditions (such as increasing urbanization) associated with progressively higher levels of economic development.

Variants of the Wagner's law hypothesis are frequently found in the current literature. For example, Deger states : "The three major determinants of the defence burden are...: (a) long-term developmental factors such as per capita income; (b) the total budget constraint; (c) displacement variables such as wars or structural shifts like an oil price rise for oil-exporting countries. It must also be stressed that these three determinants affect military expenditure as a public good which produces security." (Deger 1986: 63)

The linkages among economic factors, regime characteristics, and other influences on military expenditures have been explored, in the context of a budgetary decision-making model, by several authors. Some of the key questions that have been addressed by these scholars are:

1) Does the burden (or share) of military expenditures rise with increased per capita income, as postulated by Wagner's law?

2) Are military expenditures in all Third World countries influenced in similar ways by economic and political factors, or are the set of factors influencing military expenditures different in sub-groups of developing states?

3) Do resource-constrained nations tend to have a different relationship between defence spending and economic growth as compared with resource-abundant countries?

Table 5 shows that a variety of different economic indicators have been asserted to influence military expenditure levels and trends. Several of these indicators can be interpreted as corresponding to variables postulated by Wagner's law to be

TABLE 5.

RELATIONSHIP BETWEEN ECONOMIC INDICATORS AND MILITARY EXPENDITURE

AUTHORS	PUB. DATE	TIME PERIOD	INDEPENDENT VARIABLES	DEPENDENT VARIABLES	FINDINGS: RELATIONS AMONG VARIABLES
Lotz	1970	1960-1965	per capita income	ME /GNP	negative
			urban population	ME /GNP	positive
			CGE as % of GNP	ME /GNP	positive
Maizels & Nissanke	1986	1978-1980	per capita income	ME/GDP	not significant
			urban population	ME/GDP	not significant
			forex constraints	ME	negative
Harris	1986	1960-1980	inflation	ME	weak negative
			balance of payments	ME	positive
			gov't revenue	ME	positive
O'Leary & Coplin	1975		GDP	ME	not significant
			rival budget levels	ME	positive
			rival arms purchases	ME	positive
Looney & Frederikson	1988	varied	GDP	ME	positive
			CGE	ME	positive
Looney	1986	1970-1982	per capita income	per capita ME	positive
			public debt	per capita ME	positive
			forex (constrained)	ME	negative
			forex (unconstrained)	ME	positive

Key: (1) forex = foreign exchange availability

(2) CGE = central government expenditures; ME = military expenditures

determinants of the size of the public sector. Lotz (1970), for example, conducted a cross-country multiple regression analysis of 37 developing countries. Utilizing military expenditure as a percentage of GNP (the military burden) as the dependent variable, Lotz found a significant negative relationship with per capita income measured in US dollars, and a significant positive relationship with the total government budget as a percentage of GNP (an independent variable which may be taken to measure relative resource constraint.) He also found a significant positive relationship with the proportion of urban dwellers, another possible indicator of the level of development.

Contrary to Lotz' findings, Maizels & Nissanke (1986) concluded there is no significant relationship between per capita income levels and military expenditure/GDP ratios. They also determine that the level of urbanization is not significantly related to the level of military spending. The most significant variable was found to be the share of the central government budget in GDP. The growth of foreign exchange availability was an important constraint.

Looney and Frederiksen (1988) examined the linkage between the effect and timing of certain economic variables and the effect of past budgets on current defense budgets. The regression analysis, conducted on an individual case study basis for ten relatively economically homogenous Latin American countries, indicated the significance of fiscal variables in accounting for fluctuations in military expenditures. A tested lag effect was also significant, indicating that changes in expenditures or revenues affects the military budget over time. The results also suggested that the large regional powers might have a somewhat different set of fiscal linkages than smaller countries.

Looney (1986) examined the influence of external debt on military expenditures among a group of 61 developing states. The author concluded that: a) per capita military expenditure tends to increase in association with increases in per capita income, a finding in support of Wagner's law; b) public external debt is a significant factor in expanding military expenditures per capita; c) regional differences in military expenditures are not as pronounced as the differences between resource constrained and unconstrained states.

Looney (1988) examined the effect that indigenous arms production capability has on determining the level of military expenditures for a sample of 104 developing states during the period 1961 to 1981. The results showed that differences in military expenditures can be explained by the level of GDP, the current account balance, and external debt -- with distinct differences between arms producers and non-producers.

Looney (1989) also found that the level of military spending in developing countries is determined in larger part by economic constraints than by external threat factors. This is qualified by Looney's earlier contention (1988) that arms producers are less vulnerable to external factors than non-producers.

Table 5 summarizes the relationship between economic/fiscal indicators and military expenditures as found in a variety of recent studies. The testing by these authors has proceeded on the hypothesis that the changes in these economic factors over time results in a displacement effect on military spending. As can be seen in Table 5, the results of these analyses are not entirely consistent. This is exemplified by the previously noted studies by Lotz (1970) and Maizels and Nissanke (1986). Both studies used military expenditure as a percentage of GNP as the dependent variable and per capita income as one of the independent variables. Lotz found a significant negative relationship between the two variables while Maizels and Nissanke concluded that the relationship was not significantly different from zero.

A wide variety of other economic and political variables have been examined in the literature. While a clear consensus has not emerged and the need for further research is evident, there are some observations about the effect of economic factors on military expenditures which appear to be supported by a broad range of empirical studies. For one, the proposition that effects on the level of military expenditures are attributable to multivariate influences -- political and economic, domestic and international -- has broad support in the literature.

Few analysts would now dissent from Looney's conclusion: "Most importantly, the analysis indicates the usefulness of examining the defense burden from an economic perspective. Despite the wide diversity of political and strategic situations in the sample of developing countries, economic variables were shown to account for the bulk of differences in per capita military expenditures across countries." (Looney 1986, 29)

The extent of domestic and external resource constraints, as well as the country's domestic arms production capability, appear to alter the structural relations between other causal factors and military expenditure levels. More generally, the developmental homogeneity of Third World states cannot be assumed. Cross-sectional studies which have pooled the experience of countries with extremely diverse economic and political conditions, and incorporated a variety of time periods and testing models, have had indifferent success in identifying the determinants of inter-country variations in defense spending. Sub-dividing countries according to similarities in economic characteristics reveals significant differences in the relative importance of various influences on military expenditures. We will return to the identification of significant sub-groupings in Part V., below.

II.e) MULTI-VARIABLE EXPLANATIONS OF MILITARY EXPENDITURES

Efforts to unravel the determinants of military spending using econometric analysis have centered around attempts to verify the corollary of Wagner's Law for defense spending, that there is a positive relationship between economic growth and the military burden. Early uses of multi-variate regression techniques in this vein were framed within the context of more general studies of the determinants of all public expenditures.

Table 6 summarizes the econometric analyses of five authors who have explored the hypothesis that a positive relationship exists between economic growth and the military burden. Each econometric model utilizes a multi-variate regression technique and employs several explanatory variables from the four major classifications listed in the Table.

Lotz (1970), for example, used data for 37 LDCs and employed factor analysis to determine the relationship between the composition of government spending and different dimensions of economic and social structure. Lotz' regression analysis estimated significant partial correlation coefficients for mineral and oil exports and size of the public sector (both indicators of budget-/financial constraints in Table 6), and for per capita income and urbanization (indicators of economic development level), with respect to the military burden. As shown in Table 6, the variables explained 37 percent of the inter-country variation in the military burden. Per capita income level showed a highly negative coefficient. Lotz concluded that modern military establishments have technical economies of scale and that lower-income countries must often spend more than they otherwise would in order to keep up with their wealthier, expansionist neighbors.

Lotz' effort suffered from a paucity of *a priori* theorizing and the limitations of the variables he had available for use. His failure to include foreign exchange/external resource constraints or internal/external threat variables make his specification suspect. Lotz also did not address the question of the possible simultaneity between military expenditures and economic growth. As a result, Lotz' results are questionable.

Tait and Heller (1982), in a broad IMF analysis of government expenditure in 84 developed and developing countries, regress per capita income, urban population share, the public sector size (net of defense) and population share under fourteen years of age, on the military expenditures/GDP ratio. Explaining only 15% of the inter-country variation (shown by the R2 of Table 6), Tait and Heller's estimation fails to return a significant coefficient for per capita income but mirrors closely Lotz' results for the

TABLE 6.

DETERMINANTS OF MILITARY BURDEN (MILITARY EXPENDITURE/GNP)
(Values of Regression Coefficients)

	Lotz (1970)	Tait and Heller (1982)	Tait and Diamond (1990)	Maizels & Nissanke (1986)	Deger (1986)
Economic Development Level					
Per Capita income level	-0.006**	n.s.	n.s.	n.s.	0.15**
Open economy inverse index					-0.22*
Urban population share	0.048**	0.05*	0.028*		
Urban pop. growth rate			0.33*		
Budget/Financial Constraints					
Public sector size CGE/GNP	0.081*	0.10**		0.21**	0.15**
Mineral export share	0.020*				
Growth of foreign exchange				2.79**	
GDP growth rate				n.s.	
Political/Military Influences					
War Dummy				2.43**	11.35**
Oil-Country Dummy					3.98**
Regime-type/violence score				0.65**	
Arms-supplier concentration				0.63**	
Other Structural Factors					
Population share under 14		0.16**	0.098**		n.s.
Total population					
Ratio of FDI to capital stock				-1.15**	
Concentration of FDI investors				n.s.	
R2	0.37	0.15	0.08	0.65	0.87
N	37	84	200	72	50

*, **, significant at 95% and 99% level (one-sided); n.s. = not significant at 95% level

urbanization and government size variables. Constructed in a similar fashion and containing almost the same variables, Tait and Heller's work falls victim to the same theoretical and methodological flaws encountered in Lotz' analysis.

In an update of the Tait and Heller work, Tait and Diamond (1990) returned to essentially the same analysis using data for the period 1975-86. The defense expenditure estimation explained only 8% of the variation. Tait and Diamond shed little additional light on the determinants of military expenditures.

Maizels and Nissanke (1986) introduced political, military and external resource factors into their analysis. The authors also specify internal and external economic linkages that influence military expenditures. Internally, they allow for per capital income level, GDP growth rate and public sector share of GDP; externally they suggest that growth of foreign exchange availability, foreign direct investment to total capital stock ratio, and the concentration of foreign investment should all have explanatory power with respect to the military burden.

Maizels and Nissanke's regression analysis was carried out with military expenditures data averages for 1978-1980 for 72 LDCs. Table 6 shows that both per capita income and the GDP growth rate fail to have any significant explanatory power in the equation. (Both variables are listed in the table as n.s., statistically not significant) According to Maizels and Nissanke, the most powerful explanatory variable is the public sector burden. The incorporation of political and military factors and external economic influences significantly improves the overall explanatory power of their hypotheses.

The negative, significant impact on the defense burden of the change in foreigners' share of the total capital stock has been interpreted by Gyimah-Brempong (1987) to show that military expenditure is not exogenous. Since military expenditure both impacts on and is affected by the change in capital stock, or investment, Maizels and Nissanke's (1986) results appear to suffer from simultaneity bias.

Joerding (1986) provided additional evidence of the endogoneity of military expenditures by conducting a Granger Causality Test on 1960s and 1970s data from 57 LDCs. A variable is said to be directly Granger caused by another variable if the original variable is better predicted by using lagged values of both variables than by lagged values of only the original variable. Joerding concluded that economic growth does Granger cause military spending. Since Granger non-causality is a necessary condition for considering military expenditures to be exogenous, Joerding asserted that he had demonstrated the endogeneity of military expenditures. Joerding, however, found no evidence that military expenditures Granger cause economic growth. While this

is not sufficient evidence to assert the exogeneity of economic growth (in light of contradictory evidence reviewed in Section III.g), below) it introduces uncertainty about the reliability of Joerding's test of the exogeneity of military expenditures.

Deger (1986) carried out a series of regressions, using data averaged over 1965-73 for 50 LDCs, to test the sign and significance of per capita income as different explanatory variables are added. Table 6 shows that Deger found per capita income to be positive and significant, confirming her Wagnerian expectation that as incomes rise the share in GDP of a public good such as military expenditures should increase.

Deger (1986) reported that experiments with other domestic variables, including growth rates, showed no significant explanatory relationship with intercountry variations in the military burden. She concluded that Wagner's Law cannot be validated empirically with respect to economic growth, but only with respect to levels of economic development.

Deger (1986) also found positive coefficients for two other variables explaining variations in defense spending: the indicators of government-sector size and the total population. Public sector size may be interpreted here, as in the other studies, as an indicator of relative domestic resource constraint. The population coefficient is borderline insignificant. Deger does not address the issue that adding the population variable when per capita income has already been included may be unnecessary and introduce collinearity into the equation. The question of the simultaneity of the public sector size and the military burden is also ignored by Deger.

Deger (1986) included country-specific dummy variables for oil exporters and war economies as measures of structural displacement. Both turned out positive and significant. A final variable measured the degree of integration of a national economy into the world economy by taking the difference of income per capita at both the official exchange rate and at the purchasing power parity rate. Deger argued that this open economy measure is just another index of development although she does not explain why she chose to include this measure rather than other development indices.

Although Deger's estimation explains a substantial 87% of the intercountry variance in military burdens, an assessment of her work must point out the absence of an internal threat variable or a measure of external resource availability other than the oil dummy. If higher income growth rates do not explain the variations in the military share of GDP, what about inflows of external capital or foreign exchange constraints as modeled by Maizels and Nissanke?

Considerable differences among analysts remain over the interpretation of the effects of economic growth and per capita income on the military burden. Conclusive cross-sectional evidence of economic growth impacts on the share of military expenditure in GDP have not been found. Nonetheless, a relationship between the military burden and the level of development, represented by per capita income or another indicator, does seem to emerge. In sum, the results neither fully confirm nor disprove the Wagner's law propositions. This should not be unexpected, as demonstrating the corollary of Wagner's law with respect to economic growth is a more appropriate task for time series, rather than cross-sectional, analysis. Thus far, no empirically substantive evidence has been found to counter the intuitive notion that as the process of economic growth proceeds more resources are freed for the purposes of public expenditures, including national defense.

PART III.
REVIEW OF RESEARCH AND EMPIRICAL EVIDENCE ON THE IMPACTS OF MILITARY EXPENDITURE ON ECONOMIC GROWTH

Research exploring the impact of military expenditures on macroeconomic variables and economic growth has taken many different approaches. Some scholars have focussed narrowly on a particular impact of military expenditure. Others have emphasized that the same dollar of military spending can affect economic growth simultaneously through a number of different conduits or channels. Each conduit transmits a quite different effect on economic growth. We will survey this wide-ranging literature by reviewing, in turn, how analysts have described each of five main channels through which military expenditure exercises an effect on economic growth, namely: (1) allocation effects, (2) mobilization effects, (3) spin-off effects, (4) aggregate demand effects and (5) debt accumulation effects.

Section III.a) briefly reviews modern growth theories and describes how the various effects of military expenditure are related to the determinants of economic growth, in the context of both neo-classical and post-Keynesian growth models. Sections III.b) through III.f) review the research on each of the five main channels and their effects, identifying the central questions which have been addressed in this body of literature. Finally, Section III.g) makes a technical assessment of the multi-variate statistical work that has sought to verify empirically single and multi-channel models of the impacts of military expenditure on economic growth.

III.a) MILITARY EXPENDITURE IN MODELS OF ECONOMIC GROWTH

Modern growth theories can be divided into two basic models: post-Keynesian and neo-classical models. The post-Keynesian models emphasize the sources of aggregate demand such as consumption, investment, government purchases and net exports. The neoclassical models focus on the factors that affect aggregate supply, such as the labor force, capital, and level of technology. The two contending growth theories are outlined briefly in this Section and the role of military expenditure in each theory is identified. A more detailed description of these growth models is presented in Annex 3., "Modern Theories of Economic Growth," by Michael P. McLindon.

The Harrod-Domar model bridged the gap between the Keynesian theory of employment and the dynamics of long-run growth. A central feature of the Harrod-Domar model is that investment has a dual character. On the one hand, investment contributes to aggregate demand and thereby helps to promote full employment and use of full capacity in the short run. It also expands the stock of capital and therefore contributes to the supply of output that the economy is capable of producing. In this model the growth rate is determined by the savings ratio and the incremental capital output ratio.

Two-gap models have been developed in the Harrod-Domar framework to assess feasible levels of growth in developing countries. In these models, two independent resource constraints inhibit growth. First, the required level of investment to realize the growth potential of an economy may not be available because the economy cannot generate the needed savings. Second, domestic growth is constrained by access to foreign exchange, or the inability to run current account surpluses.

Economists at AID and the World Bank frequently use the two-gap approach for macroeconomic modelling which can determine the level of resources needed to help fill the saving and foreign exchange gaps. The Revised Minimum Standard Model (RMSM) is a type of two-gap model that is widely used.

In analyzing developed economies, the Harrod-Domar model has been effectively superseded by neoclassical growth theory. Neoclassical growth theory assumes that output is at the full employment level, and that the supply of labor, independently of real wages, grows at a constant exponential rate.

The most familiar neo-classical model is the Cobb-Douglas production function, where output is a function of the labor force, the capital stock and the state of technology. Growth in output is basically a function of growth of the capital stock.

The five main effects of military expenditures and the channels through which they are transmitted are identified below, along with a description of how the different effects would be incorporated into both the post-Keynesian (Harrod-Domar and two-gap) models and the neo-classical growth model.

1. Resource allocation effects. Resource allocation effects occur when increases in military expenditures divert, or re-allocate, resources away from domestic civilian investment, public expenditures on government capital investment and current account expenditures on non-military inputs.

If an allocative effect is present, it would tend to lower growth in both types of growth models. In a two-gap model, if

investment in the present year is crowded out, it will lower the growth rate for the following year. If absorptive capacity constraints are present because government economic expenditures are squeezed, there will be less private investment and the growth rate will be lower. If the agricultural sector lags behind the industrial sector because military expenditures squeeze investment in agriculture, the agricultural sector's ICOR will be higher (more investment needed to obtain a given unit of output), and the growth rate will be lower. If investment is less productive because of absorptive capacity constraints related to squeezed economic expenditures, the ICOR will also be higher, and the growth rate will be lower.

In the neo-classical model, the growth rate is a function of the growth of the capital stock. Any of the above conduits of the resource allocation effect would reduce the growth of the capital stock and thus lower the growth rate.

2. Resource mobilization effects. Increases in military expenditures are expected to influence domestic savings through the following conduits: a reduction in social services, additional taxes, an increase in the social discount rate, and inflation creation.

In the post-Keynesian models, a lower savings ratio results in a lower growth rate. Thus, if the resource mobilization effect is present in a particular economy, the growth rate would be lower. In a neo-classical model, by contrast, the rate of growth would not be affected. However, it would lower the level of the growth path.

3. Spin-off effects. Military expenditures have impacts on economic growth through spin-off effects on human capital (such as may result from military training, education and modernization influences) and on the productivity of investment (such as provided by civic action, technology transfers and the provision of other goods and services).

If there are positive "spin-offs" from military expenditures, these would tend to result in a lower ICOR (less investment is needed per unit of output) in a post-Keynesian model and thus an increased rate of growth. In a neo-classical model, spin-offs would increase the level of technology and result in a higher growth rate.

4. Aggregate demand effect. In an economy with underutilized productive capacity increased aggregated demand from military expenditures will result in increased output. This leads to a rise in capacity utilization and profit rates, in turn inducing

an increase in investment rates and putting the economy on a higher long-term growth path,

This effect is clearly Keynesian in nature, and related to the multiplier mechanism. However, the multiplier is a static concept, while the proposers of the aggregate-demand effect describe a means by which this can have a dynamic effect on long term growth. This effect is not possible in a neo-classical model, since it assumes full employment of resources.

5. Debt accumulation effect. The debt accumulation effect describes the impact on current economic performance of debt accumulation attributable to past acquisition of military goods and services from abroad.

A two-gap model such as the RMSM shows that a reduction in foreign exchange resources, because past military expenditures resulted in debt accumulation, would reduce the attainable growth rate. This effect on growth could also be found in a neo-classical model if the growth of the capital stock were impaired because needed capital goods were not available, and/or because access to foreign technology was limited.

The economic impacts of military expenditures have been grouped into five categories based on the nature of their effect. Tracing the hypothesized effects of military expenditures through the post-Keynesian and neo-classical models does not lead to radically inconsistent results. This is because both models stress, though in different fashions, the importance of capital formation and technology.

It is important to note, as several of the authors reviewed in the next sections have stressed, that these theories of economic growth do not a priori indicate whether military expenditures will promote or hinder economic growth. The final effect on economic growth is the net outcome of positive and negative impacts conveyed through the different channels. The net outcome is likely to differ across countries and through time, for reasons which are explored in the literature describing each separate channel of influence.

III.b) ALLOCATION EFFECTS

The first channel describes the economic impacts transmitted through allocation effects -- a diversion of resources away from private investment (via the crowding-out conduit), non-defense related public investment (government investment conduit) and current account external purchases (net export conduit) owing to

TABLE 7.

RESOURCE ALLOCATION AND MOBILIZATION EFFECTS

AUTHORS	PUB. DATE	TIME PERIOD	REGION	MECHANISM	FINDINGS: NET EFFECT ON GROWTH ALLOCATION	MOBILIZATION
Benoit	1973	1950-65	LDC [44]	CO (HD)	Positive	--
Dabelko & McCormick	1977	1950-72	LDC [76]	GI, SS	Negative	Negative
Faini, Annez & Taylor	1984	1952-70	LDC [69]	CO, GI, T	Negative	Negative
Lim	1983	1965-73	LDC [54]	CO (HD)	Negative	
Deger	1985 1986	1965-73	LDC [50]	CO, GI, NX T, TP, P	Negative	Negative
Looney & Frederiksen	1986	1970-82	LDC [74]	NX (HD)	Positive (unconstrained)	
Ball	1988	1965-73 1952-70	LDC [50] LDC [46]	TP	Inconclusive	Negative
Looney	1988	1970-82	LDC [74]	GI, NX, SS, T	Positive (unconstrained)	Positive (arms producers)

Key: (1) Number of country observations in brackets.

(2) Allocation Conduits
CO = Crowding Out of Private Investment
GI = Government Investment Effect
NX = Net Export Effect

(HD) = Harrod-Domar Growth Model

Mobilization Conduits
SS = Reduction of Social Services
T = Tax Burden Effect
TP = Time Preference Effect
P = Inflation Effect

increased military spending. The general consensus emerging from the literature is that military expenditures reduce economic growth through reductions in resources allocated to these three types of investment. This trend is shown in Table 7 which summarizes the conduits and direction of effects cited in the literature.

An increase in military expenditure displaces domestic private investment through a "crowding out" effect. Dornbusch and Fischer (1987) describe this effect as occurring when an expansionary fiscal policy causes interest rates to rise, thereby reducing private spending, particularly investment. While military expenditure does crowd out some investment, Emile Benoit (1978) contends that spending less on defense does not necessarily translate into greater investment. Rather than channeling funds into "productive investment," resources are reallocated toward consumption and social investment. Such a reallocation would fail to lead to real growth. Benoit also believes that crowding out is reduced because the defense sector in a developing country absorbs a smaller fraction of total resources than does private investment. Given the minimal decline in the investment rate, the decline in growth due to the marginal capital output ratio would be even smaller.

Perhaps the foremost among critics of Benoit is Saadet Deger. In addition to a crowding-out conduit, Deger (1986) contends that defense spending will negatively impact growth through resource reallocation, via a government investment conduit and a net export effect. Deger (1986), Dabelko and McCormick (1977), and Looney (1988) note that an increase in defense spending leads to a reduction in the "social wage" -- state expenditure on health, education, transport, and other infrastructure. Faini, Annez, and Taylor (1984) consider a slowdown in growth to be the result of the displacement of government investment in infra-structure. For example, a reduction of investment in irrigation may reduce the growth of agricultural output.

Looney (1988), Looney and Frederiksen (1986), and Rothschild (1973) demonstrate the effect of increased military expenditure on economic growth through a change in net exports. Deger (1985) explains that military goods are particularly import-sensitive and require foreign exchange for their financing. Since the amount of foreign exchange at a given time is necessarily limited, the more that is spent financing military imports, the less there is available to import intermediary inputs for agriculture and manufacturing. Looney and Frederiksen divide developing countries into resource-rich and resource-constrained countries. In the latter, with their disproportionately high debt service ratio and little or no access to external credit, military expenditure saps scarce foreign exchange and other resources.

III.c) MOBILIZATION EFFECTS

The second channel through which military expenditures impact economic growth is the mobilization effect. Increases in military spending may lead to change in savings behavior through the impact of a reduction in social services, additional taxes, an increase in the social discount rate and the creation of inflation. The literature on these conduits and their effects are reviewed along with the allocation effects in Table 7. If security expenditures mobilize resources that would have gone towards savings, the mobilization effect on economic growth is likely to be negative.

As mentioned above Deger (1986), Dabelko and McCormick (1977), and Looney (1988) believe most LDC governments face a trade-off between increasing military expenditure and cutting the provision of social services. Reductions in public spending on health and education entail a corresponding rise in household expenditures on these items. Resources available for household savings are negatively impacted by defense spending, and the savings ratio falls. As noted by Looney (1988), the group of arms-producing countries appears to be an exception to this rule.

Faini, Annez, and Taylor (1984) and Looney (1988) note that increases in military spending are accompanied by rises in the tax burden. With an increase in the tax burden, the level of household savings is reduced. Deger (1985) also argues that this constriction of savings hinders the mobilization of domestic resources. Higher taxes associated with increasing military expenditure may increase the mobilization of government resources, but most analysts doubt that the process will lead to growth-generating increases in output. Gandhi (1974) examined the experience of India and found that military expenditure absorbed most of the mobilized resources, development outlays decreased, and the savings ratio declined.

Deger (1985) and Ball (1988) examine savings behavior in the context of the the social discount rate. Society's time preference exerts an important influence on the balance between household consumption and savings. If higher defense outlays contribute to peace and social stability, they may be associated with an extension of society's time preference and a fall in the social discount rate. However, Deger (1985) and other investigators believe the opposite effect of defense spending to be more often the the result. She contends that with growing belligerence, a proliferation of weaponry most frequently leads to a heightening of insecurity. This translates into a rise in the rate of time preference and decreased savings propensity.

Deger (1985) also discounts the resource mobilization effect of inflation, citing econometric evidence showing an insignificant impact of inflation on the savings rate. Deger (1986), Deger and Smith (1983), and Grobar and Porter (1989), as shown in Table 7, all find that rising military expenditure appears to depress the mobilization of domestic savings. Looney (1988) notes further that the depletion of savings is accompanied by a regressive impact on income distribution.

III.d) SPIN-OFF EFFECTS

While the allocation and mobilization effects generally act to reduce the rate of economic growth, spin-off effects may act as a stimulant to growth. The net impact on growth and other aspects of economic performance varies among countries and through time. The spin-off effects of military expenditure are transmitted through two conduits: (1) improvements in human capital such as result from training, education, and modernization, and (2) improvements in the productivity of investment through spin-offs from civic action, technology, and other goods and services. The literature also considers the difference in spin-off effects between arms and non-arms producers.

IMPROVEMENTS IN HUMAN CAPITAL

Those who argue that there are positive effects of military expenditure often describe how military training and the exposure of personnel to military organization stimulate economic growth through the formation of human capital. These authors presume that spin-offs encourage innovation, increase efficiency, and reduce the costs of production. Those who cite the negative aspects of spin-offs describe the opportunity costs of diverting expenditure from potential civilian uses. The mechanisms of education and modernization facilitate the acquisition of specific knowledge, technical skills, and "modernizing" social attitudes. These attitudes translate ostensibly into a cohesive identity within the military and a receptivity to modern technology, markets, and financial structures.

Tables 8 and 9 summarize the primary findings of the authors addressing the training and modernization conduits. Two primary schools appear within the literature. Emile Benoit (1978), Lucien Pye (1962), and the Korean Labor Education and Research Institute (1975) assert a positive correlation. Nicole Ball (1983), Bruce Arlinghaus (1984), and Ikenna Nzimiro (1983) appear among those who advocate the negative opportunity costs of military expenditures. Little disagreement exists among analysts

TABLE 8.

RELATIONSHIP OF MILITARY EXPENDITURE, TRAINING AND ECONOMIC GROWTH

AUTHORS	PUB. DATE	TIME PERIOD	REGION	INDEPENDENT VARIABLES	DEPENDENT VARIABLES	FINDINGS: RELATIONSHIP
Arlinghaus	1984	1979-80	Africa	Tech and industrial training	Absorbtive capacity	Negative, ineffective
Ball	1983 & 1988	c.1982	LDC	Training in tech and admin skills	Growth	Weak postive, ineffective
Benoit	1978	1950-65	LDC	Training in tech and admin skills	Growth	Positive
Deger	1986	1965-73	LDC	Public educ.	Growth	Negative
Magnum & Ball	1987	1979-84	US	Training in specialized occupations	Growth	Positive
Korean University	1976	c.1975	Korea	In-service & pre-release training	Growth	Positive, integrates civil/mil
Pinch	1982	1970-80	Canada	Training, trends in labor-force/ tech	Institutional linkages	Positive, depends on links
Terhal	1981	1960-70	India	Tech/leader-ship training	Growth, employment	Positive, employ civ
Vivekananda	1987	1966-85	Nigeria	Training of engineers and health workers	Aggregate level of capital	Negative, lowers agg human cap.

that military establishments generally seek to acquire technologically sophisticated military hardware and systems. Considerable resources are expended in training personnel to maintain, operate, and repair these systems. At issue is the degree to which these spin-offs stimulate economic growth or benefit the military exclusively, thereby depriving the civil sector of scarce resources.

A variety of the relationships explored in the literature between military training activities and performance of the civilian economy are identified in Table 8. Magnum and Ball (1987) emphasize the importance of the provision of transferrable training by the military. Perhaps the most extensively developed of the studies is that of the Korean Education and Research Institute (1975). The integration of military manpower development with economic development surfaces as extremely important in the Korean study. The authors emphasize the training that each military recruit is given in a specific skill compatible with the needs of the civil sectors. The incorporation of pre-release training programs is cited by Ball (1983) as indicative of the limited transferability of standard military training.

Ball (1988) and Pinch (1982) address the issue of volunteer versus conscript forces. Ball considered the difference to be significant in that the turnover rate under conscription is higher than for a volunteer force. Hence, the civil economy appears to benefit less from skills acquired by volunteer forces. Pinch, in contrast, emphasizes the ability of volunteer forces to establish civilian-military linkages thereby enhancing the ability of military personnel to develop transferable skills.

Terhal (1981) described the limited employment possibilities for those leaving the Indian army as minimizing the potential benefits associated with human capital spin-offs. While the Korean study posited civilian technical manpower shortages -- satisfied partially by military training -- the Indian economy proved unable to absorb demobilized troops. Nicole Ball (1988) describes the base-level maintenance skills that too often comprise the extent of military technical training. She notes the ability of Iranian personnel to identify a weapon's problem with automated testing equipment, but the inability of the personnel to repair the equipment. The problem of technology absorption capacity appears frequently in the context of the literature. Arlinghaus (1984) describes the inability of the Sudanese infrastructure to support heavy tanks from the United States. Deger (1986) argues that adopted defense technology is often too advanced to provide relevant experience for the remainder of the economy.

A number of authors have addressed the hypothesis that military training and exposure to military organization imbue its personnel with modern social attitudes. Examples of the nature

TABLE 9.

RELATIONSHIP OF MILITARY EXPENDITURE, MODERNIZATION, AND ECONOMIC GROWTH

AUTHORS	PUB. DATE	TIME PERIOD	REGION	INDEPENDENT VARIABLES	DEPEDENT VARIABLES	FINDINGS: RELATIONSHIP
Adekson	1978	-	Africa	Training, soc and org behavior	Growth, regime type	Negative
Ball	1988	-	LDC	Training, attitude	Growth	Weak
Davis & Chan	1990	1961-80	Taiwan	Socialization, discipline	Growth, PQLI	No effect
Deger	1986	-	LDC	Socialization, education	Growth, human capital	Inconclusive
Dreyer	1988	1970-80	China	Professionalism	Ag/industrial development	Inconclusive
Korean Univer.	1976	c.1975	Korea	Training, attitude	Growth	Positive
Mintz	1985	1970-80	Israel	Personnel dist. experience	Growth	Mixed
Neuman	1978	1964-77	Iran	Attitudes, role changes	Growth, expansion	Positive
Nzimiro	1983	1958-75	Africa	Education,	Growth, rural/urban gap	Positive
Pye	1962	-	LDC	Attitude, educ., discipline	Growth	Strong positive

and direction of this modernization conduit are provided in Table 9. Davis and Chan (1990) contend that as military personnel internalize notions of discipline and efficiency, they are being prepared for a more productive role in the civilian life to follow. Conversely, Nzimiro (1983) and Adekson (1978) postulate that in diverting resources away from the civilian sector, the military has an aggregate negative modernizing effect. Deger (1986) contends that it is difficult to assert whether or not the military is a modernizing force in developing countries. She describes the difficulty in judging whether the military institution leads a nation toward modernity and contends that such an influence will vary across countries.

Mintz (1985) studied military-industrial linkages in Israel and found the industrial sector to be heavily staffed with high-ranking former military personnel in key executive posts. Mintz cites the organizational skills and contacts acquired during military service as clearly valued by the Israeli industrial sector.

The debate concerning the spin-off effects in terms of human capital formation and economic growth has deeply divided the contributors to this literature. Opponents of the argument emphasizing positive effects contend that the military is inherently more inefficient than a competitive market system in utilizing the factors of production. Proponents, on the other hand, appear to argue that the public good provided by the military (i.e., the provision of national security) justifies any economic shortcomings.

Wolf (1981) and others contend that the "production" of security leads to improved stability, which in turn facilitates realization of an economic environment conducive to low costs, low risks, and increased investment. Deger (1986) and others disagree, describing an environment of misappropriated resources, ongoing repression, and insecurity as more akin to military rule in the developing world.

Wolf (1981), among others, argues further that the military's command of a large share of the national budget contributes to national economic growth, ensures progress toward "modernity," and offsets the expense of the military. In order to establish and utilize these linkages, it is critical for governments to formulate a national technology acquisition/development strategy. Lucien Pye (1962) admits, however, that owing to the attitudinal distance that often exists between the military and civilian populations in the developing world, the military is frequently unaware of the difficulties inherent in modernizing other segments of society.

OTHER IMPROVEMENTS IN THE PRODUCTIVITY OF INVESTMENT

Emile Benoit (1973) postulated the existence of spin-off effects other than those associated with human capital. In his view dual-use goods and services -- such as infrastructure, disaster relief, and research and development -- provide unintended benefits to the civilian sector. These positive externalities fall into three categories: technology spin-offs, civic-action spin-offs, and other goods and services spin-offs. Table 10 identifies a number of studies which describe the expected strength and direction of the impacts on growth attributable to the spin-offs transmitted through these conduits.

Technology spin-offs are described by Luchsinger (1989) as the stimulation of widespread civilian research and development emanating from military spending in these areas. Kennedy (1974) notes the links between the defense sector and the metals and engineering sectors. Deger (1986) points out that the newly industrializing countries with defense production sectors readily display the technological spin-off effects. Deger also observes that the potential for technological spin-offs serves as a major motivation for the proliferation of arms industries within the developing world.

A second conduit appearing in the literature on this category of spin-off effects is that of civic-action programs. These programs employ military personnel and resources for projects designed specifically to benefit the civilian sector. Berg (1987) describes the utilization of military staff and resources in Senegal through road construction, building repair, emergency food transport, health services, and the construction of water canals. Glick (1967) describes the application of military resources in Latin America in the provision of transport and communication.

A final conduit identified by researchers is that of substitute goods and services provided independently of civic-action programs. Neuman (1979) and Dunn (1986) describe how efficient, low-cost provision of housing and bread demonstrate the positive spin-off effects of military spending. Benoit (1973) and Grobar and Porter (1989) argue that the military's production of substitute goods affects growth by allowing the civilian economy to devote a higher share of total output to investment.

As was the case with the literature addressing human capital spin-offs, investigators vigorously disagree about the net effect of these improvement-in-productivity spin-offs on economic growth. Those who contend that the net effect is negative emphasize the excessive opportunity costs, the cases of technology inappropriate to the civilian sector, and the absorption of

TABLE 10.

RELATIONSHIPS OF MILITARY EXPENDITURE, SPIN-OFFS, AND ECONOMIC GROWTH

AUTHORS	PUB. DATE	TIME PERIOD	REGION	GROWTH IMPACT BY TYPE OF SPIN-OFF		
				TECHNOLOGY	CIVIC-ACTION	GOODS
Albrecht et al	1975	-	LDC	Limited positive		
Albrecht	1977	-	LDC		Negative	
Ball	1983	-		Unclear		Weak positive
Benoit	1973	1950-65	LDC [44]	Positive	Positive	Positive
	1978	1950-65	LDC [44]		Positive	
Berg	1987	1987	Senegal		Positive	
Biswas & Ram	1986	1960-70 1970-77	LDC [58]	Negligible		
Brigagao	1986	-	Brazil	Positive		
Deger	1986	1965-73	LDC [50]	Negligible		
Deger & Sen	1983	1951-71	India	Positive in metals sector		
Dunn	1986	-	Egypt			Positive
Faini et al	1984	1952-70	LDC [67]		Positive (short) Negative (long)	
Feldman	1982	1945-71	Argentina		Positive	
Frederiksen & Looney	1983	1950-65	LDC [37]	Depends on resource constraints	Negative for resource constrained	
Glick	1967	-	LA, AS, ME	Positive		Positive

scarce resources by the military. Some critics who acknowledge that there are positive spin-off effects regard them as insignificant for practical purposes. A final group, following the lead of Benoit, argue that these spin-off effects, on balance, have a positive impact on economic growth.

SPIN-OFF EFFECTS IN ARMS-PRODUCING COUNTRIES

A rich body of literature has appeared concerning the subgroup of arms producing countries and possible spin-off effects. With the proliferation of arms production capabilities in the developing world, studies dealing specifically with the impact of military industrialization warrant special attention. Table 11 provides a summary of research addressing the central question of the impact of a domestic arms industry on the rest of the economy. The literature contains the findings of investigators who conclude that a negative impact is generated as the local defense industries "absorb" scarce domestic and foreign resources, as well as researchers who find, on balance, that the technological spin-offs from the domestic production of armaments "supply" additional scarce resources to the civilian economy.

As is evident from inspection of the "Findings" column of Table 11, the contributors to this literature are deeply divided in their evaluation of the net impact of the activities of domestic defense industries in the Third World on the performance of the civilian economy. There is no clear trend toward a consensus.

Many scholars describe the need to improve the data collection and research methods of studies on the spin-off effects of military expenditure. Terhal (1981) describes the lack of knowledge precluding a consensus regarding spin-off effects. A common barrier to better research involves a lack of access to information by governments sensitive to such inquiries. Many of the studies examined in this section were based on casual observation, description, and anecdotal evidence, rather than on more solid empirical evidence. Albrecht et al. (1975) note that empirical studies in this arena are impeded almost by definition.

Neuman (1979) cites the complexity of the issue as beyond the methodological and conceptual capability of contemporary analysis. Grobar and Porter (1989) note further the difficulty in conceiving of data that would meaningfully measure investments in infrastructure and the like. Furthermore, Neuman (1978) describes macrostatistics as inadequate for examining relationships as complex as spin-offs to economic growth. Grobar and Porter (1989) characterize the growing use of cross-country correlation evidence as failing to yield consistent results and hence providing little in the way of clear and significant evidence.

TABLE 11.

RELATIONSHIP OF ARMS PRODUCTION TO SPIN-OFF EFFECTS

AUTHORS	PUB. DATE	TIME PERIOD	REGION	FINDINGS: RELATION OF DOMESTIC ARMS INDUSTRY TO CIVILIAN ECONOMY
Ayres	1983	c.1977	Turkey	Absorb
Ball	1986	1969-85	LDC	Absorb
Ball & Leitenberg	1983	1970-81	LDC	Absorb
Brzoska	1989	1968-88	LDC	-
Brzoska & Ohlson	1986	1950-84	LDC	Absorb
Clare	1987	1981-85	LDC	Absorb
Deger	1986	c.1983	LDC	Supply
Deger & Sen	1985	1977-80	LDC	Supply
Evans	1986	1960-85	LDC	Supply
Fontanel & Drumont-Saraiva	1986	c.1985	LDC	Absorb
Kaldor	1977	c.1976	LDC	Absorb
Katz	1984 1986	1963-80	LDC	Supply
Looney	1989	1975-85	LDC	Supply
Louscher & Salomone	1987	1950-86	LDC	-
Moodie	1979	1965-75	LDC	-
Mushkat	1978	c.1977	Mid-East	Absorb
Neuman	1984	1979-80	LDC	-
Rosh	1990	c.1982	LDC	-
Ross	1986	c.1985	LDC	Supply
Vayrynen	1979	1974-78	Mid-East	-
Wulf	1979 1983	c.1978 c.1980	LDC LDC	- -

Key: Relationship: On balance, do domestic arms producers divert (Absorb) scarce resources from, or Supply technological spin-offs to, the civilian economy?

III.e) AGGREGATE DEMAND EFFECT

Another channel through which military spending in developing countries may impact on economic growth is the stimulation of output and investment induced by a rise in aggregate demand. In an economy with excess production capacity, increased aggregate demand will stimulate output, capacity utilization, and profit rates, which in turn fosters investment. The presence of this effect is predicated on the existence of excess capacity in LDCs. Models seeking to measure this impact must contain provisions for relating excess idle capacity, underemployment and other indicators of excess demand to changes in the growth rate. General conclusions about the strength and direction of the aggregate demand effect do not emerge from the literature. Table 12 summarizes the direction of the aggregate demand effect as seen by a number of researchers.

Benoit (1973) described a Keynesian multiplier effect of increased military expenditure in noting the incorporation of resources that were previously hoarded or otherwise underutilized. Benoit initially had accepted the conventional assumption that supply side constraints are more important than deficiencies of demand, as impairments to growth in developing countries, but conditions in India during the 1960s appeared to offer a contrary case. The stimulating effect of government expenditures on aggregate demand appeared to demonstrate a beneficial impact via the multiplier effect.

Faini, Annez and Taylor (1984) postulated that in an economy characterized by excess production capacity, increased aggregate demand from the military or any other source will stimulate output, capacity utilization, and profit rates. Investment may increase in response to higher profits, accelerating economic activity in terms of long-term growth.

Deger (1986) describes four conditions necessary for the aggregate demand effect to occur, namely (1) the presence of idle installed productive capacity, (2) underutilized capital stock or a tight monetary policy, (3) less than full employment, and (4) relatively stable prices. Given these conditions, an autonomous increase in any type of government expenditure will increase aggregate demand and increase output by more than the amount of stimulus due to the multiplier.

The multiplier effect also may impact on long-term growth. Deger (1986) notes that owing to structural rigidities, inflationary pressure may arise as the economy moves to its new equilibrium. Benoit (1978) identifies this inflation as useful in

TABLE 12.

AGGREGATE DEMAND EFFECT: MODELS OF MILITARY EXPENDITURE AND INDUCED INVESTMENT

AUTHORS	PUB. DATE	TIME PERIOD	REGION	EXCESS CAPACITY	DEPENDENT VARIABLE	EFFECT OF EXPENDITURE ON DEPENDENT VARIABLE
Benoit	1973	1950-65	India	Yes	Growth	Positive
Benoit	1978	1950-65	LDC [44}	Yes	Growth	Positive
Deger	1985	1965-73	LDC [50]	Yes	Growth	Negative
Deger	1986	1965-73	LDC [50]	Yes	Growth	Positive, offset by savings effect
Deger & Sen	1983	1951-71	India	Yes	Sectoral output	Weak positive
Deger & Smith	19[illegible]	1965-73	LDC [50]	Yes	Growth	Negative
Faini, Annez & Taylor	[illegible]4	1952-70 1952-72	LDC [69] India	Yes Yes	Growth Growth	Negative Negative
Lebovic & Ishaq	[illegible]7	1973-82	Mid-East [20]	Yes	Growth	No impact
Looney	1986	1969-81	LDC	Yes	Stabilization	Positive (Arms Producers) Negative (Non Producers)

Key: (1) Number of country observations in brackets.

(2) Excess Capacity: "Yes" indicates the author assumes excess capacity exists, or includes a measure for excess capacity in the testing model.

drawing into use the underutilized resources as aggregate demand increases. Deger agrees asserting that the inflation caused by the increased aggregate demand leads to a decline in real wages, increased employment and increased capacity utilization. Producers with idle installed capacity experience more efficient capital utilization due to this increase in demand. Deger (1986) points out that this, in turn, can lead to an increased profit rate which stimulates investment, increasing the long term growth rate. This chain of events is all contingent on aggregate demand being the primary constraint on output.

Using this Keynesian-structuralist approach, Deger (1986) identifies low productivity, low investment, and low growth in agriculture as the key problems for development strategies to address. At the same time, they are the source of intersectoral inadequate demand and hence the cause of underutilized capacity. Ball (1988) describes how excess capacity arises when a global recession curtails export markets in the developing world or when reduced export earnings cause lower inputs of necessary intermediate goods, generating excess capacity. Ball (1988) finds supporting evidence in Fontanel's (1980) econometric study of Morocco and Kurien's (1978) analysis of India. Deger (1986), Taylor (1980), and Chakravarty (1984) agree with Ball assuming structural rigidities in developing countries that cause output to be below its potential due to inadequate aggregate demand.

Benoit, in contrast, was cautious in assigning significance to the evidence of excess capacity in LDCs. This caution accords with the neoclassical assumption that supply constraints are the effective. limiting constraints on output growth in developing countries. This viewpoint is prevalent in the literature, and it may be one reason why few analysts assume excess capacity to be present or attribute importance to the phenomenon.

In order to test the effect of military expenditure on effective demand, Deger and Sen (1983), in their study of India, inspect the technical linkages identified by Kennedy as being associated with the industrial sectors which provide an economy with potential domestic defense production capability. Deger and Sen conclude that, in the case of India, the effect of increased military expenditure on sectoral output was insignificant. Pursuing a similar line of investigation, Looney (1986) examined distinctions between arms producers and non-producers. He finds that military expenditure can result in fuller utilization of capacity among arms producers, but not for non-producers. Looney (1988) concludes that, for arms producers, military expenditure can induce higher rates of investment and savings, with minimal leakage to imports, and thus contribute to higher growth rates.

In sum, the literature supports only limited general conclusions since investigators bring such a range of different perspectives to analysis of the effects of changes in aggregate demand..

III.f) DEBT ACCUMULATION EFFECT

A final channel affecting economic growth in developing countries relates to the impact of military expenditure through its effect on the accumulation of external debt and the use of foreign exchange. It is clear that most developing countries face trade-offs between military expenditure and inflation, debt, or the reduction of government spending for civilian purposes. Many governments in the developing world appear to have financed militarization by borrowing abroad. This, in turn, has led to a decline in available foreign exchange due to the service requirements of the new debt, a short-term drop in imports and national output, and a long-term weakening of the country's currency.

Brzoska (1983) describes the shift in arms imports financing from grants in the 1950s and 1960s to credits and cash payments in the 1970s. He concludes that, since the second half of the 1970s, grants and credits have declined in importance as arms imports financing sources. He finds that the cost of military credits in the late 1970s contributed from twenty to thirty per cent to the growth of total real LDC debt. The sharp increase of the debt burden adds an important dimension to the overall effect of arms expenditures on economic growth.

Looney and Frederiksen (1986) examine the differences in the borrowing capacity of various countries. They divide developing countries into two sub-groups: countries with relatively unconstrained access to financial resources vs. resource-constrained countries. They find that a positive relationship exists between external debt and economic growth in countries with relatively unconstrained access to resources, but a negative relationship in relatively constrained economies. They believes the results suggest the importance of inspecting access to foreign exchange and external debt service capacity in assessing the debt accumulation effect of military expenditures.

Looney (1988) observes the relatively limited reliance on external debt (seen in relation to gross domestic product) by many of the larger, more affluent developing countries. He argues that, for these countries, military expenditures did not contribute importantly to accumulation of public external debt. For the resource-constrained and non-arms producing countries, it is more evident that scarce resources have been utilized for military spending. Relatively-unconstrained countries can more easily manage the capital investment programs necessary for economic growth while maintaining or increasing defense programs. Given the high debt service ratio of the constrained countries and the generally "unproductive" nature of military expenditures, Looney (1988) considers the future expansion of defense expendi-

tures by those countries as highly unlikely. He also finds that arms producers are less likely to encounter negative economic impacts from external debt accumulation than non-producers.

Shubik and Braken (1983) regard the external debt variable as critical to strategic planning and an extension of the economic and military security relationship of the 1950s and 1960s. The authors contend that the debt crisis signals a political crisis of declining sovereignty, despite the massive militarization facilitated by foreign borrowing. Shubik and Braken differentiate between countries whose borrowing primarily financed infrastructural development, such as Brazil, versus armament purchases and capital flight, such as Argentina.

III.g) EMPIRICAL EVIDENCE ON THE IMPACTS OF MILITARY EXPENDITURE

In sections III.b) through III.f), above, we have reviewed the literature describing five different kinds of effects on economic growth that are associated with various conduits transmitting the economic impacts of military expenditure. The research we have surveyed is chiefly focused on identifying the different mechanisms of transmission and describing how each channel conveys the impact of military expenditure on macroeconomic performance. As indicated, the result of military spending can be simultaneous positive and negative effects on economic growth flowing through different channels. Section III.g) will review research which has attempted to model and measure the impact of military expenditure on economic growth, with an emphasis on empirical investigations which have tried to overcome problems of econometric technique discussed in section I.b). We will review the research in the order of increasing complexity of the testing models utilized. Earlier studies, generally, did not acknowledge all of the problems of inter-action and simultaneity which are addressed in the more recent research.

SINGLE CHANNEL MODELS: BENOIT AND HIS CRITICS

Since Emile Benoit's work, Defense and Growth in Developing Countries, was published in 1973 social scientists and econometricians have repeatedly challenged Benoit's conclusion that his work "suggests the possibility, though this is not strictly demonstrable, that on balance the defense programs may have stimulated growth" (Benoit 1973, xix).

While a number of investigators have criticized Benoit's statistical work, others have taken the time to rework his data

in an effort to confirm or disprove the Benoit finding of a positive impact of defense spending on economic growth. Other analysts have introduced more sophisticated structural models in order to evaluate the direct and indirect impacts of defense spending on economic growth (Lim 1983; Faini, Annez and Taylor 1984; Deger and Smith 1983; Deger 1986). Questioning the assumed unidirectional nature of the relationship between military expenditures and economic growth, Deger and Smith first abandoned the static single equation specification, and introduced a testing procedure to estimate multi-channel impacts simultaneously. Following an examination of Benoit's finding and a summary of subsequent criticism, we will review some of these more recent and innovative studies.

Benoit compiled data on growth in civilian output (G'), bilateral foreign aid receipts (R2), investment (I) and the military burden defined as military expenditures/GDP (B) for 44 LDCs. Two cross-sectional samples consisting of period averages were constructed. Benoit judged the A series (from 1950-1965) as less accurate than the C series (from 1960-1965) but preferable because it allowed a more realistic period for "the determinants to have exerted their full effect on the growth rates" (Benoit 1978, 274).

Concentrating on simple correlations for the A series, Benoit observed that civilian output growth (AG') was positively correlated with all three explanatory variables, including a correlation of +0.54 between civilian growth and the military burden. Further, while investment showed little correlation with bilateral aid or the military burden, a high correlation (+0.70) is observed between the military burden and bilateral aid (Benoit 1973, 117).

Multiple regression analysis including all three variables showed the military burden to be positive but insignificant for the A series, but positive and significant for the C series:

AG' =	.61*AI	+ .54*AB		R^2 = .55	(1)
	(4.9)	(4.1)			
AG' =	.70*AI	+ .59*AR2		R^2 = .59	(2)
	(6.2)	(4.6)			
AG' =	.66*AI	+ .34*AR2	+ .21*AB	R^2 = .61	(3)
	(5.6)	(2.3)	(1.3)		
CG' =	.35*CI	+ .13*CR2	+ .49*AB	R^2 = .41	(4)
	(2.4)	(-0.83)	(3.6)		

Equation (4) uses C series data
T-statistics in parentheses
Source: Benoit 1978, 275

On the basis of Equation (4) and the lack of significant correlation between the military burden and either income per capita or

government revenues and expenditures, Benoit concluded that the military spending increased economic growth and that the direction of cause and effect was from military spending to growth in civilian GDP, and not vice versa.

Benoit's many critics have found his pioneering work flawed in both the method applied and conclusions reached. As Benoit himself points out by labeling his coefficients as partial correlation coefficients, the results of his statistical work are only correlative in nature. As discussed in the Introduction to this Report, correlations do not necessarily imply anything about causality or its direction. Benoit's troubles are complicated by the inherent difficulty of trying to make causal statements based on correlations between such broad cross-sectional averages.

With respect to Benoit's method, his multiple regression suffers from three possible violations of classical OLS assumptions, raising questions about the validity of his results. The high degree of correlation between bilateral aid and the military burden indicates that in Equation (1) the military burden might act as a proxy for bilateral aid (Gyimah-Brempong 1987, 10). By restricting his measure of external resources to bilateral aid, Benoit emasculates the external resources variable of its potential contribution to economic growth. This increases the explanatory power of the military burden, biasing his results in favor of the military burden (Ball 1983, 509-512).

In addition to this source of bias, the inclusion of both the military burden and bilateral aid in Equations (3) and (4) results in collinearity, making results very sensitive to the equation's specification and the nature of the sample. This dovetails with Porter and Grobar's finding that the correlation coefficients between the military burden and civilian output growth are reduced by half as a result of the exclusion of just two countries, Jordan and Taiwan (Grobar and Porter 1989, 330). Thus it is likely, contrary to Benoit's assertion, that the correlation he found between the growth of civilian output and the military burden is spurious.

A second possible violation of OLS assumptions concerns the variance in economic and military structures in Benoit's sample, which could result in heteroskedasticity (Gyimah-Brempong 1987, 11). Again this would increase the variance of the coefficients making it even more difficult to rely on Benoit's regression analysis.

Benoit's most serious shortcoming, however, was his failure to construct and estimate a structural model that takes into account the multiple channels through which the military spending can transmit an impact on economic growth. It is apparent that a single equation model of the type estimated by Benoit captures only a portion of the different impacts reviewed, above.

A substantial amount of research time has been spent attempting either to verify or disprove Benoit's conclusions and "on balance they have not supported his conclusion" (Chan 1985, 412). Fredericksen and Looney divide Benoit's data into two samples based on resource constraints and re-estimate Equation (3). They find a small but significant positive coefficient for the military burden in resource-rich countries and no significant association in resource-constrained countries. (Fredericksen and Looney 1982, 1983) Although useful for differentiating the experience of relevant sub-groups of developing countries, Fredericksen and Looney's work is subject to the same criticisms as the original Bencit investigation.

Other studies using similarly flawed single equation specifications, but producing results at odds with those of Benoit include Gottheil (1974), Kaldor (1976), Nabe (1983), Weede (1983, 1986), Biswas and Ram (1986), Landau (1986), and Grobar and Porter (1989) using Kennedy's data (1974).

MULTI-CHANNEL MODELS

David Lim (1983) used World Bank data from 1965-73 for 54 LDCs and a more explicit Harrod-Dommar growth equation to obtain results contrary to those reached by Benoit. Lim regressed the incremental capital output ratio (ICOR), military expenditures budget share, and the external capital inflow to national savings ratio on the annual growth rate of real GDP. With a log-linear form and taken across all countries in the sample the military burden coefficient is -0.08. Unfortunately Lim specified a single equation model for estimation purposes, thereby losing the multiple channel effect on investment. His choice of a log-linear form based on fit is not particularly compelling. Increasingly, analysts are expressing doubts that a capital-centered model, such as the Harrod-Domar model, provides a sufficient means for measuring growth in developing country economies (Gillis et al. 1987, 372; Gyimah-Brempong 1987, 24).

A study by Faini, Annez and Taylor (1984) seeks not only to measure the direct correlation between military expenditure and economic growth, but to disaggregate the different intermediate channels through which military expenditure influences growth. They constructed a multi-equation Keynesian macroeconomic model incorporating both capacity utilization and absorptive capacity constraints on investment. For estimation purposes they specify a reduced form equation with growth rate of GDP as the dependent variable and the following independent variables: growth rates of exports, population, and capital stock; changes in the military burden; changes in capital inflows from abroad; and GDP per capita. Pooling available time series data for developing countries for the period 1952-1970, the estimating equation explains only 9% of the variation in GDP growth rates. A nega-

tive and significant estimate is obtained for the defense burden (Faini, Annez and Taylor 1984, 493).

Faini, Annez and Taylor then measured the contribution of military spending to important determinants of growth such as investment, imports, industrial and agricultural output and tax receipts (all as a share of GDP). Modifying Chenery and Syrquin's 1975 estimating model, they introduced the military burden into a regression which includes per capita GDP, population, and capital inflows as independent variables determining, in turn, each of the dependent variables listed above. They found significant relationships between the military burden and investment (-0.23), agriculture (-0.19) and tax receipts (+0.41) (Faini, Annez and Taylor 1984, 495).

By incorporating absorptive capacity constraints into their investment function and demonstrating how military expenditures's negative direct effect can be split into negative indirect impacts on investment, agricultural output, and an increase in the tax burden, Faini, Annez and Taylor achieved significant improvements over the testing efforts reviewed above. Unfortunately they chose to estimate a reduced form of their original structural equations and failed to incorporate economic growth and the other macroeconomic variables as endogenously determined variables. Instead they opted to use the Chenery and Syrquin model in a separate analysis. Just how much confidence can be placed on their negative result for the partial correlation of the military burden and economic growth has been called into question in light of the collinearity arising from the intimate relation between military spending and investment in their structural model (Gyimah-Brempong 1987, 22).

In 1983 Deger and Smith constructed a multi-equation structural model allowing for a direct modernization spin-off effect and an indirect savings mobilization effect. The military burden, though determined by exogenous variables is included and considered by Deger and Smith to be "endogenous" to the system. In the first of their structural equations, economic growth is determined by a conventional production function. The growth of capital is determined by the growth of domestic savings and external finance; population growth stands in as an estimate of the growth of the labor force; and technological change is hypothesized to depend on the defense burden (spin-off effect), the level of per capita income and the growth rate of agricultural output.

For a "savings/investment" function, Deger and Smith use a Keynesian national income identity expressed as shares of total output. Consumption's share varies with the defense burden (representing an indirect savings effect), external finance, growth rate of GDP and the change in per capita income. Deger and Smith assume away all government expenditure outside of

military expenditures. Taking domestic savings plus external finance to equal investment, they specify the second equation with the savings ratio as the dependent variable. Price inflation is added as a variable to check for an inflation conduit and to complete the second equation.

Noting the lack of theory to guide the choice of the determinants of military expenditures, Deger and Smith suggest per capita income, an estimate of exchange distortion, total population and dummies for oil-producing countries and countries engaged in external conflict -- all as independent variables determining the defense burden.

The model was estimated by three-stage least squares using cross-sectional averages for 50 LDCs from the 1965-1973 period. The explanation of variance in the dependent variables comes to 78% in the military expenditures equation, 87% in the savings equation and 22% in the growth equation. The authors reported that in all but three minor cases all independent variables are significant with the expected sign. The negative savings ratio effect of the defense burden overwhelmed the positive mobilization effect, yielding a multiplier of defense burden on the GDP growth rate of -0.201 (at mean per capita income).

Deger (1986) used the same data to reestimate a simultaneous equation system practically identical to the Deger and Smith formulation, but with the addition of a net export effect. The additional equation models the effect of the war and oil dummies, the inflation rate, the GDP growth rate and military burden on the balance of trade (exports minus imports). The balance of trade variable is substituted for external capital flows in the savings and growth equations. Thus the negative effect of the military burden on the balance of payments is translated through a reduction in savings to a reduction in economic growth. On the other hand, the deficit in the balance of payments is assumed to reflect external capital inflows, which in turn stimulate growth.

The results were as expected and similar to those of Deger and Smith study, with a small improvement in explanatory power for the growth equation (32%) and a fall in that of the savings equation (79%) The independent variables for the balance of payments equation explained 67% of the variation in the trade balance with all variables positive and significant except the military burden (negative) and inflation (insignificant).

Calculation of multipliers indicated a large impact of changes in military burden on growth (-0.36), on savings (-2.56) and trade balance (-5.02). Given the size of the trade balance multiplier, Deger found that for her sample a 1% reduction in the average military burden (from 4.5% to 3.5%) could cause trade balances to move from a deficit of about 1% of GDP to a surplus of up to 4% of GDP.

While a very significant improvement over the methods employed in previous research in this area, the reliability of the Deger and Deger and Smith analyses is subject to a number of limitations. As Faini, Annez and Taylor found, absorptive capacity and capacity utilization rates are important determinants of investment in LDCs but both are absent from Deger and Smith's savings equation. The potential effects of other classes of public expenditure are also omitted by the assumption that military expenditures equal total government expenditure. If Deger and Smith's intent was to provide a "savings/investment" function, and not just a savings function, the equation has been misspecified by the omission of such key determinants of investment behavior (see Gyimah-Brempong 1987, 29).

The difficulties of determining the relationship between per capita incomes, economic growth and military expenditures by testing procedures which use aggregative cross-sectional data is described in Section II.e), above. If the economic growth rate is in fact a significant explanatory variable for military expenditures, then all of the models we have reviewed in this literature survey suffer from misspecification and simultaneity bias because of the exclusion of economic growth from the military expenditures equation. As discussed earlier in Section II.e), further misspecification of the military expenditure equation arises from the failure to identify external finance in a determining role.

This brief overview of the testing of empirical evidence shows that progress has been made in adapting econometric techniques to the task of estimating the economic impacts delivered through multiple channels by military expenditure. From the review of the various conduits in Sections II.b) through II.f), it is clear. however. that much remains to be done. Even the most carefully specified structural models have only begun to account for the variety of channels through which the impacts of military spending are transmitted. There has also been little effort to model the lagged effects within each channel. With the empirical evidence available, it now appears that the overall effect of military expenditure on economic growth, in most conditions, is negative. But a high degree of caution must be exercised in judging the reliabilty of these results.

PART IV.
REVIEW OF RESEARCH DEMONSTRATING DIFFERENCES IN SUB-GROUPS OF DEVELOPING COUNTRIES

Despite improvements in the econometric methods of research into the security and development relationship, there remains the question of the appropriateness of using econometric techniques to analyze the determinants of public expenditures. This difficulty, discussed in an individual country time-series framework in section I.b), applies to cross-sectional analysis as well. The institutional discontinuities over time are analogous to the diverse functional and institutional characteristics of the countries in a broad cross-sectional sample. If the implicit segregation of developed from developing countries is legitimate and significant, what other sub-groups should be segregated? Looney (1988) points out the difficulty of drawing useful generalizations from studies in which the samples may include countries as diverse as Chad and Saudi Arabia.

The multi-variate research reviewed in sections II.e) and III.g), above, has often used geographic regions (Latin America, Africa, and Asia) as a convenient way of choosing sub-samples for analysis. Unfortunately, the political and economic diversity present across such broad regions, as well as the small sample sizes for some regions, frequently results in coefficient estimates of little significance or practical application. (e.g. Lim (1983), Deger and Smith (1983), Faini et al. (1984)). It should also be noted that basing sub-groupings on continents provides little opportunity for transfer between sub-groups as underlying characteristics of individual countries change over time.

Other sub-groupings that have been suggested include sub-regions (e.g. Francophone Africa), political blocs, war and peace economies, size of military expenditures, physical quality of life indices or regime type. (Brauer 1988, 29-33) Analysis of regime type differences has received the most attention, but as pointed out in section II.b) there is no decisive evidence that military spending is correlated with the civilian/military regime distinction.

Two sub-groupings, one based on the existence of domestic defense industries and the other on the availability of financial resources, are worth reviewing for their salient insights into the relationship between security and development in LDCs. Robert Looney's work in both areas is explored because of his innovative use of statistical techniques in segregating countries as well as for the interesting results he has obtained.

IV.a) DIFFERENCES ATTRIBUTABLE TO DOMESTIC DEFENSE INDUSTRIES

For his analysis of the domestic defense industry sub-grouping Looney (1986, 31-49) follows Neuman's (1984) classification of LDCs based on the presence of one indigenously produced major weapons system. As shown in Text Table IV-1 Looney finds that internal economic factors account for military spending behavior among arms producers. The military's budgetary allocation in non-producing nations, on the other hand, is importantly influenced by external factors. Non-producers, Looney maintains, do not face the same internal pressures to continue defense spending in times of minimal external threats, as do arms producing nations. Thus, there is a kind of artificial demand stimulation or "military Keynesianism" at work in arms producing nations.

Text Table IV-1
Determinants of Military Expenditure by Sub-Groupings

Sub-Group	GNP	Debt	BOP	Mobilization
Arms Production			(trade deficit)	(external threat)
Producers	+	+	n.s.	n.s.
Non-Producers	+	n.s.	+	+
Resources			(reserves)	(govt. deficit)
Unconstrained	n.s.	-	n.s.	-
Constrained	n.s.	+	+	+

Source: Looney 1988C

Looney's evaluation of the differing economic impacts of military expenditures on the two sub-groupings is presented in Text Table IV-2. Looney finds that arms producers experience positive impacts on growth, investment, and savings, but declines in productivity and income distribution. Growth and investment among non-producers are negatively correlated with military expenditures.

Text Table IV-2
Impacts of Military Expenditure by Sub-Groupings

Sub-Group	Growth	Debt	Imports	Investment	Income Distribution
Arms Production					
Producers	+	+	n.s.	+	-
Non-Producers	-	-	+	-	n.s.
Resources					
Unconstrained	+	-	n.s.	na	na
Constrained	-	+	-	na	na

Significance level is 99%
Source: Looney 1990

Contrary to assertions by other analysts of defense industries in the Third World, Looney does not find economic size, a threshold level of per capita income, or an industrial base to be necessary or sufficient preconditions for domestic arms production. Instead, due to continued technological dependence on the developed world, Looney's analysis shows that the economic environment, in particular foreign exchange availability, is the key determinant. He differentiates between Latin American and non-Latin American arms producers. Latin American arms production developed in the early 1960s as export growth and external borrowing created a large import capacity. The establishment of indigenous arms industries in other LDCs seems to be independent of trade performance, depending primarily on current account financing through publicly guaranteed loans. (Looney 1987; 1988)

Looney's emphasis on a country's economic environment as the primary factor influencing the installation of domestic defense production capacity arises from his efforts to predict the classifications of countries as producers or non-producers, based on a discriminant analysis using socioeconomic variables. Political variables proved to add little to the differentiation between producers and non-producers. Looney's analysis demonstrates that arms producers have greater access to financial resources, particularly foreign exchange. Therefore, they can afford to finance their domestic defense industries through external debt accumulation. Unlike their resource-constrained non-producing counterparts who lack debt service capacity, arms producers can maintain arms production without diverting domestic resources from productive civil sector investment.

The arms production basis for identifying sub-groups, while providing useful insights, is one-dimensional and static. The use of discriminant analysis does not determine the groupings, but only uncovers the best predictors of a de facto segregation of countries. Given Looney's conclusions that it is unlikely that additional LDCs will initiate defense industries because of the existing debt problem, this categorization of countries is also unlikely to mirror changing economic circumstances among LDCs. A typology based on economic variables is likely to be a much better candidate for effectively separating LDCs into fluid groups with different functional characteristics.

As noted in section I.b), above, a methodologically preferable solution to the problem of identifying country sub-groups is the use of techniques such as factor analysis which do not force the researchers' preconceived notions of country classification on to the analysis. Instead, the data is allowed to sort itself out and define the important characteristics (factors) that distinguish significant sub-groups. With the discontinuities eliminated, econometric analysis can be conducted.

IV.b) DIFFERENCES ATTRIBUTABLE TO FINANCIAL CONSTRAINTS

This section describes Frederiksen and Looney's (1982; 1983; 1985) and Looney's (1986, 3-30; 1990) methodology for grouping countries based on financial capabilities. We will summarize their findings on the differences between the two groupings, and conclude with an appraisal of the contribution made by this body of work to understanding and modeling the security and development relationship in developing countries.

In 1982 Looney and Frederiksen first argued that a fiscal crunch in a resource-constrained nation causes development projects to be sacrificed in order to maintain military expenditures. They predicted that in a similar situation the relatively less constrained nations would utilize their access to foreign credits to maintain development programming and expand military expenditures. This behavior was confirmed in their 1982, 1983 and 1985 studies. Although the military expenditure impact on growth in the constrained countries was insignificant in two of the three studies, the unconstrained countries were found to benefit positively from military expenditures in all three cases.

The early studies used cluster analysis based on variables representing savings, investment, foreign exchange earnings, import elasticity and productivity of investment to group countries for the 1965-1973 period. Discriminant analysis then tested the probability of having correctly classified each

country. Finally, single equation OLS regressions produced estimates of the impact of military expenditures on growth. Unfortunately, in their initial estimates, a complete data set was available for only 9 countries in the resource-rich group and 24 in the resource-poor group.

Later work by Looney assembled a large number of economic and financial variables for over 60 LDCs during the 1970-82 period. (Looney 1986, 3-30) This research demonstrated a greater statistical sophistication, employing factor analysis to select the variables for discriminant analysis. Looney found seven variables contribute significantly to dividing his sample into two groups, based on their total access to foreign resources. The results of the discriminant analysis are shown below in Text Table IV-3. The relatively constrained ("poor") group included most of the African and poorer Latin American countries. The "rich" group was made up largely of Middle-Eastern and North African countries as well as the oil exporting and newly industrializing countries of Asia, African and Latin America.

Text Table VI-3
Summary of Mean Values of Discriminant Analysis Variables

Variables	Rich to Poor Ratio
1. Inflow of public loans as % of exports, 1982	1 to 3.6
2. External public debt, 1982	4.5 to 1
3. Gross international reserves, 1982	10.5 to 1
4. External public debt as % of GDP, 1982	1 to 2.3
5. Average annual growth in imports, 1970-1982	8.7 to 1
6. Debt service as % of exports, 1982	1 to 1.2
7. External public debt as % of GDP, 1970	1 to 2

Source: Looney 1986, 11.

Looking back to Text Table IV-1, we may note that two-thirds of the arms producers are also in the resource-rich category. With groupings based on access to foreign exchange, external threat factors are found to be not significant. This leaves internal economic variables such as the government deficit and external public debt as the significant determinants of military spending.

Military expenditures per capita in the larger, more debt-free, financially-unconstrained nations show a negative correlation with external public debt and the government deficit. Looney believes that this demonstrates their reluctance to let military spending exceed their means and jeopardize their overall credit-

worthiness. Meanwhile, among the more-constrained countries there appears to be an association of expenditures on defense, foreign exchange shortages, and high levels of external indebtedness.

Looney's more sophisticated factor and discriminant analysis procedure substantiates Looney and Frederiksen's earlier findings about the impact of military expenditures on growth in LDCs. As shown in Text Table IV-2, the resource-rich countries experience positive impacts from increases in military expenditures. Disarmament for these countries would cause growth to suffer, as in the short-term resources freed would not necessarily result in increased growth. Countries with limited access to foreign resources, on the other hand, could benefit from reductions in arms expenditures which would free up scarce foreign exchange for civilian investment purposes.

In an Annex to this Report Looney updates his work using additional data from 1980-1987. Discriminant analysis carried out on military expenditure and economic growth variables separates out eight variables useful for distinguishing between subgroups of developing countries. Despite the attempt to incorporate time lags in the analysis, however, Looney's three equation simultaneous model retains some problems of specification (e.g. growth of exports being the sole explanatory variable for investment growth). In this case, factor analysis was not used to define the sub-groupings.

Throughout, Looney's work has consistently addressed the crucial question of how to let cross-sectional data distinguish distinct sub-groups of countries, each with a distinctive set of security-development relationships. The variety of techniques used by Looney and Frederiksen have served to disaggregate LDCs into sub-groups over four different time periods since the 1950s. One important result of this research has been to demonstrate that differences in techniques and in time periods used in the analysis reveal shifts in country group affiliations over time. Fifteen of the fifty countries in Looney's factor analysis for 1970-1982 switched groupings in his latest analysis, which used data for the period 1965-1987.

This indicates the need for periodic reapplication of the best available sorting procedure in order to make available timely and appropriate sub-groupings for policy analysis. As the characteristics underlying country differences in the security-development relationship apparently fluctuate over time, both time series and cross-sectional work must be updated. Econometric analyses that are both statistically significant and theoretically sound, but that rely on experience from as far back as the 1960s, may have only limited practical significance for policy design in the 1990s.

PART V.
IMPLICATIONS OF FINDINGS FOR A.I.D.

The unprecedented growth of defense spending during the 1970s in many developing countries, to a high plateau sustained throughout the 1980s, imposed a severe burden on these economies and led to many efforts to examine the effect of such spending on economic development. The emergent consensus reported in this interim review -- namely, that on balance the effect of military spending, despite some positive spin-off effects, is deleterious to development -- is intuitively satisfactory and should be assumed to have programmatic and policy implications.

Nevertheless, with a few compelling and obvious exceptions enumerated below, the development of policy implications for A.I.D. awaits discussion with the project's Working Group, and, if funded, the work of Phase II for which the current report is merely preparatory.

A few general comments are in order, however. The timing of this study has been propitious, if it is to have implications for A.I.D. program planning in the 1990s. The fast-moving detente between the United States and the Soviet Union, with implications of co-operation in the Third World for the dampening and, indeed, prevention, of conflict; the increasing constriction of development funds previously available to Third World A.I.D. claimants as new needs emerge elsewhere; and the growing inclination of the multilateral agencies to inspect defense spending and consider its scope and justification as an increasingly salient factor in their country reviews: these and other factors conduce toward a careful inspection of A.I.D.-recipient defense spending, to examine its impact on economic development.

The implications for AID that are already apparent as a result of this study are, in reverse order of import, questions of data collection, program planning, and policy development.

1. Data Collection. It is apparent from studies reviewed in this Report that currently available sources of data on military spending, as reported by subject countries and converted by use of currency exchange rates, are sufficiently misleading as to distort the statistical analysis conducted by A.I.D. to prepare the annual Section 620(s) report. Data deficiencies also seriously compromise the reliability of enquiries into the causes and economic effects of military expenditures at the country-

level of analysis. It appears to be clearly in A.I.D.'s interest to stimulate and participate in efforts to obtain improvements in the reporting of military expenditures by A.I.D.-recipient countries, with immediate attention concentrated on the disaggregation of reported expenditures to identify major components and on the estimation of military price level indices. The exploration of modalities for pursuing these data-reporting improvements will be an important objective of the country case-study work in Phase II of this project.

2. Country Development Strategy Statements. The review of the literature in Phase I has suggested diminishing returns to cross-country research, pointing to the utility of case studies so that the analysis of socio-economic data, including military expenditures, can be integrated within specific institutional settings. Accordingly, we expect that the chief utility of this overall research and field investigation, for purposes of strengthening the analysis contained in the annual CDSSs, will follow from completion of the country case studies. The central goal of the case studies is to develop an analytical framework and guidelines that can be used by A.I.D. to strengthen its capacity to assess the military-economic development relationships in recipient countries. We envisage the results of Phase II of this project will be a manual addressed to country officers for assessing the economic consequences of military expenditures. Such a manual, into which A.I.D. analysts may readily insert prescribed country data, should contribute importantly to the integration of security-development relations into the country development strategy assessment. It should also help A.I.D. to deal more effectively with recipient countries as they determine their economic and military spending levels, and guide A.I.D.'s efforts to influence both the causes and consequences of military build-ups.

3. Policy implications. Constraints on defense spending are becoming more apparent in A.I.D.-recipient countries themselves. Military establishments now routinely justify their budgets publicly in economic development-relevant terms, speaking on the one hand directly of the benefits from their civic action activities and on the other hand of the positive atmosphere for development created by their security efforts.

The five major conventional wars fought in the 1980s, which have substantially subsided in the past two years, have been instructive to all LDCs with respect to the risks and costs of defense expenditure. But the defense burden impacts differently in different countries, and the results of this project should provide assistance to A.I.D. in differentiating the impact of defense spending and determining where reductions ar likely to be most effective in stimulating economic development.

A question usefully posed by AID in the project statement is: how can AID influence both the causes and consequences of military build-ups? We believe that the attempt to influence both in the past has been hindered by the lack of sharpness of focus in the questions put, not in the relevance of the question. Data deficiencies make for sloppy results, or make analytical, as opposed to descriptive, results difficult, and it is clear that this has been a source of weakness in evaluating the military build-ups in developing countries in the past. And the failure to disaggregate countries into relevant categories, in a day when 'Third World' connotes an increasingly wide range of economies, has made generalizations about defense spending too abstract for the application of specific injunctions.

We believe that the analytical tools sharpened in this study, combined with the case study results we anticipate from Phase II of the project, will provide A.I.D. with substantially increased leverage in its discussions with recipient countries on the issues of defense spending, particularly given the timing of these studies. The most important product of this project will be to give AID a strengthened capacity to assess the consequences of the defense budgeting process in the countries with legitimate claims on its resources.

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ANNEX 1.
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ANNEX 2.
USE OF EXCHANGE RATES AND PURCHASING POWER PARITIES IN THE STATISTICAL ANALYSIS FOR A.I.D.'S ANNUAL REPORT ON THE IMPLEMENTATION OF SECTION 620(s)

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Summary

In calculating military share and military burden ratios for the statistical analysis required by the annual 620(s) Report, A.I.D. currently employs military spending estimates provided by the Arms Control and Disarmament Agency (ACDA) which are national currency figures converted into dollars using exchange rates.

It is generally acknowledged that use of estimates converted by exchange rates introduces distortion into the Section 620(s) statistical analysis. But how much difference does it make in the computation of regional norms and in the identification of the countries whose military expenditures most exceeded the norms? As a practical matter, how much difference does the conversion method make in the composition of the checklist of A.I.D.-recipient countries for Section 620(s) reporting purposes?

To answer these questions, a direct comparison is made, for the years 1980 and 1985, of the results of using exchange rates and purchasing power parities to convert the military expenditure data which A.I.D. uses in its Section 620(s) statistical analysis. The method of conversion is found to make a significant difference in both statistical and practical terms.

The Section 620(s) Report

Section 620(s) of the Foreign Assistance Act is intended to restrain arms races and proliferation of sophisticated weapons, and to ensure that resources intended for economic development are not diverted to military purposes. The implementation of Section 620(s) requires A.I.D. to examine the pattern of defense expenditures, define regional norms, and identify A.I.D. recipient countries which have exceeded the norms for military expenditures either as compared to other countries regionally and worldwide.

To provide proper regional comparability, standardized measures of military expenditures expressed as a percentage of

gross national product (the "military burden") and of central government expenditures (the "defense share").[1] These data are employed in a statistical analysis, comparing the military burden and defense share ratios and rankings, to establish an annual checklist of Section 620(s) countries. A.I.D. reports to Congress, for each country on the checklist, its assessment of the political, economic and security factors determining whether or not U.S. assistance should be ruled out under Section 620(s) considerations.

The statistical analysis is used, then, to compute regional norms and to identify the checklist-countries, i.e., the countries in each region with military burdens and defense shares which most greatly exceed the norms.

In recent years, A.I.D. has defined regional and worldwide norms by reference to a panel of 117 countries, which we will refer to as the panel of 620(s) countries. The panel includes all (82) countries receiving U. S. development assistance and economic support funds in FY 1990 or FY 1991 (i.e., the "A.I.D.-recipient" countries) -- except for four small African island-nations, Namibia and the USSR. In addition, the panel includes 41 other (mostly developing) countries in the four A.I.D. regions. For a given reporting year, data are not available to compute statistics for all panel countries; in the most recent Section 620(s) report (with data for 1985) defense shares were recorded for 80 panel countries and military burdens for 84.

Currency Conversion for the 620(s) Report

In order to make an accurate comparison, across a set of countries, of the quantities of military inputs purchased by each for national defense, it is necessary to convert the expenditures in national currencies into a common numeraire or base currency, e.g., the dollar. A.I.D. uses expenditure estimates which convert national currency data into dollar figures through the use of an average yearly exchange rate.

The data used by A.I.D. in the Section 620(s) statistical analysis are the estimates published annually by ACDA in World Military Expenditures and Arms Transfers for military expenditure, central government expenditure, and gross national product. This set of estimates is expressed in "constant dollars" of a specified base year, converted by ACDA from primary data expressed in local currency at current prices by: (1) deflating the current year data by means of the country's implicit GNP deflator (base year = 100), and (2) converting the constant-price data by the exchange rate for the base year. All three variables are deflated by the GNP price level and converted

by the exchange rate.

Converting these figures by use of exchange rates is a technically flawed procedure because the exchange rate does not accurately reflect the relative prices of different types of military expenditures, particularly salaries versus procurement items and maintenance, nor the price levels between countries. These deficiencies of the exchange rate conversion method are recognized by ACDA as well as by users of the data.[2]

Purchasing Power Parities: An Alternative Conversion Method

It is preferable to use a conversion method derived from price comparisons of the components which make up military spending, such as manpower, fuel, food, building, weapons, etc. Such conversion methods are called parities or purchasing power parities. For defense personnel, for example, parities can be estimated on the basis of full salary and maintenance costs of the various grades of defence personnel compared with costs in other countries, all appropriately weighted by the number of personnel employed.

Purchasing power parity converters for military expenditures, government expenditures, and GDP are available, for most of the panel of 620(s) countries, for the years 1980 and 1985. The basic method of PPP derivation is that of the International Comparison Project of the United Nations.[3] The GDP and government sector parities were computed in conjunction with the preparation of Penn World Table 4 as reported by Robert Summers and Alan Heston (1988).[4] Military parities were developed for 134 countries by Alan Heston, using the ICP benchmark studies and the disaggregated military expenditure components identified in submissions to the United Nations unified reporting system.[5]

We may describe briefly the methodology used to derive the military parities; a more detailed description of data derivation methods is provided in the Appendix to this paper.

Sixty countries participated in the 1980 ICP benchmark study, and an additional set of eleven countries have participated in either the 1975 or 1985 ICP comparisons. For these seventy-one countries the military price level estimate was obtained by weighting the detailed parities corresponding to personnel, operating costs, procurement and construction by the expenditure distribution of these components. These are called indirect estimates since the initial parities are civilian based but the expenditures distribution of each component is based on detailed military expenditures reported by twenty-seven countries to the United Nations.

Direct estimates are taken from the report of the U.N. Expert Group on the Reduction of Military Budgets. Defense expenditures of eight OECD countries were converted to U.S. dollars on the basis of basic parities derived from detailed price and salary comparisons centered on 1980, 1981 and 1982.[6] The two estimates, direct for the countries taking part in the U.N. study, and indirect for those in the ICP, were compared and found to be very similar,[7] indicating that the indirect estimates could be used with some confidence to approximate the direct estimates.

For those benchmark countries for which a military expenditure distribution was available, an indirect estimate could be derived from ICP parities. For the remaining benchmark countries the same type of indirect military parity could be estimated, but it also required that the distribution of military expenditures be approximated.

For the remaining set of non-benchmark countries, total military spending and the number and type of personnel (for example, conscripts, reserves, paramilitary soldiers, etc.) were available from a number of sources. In addition, the government and GDP price levels from the ICP studies (Phase IV) provided the basis for regression estimates of the military price levels for non-benchmark countries based upon the relationship estimated for the benchmark countries. [8]

Comparing the Two Conversion Methods

Using these PPP convertors and the ACDA data base, it is possible to make a direct comparison, for the panel of 620(s) countries, of the 1980 and 1985 expenditures ratios and rankings based on the use of exchange rate convertors (replicating the ACDA computational procedure) and the use of PPPs.

To compare the exchange rate conversion method with the purchasing power parity conversion method the ACDA data for 1980 and 1985 has been converted from local currency by the ACDA procedure, using 1985 exchange rates, and by use of the PWT(4) and Heston purchasing power parities.[9] Data are available for one-hundred of the panel of 620(s) countries for the 1980 comparison. Data for eighty-four countries are available for use in the 1985 comparison. For a more detailed description of the derivation of the data used in computation of the defense share and military burden ratios, see the Appendix to this paper.

In the Tables which appear, below, defense share (SH) refers to the share of military expenditures in central government spending and military burden (BU) refers to the ratio of military

expenditures to gross national product, expressed as percentages. The exchange rate conversion ratios for the military share and burden are labeled SH1 and BU1. The military parity conversion ratios for military share and burden are labeled SH2 and BU2.

In comparing the exchange rate and purchasing power parity conversions we wish to know whether or not the results of using the two methods are significantly different in both statistical and practical terms. Tables 1 through 7 contrast the two conversion methods in two different ways. First, measures of central tendency and distribution for the share and burden ratios are examined for global and regional groupings of the 620(s) countries. Statistically significant differences, attributable to the conversion method used, are found for the comparison of shares, but not for the comparison of military burdens.

Secondly, in order to measure the practical differences attributable to the two conversion methods, the countries with the highest share and burden ratios, using both conversion methods, are selected for each of the A.I.D. regions. Recognizing that the purchasing power parity method of conversion results in a more reliable cross-country comparison of ratios, an inspection of the five countries with the highest ratios in each region reveals that the exchange rate method can lead to the erroneous identification of individual countries as having ratios which exceed the regional norms. Also, countries with the highest ratios in each region as revealed by the parity conversion, can escape detection when the foreign exchange conversion method is used. As a result, these countries are not subjected to formal review by A.I.D., and they escape the attention of Congress.

Table 1 displays summary measures of central tendency for the panel of all 620(s) countries and shows that the means of both the share and burden measures tend to be overstated when converted by use of exchange rates. The 1980 mean shares ratio, for the exchange rate conversion, is 40% higher than the mean shares ratio for the parity conversion. Similarly, the mean burden ratio is 7% higher in 1980, although the ratios are roughly similar in 1985. The difference of means for the defense share ratios, for both 1980 and 1985, is statistically significant at the 95% level, but difference of the burden ratio means is not statistically significant.

Kurtosis, or peakedness, statistics for the 1980 and 1985 data demonstrate that the exchange rate conversion results in a distribution that is considerably flatter for both the share and burden ratios. The distortions introduced by exchange rate conversion disperse the ratios more widely than the parity conversion. Statistics for the skewness of the exchange rate conversions are also somewhat lower than for the distribution of ratios converted by parities, indicating a slightly smaller, skewed tail to the right.

TABLE 1.

GLOBAL STATISTICS OF CENTRAL TENDENCY AND DISPERSION
1980 AND 1985 DEFENSE SHARES AND MILITARY BURDENS
PANEL OF 620(s) COUNTRIES

	SH1	SH2	BU1	BU2
1980				
Median	11.71	7.68	2.67	2.51
Mean	13.92	10.04	4.38	4.14
Std. Dev.	10.03	9.07	5.15	5.50
Skewness	1.13	2.51	2.81	3.72
Kurtosis	1.16	8.90	8.61	17.04
1985				
Median	9.36	7.16	2.54	2.76
Mean	12.48	9.61	3.97	4.01
Std. Dev.	9.30	8.08	4.30	4.47
Skewness	1.44	2.10	2.79	3.41
Kurtosis	1.71	6.36	8.45	14.50

Key: SH1 = Defense Share, Exchange Rate Conversion
SH2 = Defense Share, PPP Conversion
BU1 = Military Burden, Exchange Rate Conversion
BU2 = Military Burden, PPP Conversion

Sample Size: 1980=100; 1985=84

TABLE 2.

REGIONAL STATISTICS OF CENTRAL TENDENCY AND DISPERSION
1980 DEFENSE SHARES AND MILITARY BURDENS
PANEL OF 620(s) COUNTRIES

	SH1	SH2	BU1	BU2
AFRICA				
Median	11.25	8.64	2.85	3.12
Mean	13.86	9.91	3.80	3.94
Std. Dev.	8.47	5.66	3.06	3.00
ASIA				
Median	12.57	5.25	2.01	1.77
Mean	12.53	6.78	2.81	2.05
Std. Dev.	8.02	5.24	1.75	1.26
NEAR EAST/EUROPE				
Median	15.85	12.70	5.49	4.84
Mean	20.50	17.90	9.53	9.14
Std. Dev.	14.15	14.97	8.76	9.92
LA/CARIBBEAN				
Median	7.80	4.93	1.48	1.32
Mean	9.47	5.87	2.09	1.68
Std. Dev.	6.69	4.17	1.44	1.13

Key: SH1 = Defense Share, Exchange Rate Conversion
SH2 = Defense Share, PPP Conversion
BU1 = Military Burden, Exchange Rate Conversion
BU2 = Military Burden, PPP Conversion

Sample Size: Africa=40; Asia=16; NE/E=20; LAC=24

TABLE 3.

REGIONAL STATISTICS OF CENTRAL TENDENCY AND DISPERSION
1985 DEFENSE SHARES AND MILITARY BURDENS
PANEL OF 620(s) COUNTRIES

	SH1	SH2	BU1	BU2
AFRICA				
Median	8.82	7.24	2.53	2.84
Mean	11.52	9.14	3.10	3.47
Std. Dev.	7.70	8.36	2.09	2.22
ASIA				
Median	9.32	4.52	2.54	2.12
Mean	12.35	7.14	3.20	2.31
Std. Dev.	7.93	4.89	1.84	1.26
NEAR EAST/EUROPE				
Median	13.56	14.52	4.60	5.50
Mean	16.35	14.61	8.03	8.10
Std. Dev.	12.73	10.13	7.67	8.12
LA/CARIBBEAN				
Median	9.94	7.13	1.83	2.00
Mean	11.58	8.72	3.24	3.31
Std. Dev.	9.93	6.86	3.86	4.01

Key: SH1 = Defense Share, Exchange Rate Conversion
SH2 = Defense Share, PPP Conversion
BU1 = Military Burden, Exchange Rate Conversion
BU2 = Military Burden, PPP Conversion

Sample Size: Africa=35; Asia=14; NE/E=14; LAC=21

The importance of the differences in the characteristics of the two distributions (i.e., that the distribution of exchange rate converted ratios is flatter with a smaller tail) is that the countries with the highest ratios are more clearly distinguished from the norm in the parity-converted distribution than in the distribution when exchange rate conversion has been used. Since the purpose of the 620(s) Report statistical analysis is to identify those countries spending excessive amounts on the military, it appears that the distribution resulting from exchange rate conversion is less well suited to the task than the distribution of ratios resulting from use of the parity conversion method.

A comparison of the two conversion methods using regional statistics (Tables 2 and 3) indicates the upwards bias in the means of the shares ratios when exchange rates are used for conversion. Although not as consistently as with the global figures, the comparison of means for the shares ratios on the regional level indicates statistically significant differences between the two conversion methods. The burden ratios, once again, do not show statistically significant differences of means.

We may note that for both 1980 and 1985 data sets the use of the exchange rate conversion method changes the rank ordering of the regions for the means of both the share and burden ratios. For example, in 1985 Asia is the region with the lowest mean ratios for both the share and burden when parity conversion is used, but occupied the position as the region with, respectively, the second and third highest mean ratios when exchange rate conversion is used

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Given the mixed evidence concerning the statistical significance attributable to differences between the two conversion methods, for the computation of military spending norms at the global and regional levels, an evaluation is undertaken in Tables 4 through 7 of the practical significance of using the less reliable exchange rate method rather than parity conversion. The Tables compare the two conversion methods by displaying the countries with the highest ratios of defense share and military burden on a region-by-region basis for the 1980 and 1985 data.

The comparison of defense shares for 1980 shown in Table 4 indicates that five countries -- Mozambique, Thailand, India, Syria and El Salvador -- are erroneously identified as having the highest rates in their regions as a result of using foreign exchange conversion (that is, they would not have been so identified if the more reliable parity conversion method were used.) At the same time, five countries -- Mauritania, Australia, Indonesia, Saudi Arabia and Ecuador -- which are identified as exceeding the regional norms by parity conversion would have escaped detection by exchange rate conversion. On average, this

TABLE 4.

COUNTRIES WITH HIGHEST DEFENSE SHARES IN EACH REGION, 1980
PANEL OF 620(s) COUNTRIES

EXCHANGE RATE CONVERSION (SH1)			PPP CONVERSION (SH2)		
	DEFENSE SHARE RATIO	REGION RANK ORDER		DEFENSE SHARE RATIO	REGION RANK ORDER
AFRICA			AFRICA		
Ethiopia	38.0	1	* Zambia	21.9	1
* Zambia	30.6	2	* Zimbabwe	21.3	2
* Mozambique	27.8	3	* Chad	19.6	3
* Chad	27.2	4	Ethiopia	18.9	4
* Zimbabwe	24.9	5	* Mauritania	18.7	5
ASIA			ASIA		
S. Korea	29.3	1	Singapore	19.7	1
* Pakistan	23.6	2	S. Korea	17.1	2
* Thailand	21.0	3	Australia	10.9	3
Singapore	20.8	4	* Pakistan	8.7	4
* India	17.2	5	* Indonesia	8.2	5
N.E./EUROPE			N.E./EUROPE		
* Oman	49.6	1	U.A.E.	57.0	1
U.A.E.	41.4	2	* Oman	43.4	2
* Israel	36.8	3	* Israel	42.3	3
Syria	35.8	4	SaudiArabia	28.3	4
* Jordan	35.8	5	* Jordan	26.8	5
L.A./CARR.			L.A./CARR.		
* Peru	23.0	1	* Peru	15.9	1
Nicaragua	18.8	2	Argentina	13.9	2
* Bolivia	18.0	3	* Bolivia	11.9	3
Argentina	16.8	4	Nicaragua	11.0	4
* ElSalvador	15.5	5	* Ecuador	8.8	5

Key: * = A.I.D. Recipient

TABLE 5.

COUNTRIES WITH HIGHEST DEFENSE SHARES IN EACH REGION, 1985
PANEL OF 620(s) COUNTRIES

EXCHANGE RATE CONVERSION (SH1)			PPP CONVERSION (SH2)		
	DEFENSE SHARE RATIO	REGION RANK ORDER		DEFENSE SHARE RATIO	REGION RANK ORDER
AFRICA			AFRICA		
* Mozambique	38.0	1	* Somalia	48.9	1
* Somalia	27.5	2	* Mauritania	21.7	2
* Mauritania	25.0	3	* Morocco	18.7	3
Ethiopia	22.7	4	* Mozambique	14.7	4
* Morocco	21.4	5	* Zambia	13.8	5
ASIA			ASIA		
* Pakistan	28.1	1	Singapore	17.0	1
S. Korea	26.6	2	S. Korea	16.4	2
* Thailand	19.7	3	* Pakistan	11.5	3
Singapore	17.0	4	Australia	10.3	4
* India	15.7	5	* Thailand	7.5	5
N.E./EUROPE			N.E./EUROPE		
Syria	42.0	1	* Israel	34.0	1
* Jordan	34.6	2	* Jordan	27.8	2
* Yemen A.R.	28.2	3	* Egypt	25.1	3
* Israel	27.2	4	Kuwait	21.7	4
* Egypt	22.1	5	Syria	18.1	5
L.A./CARR.			L.A./CARR.		
* Peru	42.6	1	* Peru	25.5	1
* ElSalvador	27.5	2	Nicaragua	21.6	2
Nicaragua	26.2	3	* ElSalvador	19.1	3
* Guatemala	18.7	4	* Guatemala	14.4	4
* Honduras	12.9	5	* Bolivia	13.9	5

Key: * = A.I.D. Recipient

TABLE 6.

COUNTRIES WITH HIGHEST MILITARY BURDENS IN EACH REGION, 1980
PANEL OF 620(s) COUNTRIES

EXCHANGE RATE CONVERSION (BU1)			PPP CONVERSION (BU2)		
	MILI-TARY BURDEN RATIO	REGION RANK ORDER		MILI-TARY BURDEN RATIO	REGION RANK ORDER
AFRICA			AFRICA		
* Zambia	14.6	1	* Zambia	14.6	1
* Mauritania	10.7	2	* Mauritania	11.1	2
Ethiopia	9.6	3	Angola	9.2	3
* Zimbabwe	8.8	4	* Zimbabwe	8.5	4
Angola	8.5	5	* Morocco	8.4	5
ASIA			ASIA		
S. Korea	6.1	1	Singapore	4.9	1
* Pakistan	5.4	2	S. Korea	4.2	2
Singapore	5.2	3	* Pakistan	2.8	3
Malaysia	4.4	4	* Indonesia	2.8	4
* Thailand	4.0	5	* India	2.6	5
N.E./EUROPE			N.E./EUROPE		
* Israel	29.1	1	* Israel	38.2	1
* Jordan	23.3	2	* Oman	23.6	2
Iraq	22.5	3	Iraq	22.4	3
* Oman	22.1	4	* Jordan	20.8	4
Syria	17.1	5	SaudiArabia	15.5	5
L.A./CARR.			L.A./CARR.		
Nicaragua	5.8	1	Nicaragua	4.3	1
* Peru	5.0	2	* Peru	4.2	2
* Guyana	4.0	3	Chile	3.2	3
Chile	3.6	4	* Guyana	3.1	4
Argentina	3.6	5	* Bolivia	2.6	5

Key: * = A.I.D. Recipient

TABLE 7.

COUNTRIES WITH HIGHEST MILITARY BURDENS IN EACH REGION, 1985
PANEL OF 620(s) COUNTRIES

EXCHANGE RATE CONVERSION (BU1)			PPP CONVERSION (BU2)		
	MILI-TARY BURDEN RATIO	REGION RANK ORDER		MILI-TARY BURDEN RATIO	REGION RANK ORDER
AFRICA			AFRICA		
Ethiopia	9.0	1	* Morocco	11.0	1
* Morocco	7.6	2	* Congo	7.5	2
* Mozambique	7.4	3	* Zambia	7.1	3
* Zambia	7.3	4	Ethiopia	7.0	4
* Mauritania	6.5	5	* Zimbabwe	6.4	5
ASIA			ASIA		
* Pakistan	6.8	1	Singapore	5.3	1
Singapore	5.9	2	S. Korea	3.7	2
S. Korea	5.4	3	* Pakistan	3.6	3
* Thailand	4.4	4	Australia	2.8	4
Malaysia	3.8	5	* India	2.7	5
N.E./EUROPE			N.E./EUROPE		
Syria	21.8	1	* Israel	29.6	1
* Israel	21.7	2	* Egypt	18.1	2
* Jordan	20.1	3	* Jordan	16.4	3
* Egypt	11.0	4	* Turkey	9.8	4
* Yeman A.R.	7.7	5	Syria	7.7	5
L.A./CARR.			L.A./CARR.		
Nicaragua	17.2	1	Nicaragua	18.8	1
* Guyana	9.3	2	* ElSalvador	7.6	2
* Peru	6.3	3	* Peru	5.8	3
* ElSalvador	5.1	4	* Guyana	5.5	4
Chile	4.1	5	Chile	3.9	5

Key: * = A.I.D. Recipient

pattern of five countries being mistakenly identified and five countries escaping notice by the foreign exchange conversion method is also found in the other conversion comparisons shown in Tables 5 through 7.

A region-by-region review of the differences in the identification of countries with the highest military expenditure ratios illustrates the practical problem posed by the misspecifications resulting from the use of the exchange rate conversion process. The region demonstrating the greatest number of misspecifications in the ratios is Asia. Out of the forty possible mismatches across the share and burden ratios in 1980 and 1985, fourteen mismatches occur. The exchange rate method most often erroneously identifies Thailand and Malaysia as high-ratio countries. Conversely, exchange rate conversion allows Australia and Indonesia to escape detection as countries with high ratios, as indicated by the parity conversion. The two methods disagree on the placement of India in all four cases.

The regional results for Africa indicate ten mismatches with the exchange rate method wrongly identifying Ethiopia and Mozambique in a number of instances.

In the Middle East and Europe region, Israel and Jordan are consistently identified by both methods as having high burden and share ratios. Syria's ratios are overstated and Yemen is twice erroneously placed in the high ratio group by the exchange rate conversion method. Saudi Arabia's (and perhaps also Turkey and Kuwait's) high ratios, as indicated by parity conversion, go undetected under the exchange rate conversion method.

The Latin American and Caribbean region demonstrates the greatest similarity between the two methods in identifying countries with ratios in excess of regional norms. Nicaragua and Peru, and to a lesser degree Chile and Guyana, are identified as high-ratio countries by both methods. Bolivia appears to be the high-ratio country most strongly effected by the use of exchange rate conversion in place of the parity conversion. It escapes detection when the exchange rate conversion method is applied.

Tables 4 through 7 also show the number of A.I.D.-recipient countries that are erroneously identified or escape detection when exchange rate conversion is used, rather than parity conversion. We should also note that often countries whose very high expenditure ratios have the result that, by both methods, they are included in the top five in a given region, often have quite different relative positions depending upon the conversion method used.

For the 1980 data on military share ratios, thirteen of the highest ranking countries identified by the exchange rate method are A.I.D.-recipients and four of these are erroneously identi-

fied as high-ratio countries (i.e., they are not so identified when parity conversion is used.) Using the parity method, twelve countries with the highest ratios are A.I.D.-recipients; three of these escape detection when conversion is by the exchange rate method. In sum, for the 1980 data, the two methods agree on nine A.I.D.-recipient countries as having excessive defense share ratios relative to the norm, and disagree on seven A.I.D. recipients.

A similar analysis for share ratios in 1985 reveals greater agreement between the two methods. Fourteen A.I.D.-recipients are identified by each method with two countries erroneously identified and two countries escaping detection when the exchange rate method of conversion is used in place of the parity method. In 1985, the two conversion methods agree on twelve A.I.D.-recipients and disagree on four.

For the 1980 data on military burden ratios, ten of the high-ratio countries identified by the exchange rate method are A.I.D-recipients and only one of these is erroneously identified. With the parity method, thirteen countries identified as having the highest ratios are A.I.D.-recipients, four of which would escape detection by the exchange rate method. Using the 1980 military burden data, the two methods agree on placing nine A.I.D.-recipients among the countries with excessive ratios relative to the norm, and disagree on five A.I.D.-recipients.

Finally, for the 1985 data on military burden ratios, twelve of the countries identified by the exchange rate method are A.I.D.-recipients, three of which are erroneously identified as high-ratio countries. Using the parity method, thirteen countries identified are A.I.D.-recipients, four of which would escape detection by the exchange rate method. When applied to the 1985 data on military burdens, the two methods agree on placing nine A.I.D.-recipients in the group with highest ratios relative to the norm, and disagree on seven A.I.D.-recipients.

In sum, it appears that -- in addition to the statistically significant differences in the distributions of ratios which result from use of the exchange rate conversion method rather than the parity method -- the conversion method selected does have a practical impact on the outcome of the 620(s) statistical analysis and on the identification of countries for inclusion on the Section 620(s) checklist. Recognizing that the parity conversion method is more reliable than the exchange rate method, and that a database of statistical information is emerging to support its employment, a strong argument can be made for AID to adopt the purchasing power parity conversion method for use in its Section 620(s) statistical analysis.

APPENDIX: DATA DERIVATION

Military Price Levels

The 1980 military price levels for the 134 countries are taken directly from Heston. Government and GDP price levels are from the ICP benchmark studies for both 1980 and 1985. The 1985 military price level estimate has been extrapolated from 1980 using:

-the World Bank government price index change between 1980 and 1985,
-the World Bank exchange rate change between 1980 and 1985, and
-the U.S.A. price index change for the military sector.

It is estimated as follows:

$$plevel\_85 = PLEVEL\_80 * (r85\_80/xr85\_80) / US85\_80$$

where

plevel_85 = estimate of military price level 1985
PLEVEL_80 = military price level 1980
r85_80 = government price index change (World Bank) (current government expenditures 1985 / 1980 divided by constant government expenditures 1985/ 1980)
xr85_80 = 1985 / 1980 exchange rate (World Bank)
US85_80 = U.S. price index change for the military sector (Survey of Current Business) = 1.349

An alternative estimate of the 1985 military price level could be made using the U.S. price index change for government instead of the price index change for the military sector.

Conversion Methods

(1) Regional Norms and Relative Rankings

Total military expenditures in current 1980 and 1985 national currency units, as well as government expenditures and GNP, are compared using two different conversion methods.

First, the national currency expenditures are converted into constant 1985 dollars. They are divided by the GNP deflator (GNP

local currency units, current 1985 prices / GNP local currency units, constant 1985 price) and by the 1985 exchange rate. This replicates the ACDA conversion method and results in estimates "in ACDA constant 1985 dollars."

Second, all three national currency expenditures are divided by the exchange rate. Defense expenditures are then divided by the military parity estimate, government expenditures by the government parity, and GNP by the GDP parity.

The exchange rates are relative to the U.S. and the overall GDP parity is also normalized on the U.S. for both 1980 and 1985.

(2) Computations and Reconciliations of Data

I = Military price level

PLT = Price level across GDP

PLGO = Price level across Government expenditures

PLG is multiplied by the U.S. price level government
1980 = 1.159 = 1 / 0.8628 (G-K)
1985 = 1.122 = 1 / 0.8913 (pi bar)
(PLG is normalized by this factor in PWT4)

XRR is the exchange rate, reconciled to the expenditure units in which ACDA data are expressed.

MILEX1 and MILEX2 = military expenditure local currency conversions by

i) the exchange rate:
MILEX1 = MILEX / XRR

ii) the military parity
MILEX2 = MILEX * 100 / (I * XRR)

CGE1 and CGE2 = central government local currency conversions by

i) the exchange rate:
CGE1 = CGE / XRR

ii) the government parity:
CGE2 = CGE * 100 / (PLGO * XRR)

GNP1 and GNP2 = Gross National Product conversions by

i) the exchange rate
GNP1 = GNP / XRR

ii) the GDP parity
GNP2 = GNP * 100 / (PLT * XRR)

AG_AH = GNP deflator 1985 base

(GNP in national currency units, current prices divided by GNP in national currency units, constant 1985 prices)

The constant 1985 dollar estimates for 1980 expenditures are obtained as follows:

```
C_MIL80 = MILEX 80 / (AG_AH * XRR 85)
C_CGE80 = CGE   80 / (AG_AH * XRR 85)
C_GNP80 = GNP   80 / (AG_AH * XRR 85)
```

For 1985 expenditures:

```
C_MIL85 = MILEX 85 / (AG_AH * XRR 85)
C_CGE85 = CGE   85 / (AG_AH * XRR 85)
C_GNP85 = GNP   85 / (AG_AH * XRR 85)
 where AG_AH = 1.
```

The shares of military expenditures to government expenditures are calculated as follows (in percent):

```
SH1 = 100 * MILEX1 / CGE1
SH2 = 100 * MILEX2 / CGE2
```

The shares of military expenditures to GNP (the military burden) are calculated as follows (in percent):

```
BU1 = 100 * MILEX1 / GNP1
BU2 = 100 * MILEX2 / GNP2
```

ENDNOTES

1. A third ratio, value of military imports as a percentage of total imports, is also computed and employed in identification of the countries exceeding comparative norms. These import data are reported in dollars by the original source. In its use of these data, A.I.D. does not confront the same problem of conversion from local currency expenditures. The problems associated with use of the import ratio are not discussed in this paper.

2. See U.S. Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers 1988, Washington, D.C.: U.S. Government Printing Office, June 1989, 145-6. A more detailed assessment appeared a decade ago in the WMEAT volume for 1969-78, published in December 1980, pp. 15-17.

3. See, for example, the description in the ICP Phase III report: Irving B. Kravis, Alan Heston and Robert Summers, World Product and Income: International Comparisons of Real Product, Produced by the Statistical Office of the United Nations and the World Bank, Baltimore: The Johns Hopkins University Press, 1982.

4. Robert Summers and Alan Heston, "A New Set of International Comparisons of Real Product and Prices for 130 Countries, 1950-85," The Review of Income and Wealth, Vol. 34, No. 1, March 1988, 1-25.

5. Alan Heston, Real World Military Expenditures: 134 Countries, 1980, CADE Discussion Paper 90-4, University of Pennsylvania, 1990.

6. See United Nations, Department of Disarmament Affairs, Reduction of Military Budgets: Construction of Military Price Indexes and Purchasing Power Parities for Comparisons of Military Expenditures, Report of the Secretary General. General Assembly Document A/40/421. New York: United Nations, 1986.

7. See Heston, op.cit., p. 8.

8. These derived estimates, as well as the indirect and direct results described above, are explained in detail and presented in Tables 1 and 2 in Heston, ibid., p.9.

9. The 1985 data are very similar, but not identical, to the data base used by A.I.D. in the statistical analysis reported in its Section 620(s) Report for 1987/88, published in May of 1989. The data set provided by ACDA to support this exercise contains a number of up-dates and revisions for the year 1985 which have been made since publication of the most recent 620(s) Report.

ANNEX 3.
MODERN THEORIES OF ECONOMIC GROWTH
by Michael P. McLindon

Modern growth theories can be divided into two basic models: post-Keynesian and neo-classical models. The post-Keynesian models emphasize the sources of aggregate demand such as consumption, investment, government purchases and net exports. The neoclassical models focus on the factors that affect aggregate supply, such as the labor force, capital, and level of technology.

Because the classical and Keynesian models are important in the development and discussion of the growth models, their essential features are first summarized.

The Classical World. The classical economists--those from Adam Smith to the time of Keynes--emphasized the importance of supply in economic performance and growth. Their relative disinterest in demand stemmed from Say's Law, which maintained that general overproduction of goods relative to total demand is not possible since supply (production) creates its own demand. Say's Law was based on the view that people work to obtain the income required to purchase desired goods and services. The purchasing power necessary to buy (demand) desired products is generated by production.

In classical theory, output could temporarily exceed demand in the short run, but wages and prices would be adjusted accordingly until the surplus was eliminated and the economy was directed to full employment. The rate of growth of per capita output is determined by the accumulation of capital relative to the growth of labor and on the pace of technical progress.

The Keynesian System. The breadth and depth of the Great Depression posed a serious challenge to the classical world view, which the basic Keynesian model rejected. Keynes argued that spending induced business firms to supply goods. If total spending fell, business firms would respond by cutting back production. Less spending would thus lead to less output. Keynes also argued that wages and prices are highly inflexible, particularly in a downward direction, in modern economies characterized by large business firms and powerful trade unions. Wage and price reductions are thus ruled out as a feasible mechanism for directing the economy to full employment.

In the Keynesian view, changes in output, rather than changes in prices, direct the economy to an equilibrium. Equilibrium is present in the Keynesian model when planned aggregate expenditures equal the value of current output. If an economy is in Keynesian equilibrium, there will be no tendency for output to change even if output is well below full employment capacity.

A Keynesian policy prescription is that if the private components of demand--consumption and investment--are not sufficient to ensure the full-employment level of output, then the government should spend enough to push the economy to the full-employment level. It does this through the working of the multiplier, discussed below.

Aggregate expenditures are the sum of spending by the four sectors-consumption (C), investment (I), government purchases (G), and net foreign expenditures (X).

$$AE = C + I + G + (X-M)$$

At equilibrium national income, or Y, = AE

Keynes believed that current income is the primary determinant of consumption expenditure, with saving as a residual. (In the classical system, saving depends on the interest rate, with consumption as a residual.) Specifically, as people's incomes rise, they will consume more, but their consumption will not rise by as much as their income increases. The fraction of their additional disposable income that they consume is known as the marginal propensity to consume.

$$MPC = \frac{\Delta C}{\Delta Y} = c$$

Since the marginal propensity to consume (c) plus the marginal propensity to save (s) equal one, the multiplier may be written as:

$$\frac{1}{s}$$

Investment expenditures are viewed as independent of income, and primarily a function of current sales relative to plant capacity, expected future sales, and the interest rate. Government expenditures are viewed as a policy variable.

Exports are dependent on spending choices and income levels abroad, and unaffected by changes in a nation's domestic income level. Therefore, exports remain constant when income changes. In contrast, increases in domestic income will induce consumers to purchase more foreign as well as domestic goods. Therefore, the level of imports increases as income rise.

The condition for equilibrium is that actual output equals aggregate demand:

$$Y = C + I + G + (X-M)$$

Changes in income are equal to the sum of changes in sector expenditures:

$$\hat{Y} = \hat{C} + \hat{I} + \hat{G} + \hat{(X-M)}$$

If we assume for simplicity that there is no change in investment and net exports, then the change in income is equal to:

$$\hat{Y} = \hat{C} + \hat{G}.$$

From above:

$$\hat{C} = c\hat{Y}$$

$$(1-c)\hat{Y} = \hat{G}$$

$$\frac{\hat{Y}}{\hat{G}} = \frac{1}{1-c}$$

This last equation defines the "government multiplier," which for the purposes of this analysis would be the impact of additional, autonomous government spending on, e.g. military expenditures.

Post Keynesian Growth Models. Keynes stressed that full employment is not automatically achieved. With this orientation toward the short-run employment problem, Keynesian economics tended to ignore long-run growth and the role of capital accumulation in growth.

Harrod and Domar first bridged the gap between the Keynesian theory of employment and the dynamics of long-run growth. A central part of the Harrod-Domar model is that investment has a dual character. On the one hand, investment contributes to aggregate demand and thereby helps to promote full employment and full capacity in the short run. On the other hand, investment involves expansion of the stock of capital and therefore contributes to the supply of output that the economy is capable of producing.

Key to the Harrod-Domar model is the rate at which investment must grow in order for full capacity output to be maintained. To do this, Harrod-Domar adds to the Keynesian model of income determination the assumption that output is proportional to the size of the capital stock.

The equilibrium growth rate is derived from three underlying equations:

$$S = I$$

$$S = sY$$

$$\hat{Y} = (1/@)*I,$$

where

^Y is the change in real income

I is net real investment, i.e. the change in the stock of capital

S is real saving

s is the marginal propensity to save

@ is the incremental capital-output ratio.

By combining the above equations, we can arrive at the equilibrium rate of growth:

$$\hat{Y} = (1/@)*sY$$

or $\hat{Y}/Y = s/@ = g$, the equilibrium growth rate.

If one introduces a government sector and exports in this model, this growth equation becomes

$$g = \frac{s-b-c}{@}$$

where

b is governmental expenditure as a proportion of national income

c is imports minus exports as a proportion of national income

Thus, in this model the growth rate will be determined by the savings ratio, the government budget ratio, the current account ratio and the incremental capital output ratio.

Two-Gap Growth Models. Two-gap models have been developed in the Harrod-Domar framework--i.e., they rely on a specified saving rate and a given capital-output ratio to determine feasible levels of growth in developing countries.

In two-gap models, two independent resource constraints inhibit growth. First, the required level of investment to realize the growth potential of an economy is not available because the economy cannot generate the needed savings. Second, domestic growth is constrained by access to foreign exchange, or the inability to run current account surpluses. Since foreign inflows can both add to domestic saving and provide the foreign exchange for imported inputs for which there are no close domestic substitutes, the latter constraint is generally considered to be dominant.

Economists at AID and the World Bank frequently use the two-gap approach for macroeconomic projections and policy work. The Revised Minimum Standard Model (RMSM) is a type of two-gap model that is widely used.

The RMSM itself is essentially an accounting framework that links the national accounts and the balance of payments, and pays particular attention to the foreign financing gap and projections of foreign borrowing. Some important features of the model are:

--An incremental capital-output ratio (ICOR) is either historically or technologically given. This permits one to obtain either the growth of real GDP based on the available level of investment, or, more typically, the required level of investment consistent with a desired rate of growth.

--The private sector saving function is stable and historically given.

--There is a stable relationship between imports and GDP.

--Exports are determined exogenously.

Thus, the RMSM relies on the assumed behavioral relationships for saving, investment, and output. Typically, a targeted growth rate for the following year can be set based upon consensus estimates of attainable growth. Meeting this growth rate entails a minimum level of investment in the present year, which through the incremental-capital output ratio (ICOR) determines the level of output next year. The financing of investment comes from domestic saving, which is determined by output, but which may not equal the required investment. Thus, there may be a gap ex-ante between saving and investment.

The other critical sector is foreign trade. Several categories of imports are usually specified. As noted above, the model assumes a stable relationship between imports and GDP. For example, the level of growth of petroleum imports and GDP is given by the historical relationships of GDP and petroleum imports. Capital goods are linked to the level of required investment. As noted, exports are determined exogenously.

In order to meet targeted growth rates, imports usually have to rise relative to the fixed level of exports, creating a second gap ex-ante. By including factor and non-factor services, the current account deficit corresponding to different growth targets can then be calculated. The donors then try to identify sources of funding--including balance of payments and project financing--to close the gap between exports and imports. In the models, the gap between exports and imports is usually larger than that between investment and saving. In this case, closing the export-import gap also closes the investment-saving gap.

Although the model obviously has limitations, it has proven its usefulness as a programming and analytical tool. Many of the key macroeconomic variables upon which military expenditures are hypothesized to have an impact can be modelled in this framework.

Neoclassical Models. In analyzing developed economies, the Harrod -Domar model has been superseded by neoclassical growth economics.

Part of the differences in the two models lies in the purpose to which they were used: while Harrod-Domar calculated the rate of growth that was necessary to maintain full employment, neoclassical theory takes full employment for granted and attempts to analyze the long-run growth path.

In Harrod-Domar model, potential output is proportional to the stock of capital, and capital is the only factor of production. Neoclassical theory more realistically allows for the possibility of substitution between labor and capital. It also incorporates diminishing returns to the factors of production, technical change and other economic processes such as the depreciation of the capital stock.

Neoclassical growth theory assumes that output is at the full employment level, and that the supply of labor, independently of real wages, grows at a constant exponential rate.

The most familiar neo-classical model is the Cobb-Douglas function:

$$Y = Y(L,K,A)$$

in which L is labor force, K is capital and A is the parameter for the state of technology.

In the model, investments are defined by the increase in the capital stock:

$$I = dk/dt$$

Savings are proportional to national product

$$S = sY$$

The equilibrium condition is

$$I = S$$

Therefore

$$dk/dt = sY$$

and

$$gk = (dk/dt)/K = sY/K$$

A necessary condition for balanced growth is that the growth rate of capital is constant. This can be realized only if the growth rate of production equals that of capital.

$$gy = gk$$

One well known but curious characteristic of equilibrium growth in the neo-classical model is that the growth rate is not a function of the saving rate. This differs from the Harrod-Domar result that the growth rate is the quotient of the saving rate and the ICOR.

The reason for this difference is that an increase in the fraction of income saved will accelerate the growth of capital and output temporarily, but diminishing returns will eventually restore the original growth rate. An increase in the fraction of income saved cannot therefore permanently raise the growth rate.

However, although the equilibrium growth rate is not a function of the saving rate, the saving rate determines the capital output ratio. Thus, the fraction of income saved affects the level at which the economy grows (the initial conditions) but it does not affect the rate at which it grows.

Conclusion. In the "Design for Country Case Studies" it is proposed that the RMSM be used to capture simultaneously the five principal effects of military expenditure on economic growth. The RMSM is also practical in that it is already widely used by World Bank and AID for macroeconomic and policy analysis, and could capture the effects in a manner that would be time and cost efficient.

ANNEX 4.
THIRD WORLD DEFENSE EXPENDITURES
AND ECONOMIC GROWTH IN THE 1980S

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Introduction

During the 1980s there has been a slowdown in defense spending in many developing countries, especially in Middle East, and to a lesser extent South Asia and Northern Africa. In large part reductions in allocations to the military have been brought on by growing fiscal problems, forcing governments to reorder their spending priorities. It is apparent that for the developing world as a whole, countries are examining the potential benefits of reduced allocations to the military. Depending on the relative impact of defense spending, shifts in resources may significantly affect the economic performance of these countries.

The purpose of this paper is to update previous work examining the security and development relationship using a typology of LDCs based on the economic environment. Utilizing new data extending up to 1987 the study addresses the following questions:

1. Did defense expenditures hinder or aid developing country in the 1980s?

2. Were the linkages from military expenditures to growth different than in previous time periods?

3. Did defense expenditures impact uniformly or vary by country?

4. If the impact varied across countries, what country groupings best depict these differences?

5. If they exist, what are the underlying environmental causes of these differences?

The main hypothesis of the study is that developing countries are likely to show considerable variations with regard to the manner in which defense expenditures affect economic growth. In turn, these variations reflect the underlying economic health of developing countries, and thus their relative ability to minimize potential adverse effects associated with increased defense burdens.

Recent Patterns

In the period following the 1973/74 oil price increases, the developing regions as a whole and the Middle East in particular have experienced an unprecedented growth in economic output, exports, military spending (Table 1), armed forces (Table 2) and arms transfers (Table 3). Growth in military expenditures and arms transfers, however, is decelerating and for many countries has been negative over the last several years. Nevertheless, there is reason to believe that these declines will not continue indefinitely[1]:

1. Defense expenditures seem remarkably steady, even when income is falling. In some cases, they even rise slightly.

2. The figures on expenditures for the last several years may be too low. The greatest part of armed forces spending is on salaries and training, rather than equipment purchases. There is little evidence of manpower reductions.

3. Preliminary figures for defense expenditure in 1988 seem to show that in many cases--especially Gulf States--that the proportion spent on defense has risen back to 1985/86 levels. A similar trend--maintenance of defense spending levels--will probably be evident in many Middle East states in the next several years.

Table 1

Military Expenditures: Shares and Growth

(percentage)

Region	World Share		Average Annual Growth	
	1977	1987	1977-1987	1982-1987
World	100.0	100.0	2.8	1.8
Developed	78.4	83.0	3.3	2.9
Developing	21.6	17.0	0.9	- 2.8
Region				
Africa	1.6	1.4	0.7	- 1.3
East Asia	6.9	6.9	2.4	1.9
Europe, all	55.2	51.7	1.8	1.4
NATO Europe	14.7	13.9	1.9	1.1
Warsaw Pact	38.3	35.9	1.8	1.6
Other Europe	2.2	2.0	1.7	0.5
Latin America	1.5	1.5	4.5	- 1.3
Middle East	**10.5**	**6.6**	**- 0.7**	**- 6.9**
North America	22.8	30.0	6.1	5.3
Oceania	0.5	0.6	4.5	3.8
South Asia	**0.9**	**1.3**	**6.0**	**6.9**
Organization				
NATO, all	37.5	43.9	4.5	3.9
Warsaw Pact	38.3	35.9	1.8	1.6
OPEC	**8.9**	**5.6**	**- 1.1**	**- 7.6**
OECD	41.6	48.7	4.5	3.8

Source: United States Arms Control and Disarmament Agency, **World Military Expenditures and Arms Transfers, 1988** (Washington, USACDA, June 1989), p. 2.

Table 2

Armed Forces: Shares and Growth

(percentage)

Region	World Share		Average Annual Growth	
	1977	1987	1977-1987	1982-1987
World	100.0	100.0	1.4	- 4.6
Developed	19.7	17.8	3.2	- 2.2
Developing	80.3	82.2	0.9	- 5.2
Region				
Africa	18.1	10.5	- 6.1	- 12.3
East Asia	6.4	12.5	4.8	1.9
Europe, all	21.4	18.7	2.4	- 1.9
NATO Europe	7.7	6.9	1.7	- 6.5
Warsaw Pact	11.1	7.5	2.1	- 1.6
Other Europe	2.5	4.3	3.1	5.2
Latin America	6.4	7.3	2.7	- 5.2
Middle East	**39.6**	**37.7**	**1.4**	**- 8.4**
North America	1.3	1.6	3.2	- 4.7
Oceania	0.8	1.4	9.9	24.1
South Asia	**5.8**	**9.9**	**10.4**	**10.4**
Organization				
NATO, all	9.0	8.6	2.0	- 6.1
Warsaw Pact	11.1	7.5	2.1	- 1.6
OPEC	**38.7**	**27.6**	**- 0.7**	**- 9.6**
OECD	12.3	15.4	4.5	- 0.7

Source: United States Arms Control and Disarmament Agency, **World Military Expenditures and Arms Transfers, 1988** (Washington, USACDA, June 1989), p. 7.

Table 3

Arms Imports: Shares and Growth

(percentage)

Region	World Share		Average Annual Growth	
	1977	1987	1977-1987	1982-1987
World	100.0	100.0	1.3	1.3
Developed	38.5	37.5	1.0	0.7
Developing	61.5	62.5	1.4	1.7
Region				
Africa	5.1	6.0	3.2	4.4
East Asia	30.4	27.8	0.2	- 0.6
Europe, all	35.8	43.3	0.8	0.5
NATO Europe	12.4	11.6	0.7	0.7
Warsaw Pact	20.1	20.1	1.2	0.9
Other Europe	3.4	2.6	- 1.3	- 2.8
Latin America	5.6	6.2	2.9	2.0
Middle East	**6.0**	**9.2**	**4.9**	**6.9**
North America	8.3	8.1	1.2	0.8
Oceania	0.2	0.3	0.3	- 0.4
South Asia	**8.4**	**7.9**	**1.4**	**4.0**
Organization				
NATO, all	20.7	19.7	0.9	0.8
Warsaw Pact	20.1	20.1	1.2	0.9
OPEC	**5.3**	**7.6**	**4.8**	**8.7**
OECD	24.0	22.5	0.7	0.4

Source: United States Arms Control and Disarmament Agency, **World Military Expenditures and Arms Transfers, 1988** (Washington, USACDA, June 1989), p. 7.

Methodology

The first step was to determine if the sub-grouping work for the pre-1980s data sets[2] extended into the 1980s--that is, did developing countries continue to fall into roughly two groups based on their relative resource endowments and resulting economic performance? For this purpose, our sample of sixty-eight developing countries[3] was split into two groups--those with real rates of Gross Domestic Product (GDP) growth (1980-87) higher than the total sample mean (2.3%), and those with growth rates lower than the sample mean. Here, the presumption was that the high growth countries possessed resources adequate to enabling them to sustain fairly high rates of economic growth, while the low growth countries were not able to overcome resource scarcity created by poor export markets, high debt burdens and the like.

This initial grouping of countries comprised twenty-eight high growth countries and forty with growth rates below the group mean[4]. Both groups varied considerably with regard to a number of military expenditure, and economic performance indices (Table 4):

1. The high growth countries sustained considerably greater rates of growth of military expenditures, during both the 1970-79, and 1980-87 periods. On the other hand the lower growth countries had higher rates of growth in the armed forces during the 1970-79 period, and only marginally lower rates of growth during the 1980s.

2. The military burden (defense expenditures as a percentage of Gross National Product) for both groups of countries was roughly the same. While for both groups military expenditures averaged around 3.5 percent of GNP, the low growth countries had a sight increase in this ration in the 1980s, while the high growth group had a slight decline.

3. During the 1980s the share of the central government budget accounted for by defense was roughly similar for the two groups: 13.7% for the low growth countries and 13.4% for the high growth countries. However, while this figure was roughly the same in the 1970s for the low growth countries, it was considerably below the 18.7 percent average for the high growth countries.

4. A major group difference involved military expenditures per capita, with the low growth countries spending well over twice ($110 vs $41) the amounts as the high growth countries. The low growth countries also had more armed forces per capita as well as nearly twice the share of arms imports in their total import bill.

Table 4

Profiles of High and Low Growth Developing Economies, 1980-1987: Military Expenditures and Economic Growth

(means)

Variable	Growth 1980-87	
Discriminating Variables in Analysis	**<2.3%**	**>2.3%**
Military Expenditure Variables		
Growth Military Expenditure 1970-79	4.6	7.7
Growth Military Expenditure 1980-87	0.5	2.9
Growth Armed Forces 1970-79	4.1	3.6
Growth Armed Forces 1980-87	3.4	3.6
Average Military Burden 1970-79	3.5	3.1
Average Military Burden 1980-87	4.1	3.4
Average Share ME in Government Exp 1970-79	13.1	18.7
Average Share Me in Government Exp 198087	13.7	13.4
Average Military Exp Per Capita 1980-87	111.0	41.2
Average Forces Per 1000 Pop 1980-87	7.9	5.1
Average % Arms Imports in Total Impor 1980-87	8.2	3.6
Economic Growth Variables		
Growth in Gross National Product 1979-79	4.4	5.5
Growth in Gross National Product 1980-87	0.2	5.1
Growth in Gross Capital Formation 1965-80	7.4	9.2
Growth in Gross Capital Formation 1980-87	- 5.0	1.9
Growth in Private Consumption 1965-80	4.3	5.3
Growth in Private Consumption 1980-87	1.0	4.0
Growth in Government Consumption 1965-80	7.1	6.7
Growth in Government Consumption 1980-87	0.0	4.9
Growth in Imports 1965-1980	4.4	6.1
Growth in Imports 1980-87	- 2.4	2.1
Growth in Exports 1965-80	5.8	6.1
Growth in Exports 1980-87	0.9	6.4
Growth in Government Expenditure 1970-79	8.1	8.4
Growth in Government Expenditure 1980-87	- 0.1	4.0

Notes: Military expenditure data from: United States Arms Control and Disarmament Agency, **World Military Expenditures and Arms Transfers, 1988** (Washington: USACDA, June 1989). Economic data from: World Bank, **World Development Report, 1989** (New York: Oxford University Press, 1989).

Several sharp differences also characterized the economic performance of the two groups of countries:

1. While both groups of countries had roughly similar rates of growth in the 1970s, the high growth countries averaged 5.5% per annum increases in GDP in the 1980s, compared to 0.2% for the low growth countries.

2. Even sharper differences occurred in the relative rates of growth in investment (gross capital formation), and government consumption, imports, exports, and total government expenditures, with the high growth countries averaging significantly higher rates of expansion in each category. In addition, while the high growth countries obtained lower growth rates in each category relative to the 1970s, this fall-off was considerably less than that experienced by the low growth countries.

3. Especially telling is the fact that during the 1980s the low growth countries experienced negative rates of growth in gross capital formation (-5.0 percent per annum), imports (-2.4 percent per annum), and government expenditures (-0.1 percent). The high growth countries experienced positive growth (albeit lower than in the 1970s) in each of these areas.

In terms of other economic indices (Table 5):

1. The high growth countries experienced relatively low rates of inflation during both the 1970s and 1980s.

2. Despite divergent export patterns in the 1980s, both groups of countries had experience roughly the same deterioration in the terms of trade by 1985.

3. While the log growth countries had on the average higher per capita incomes, their populations were considerably below that of the high growth countries.

4. As one might imagine the low growth countries, had accumulated larger debt burdens (long term debt as a percentage of GNP) by the end of the period under consideration (1987). However, their debt service as a percentage of GNP was roughly similar to that of the high growth countries.

5. Finally, the low growth countries, despite higher per capita incomes, had accumulated relatively large amounts of official development assistance as a share of GNP and a per capita basis.

Table 5

Profiles of High and Low Growth Developing Economies, 1980-1987: Other Economic Differences and Discriminating Factors

(means)

Variable	Growth 1980-87	
Discriminating Variables in Analysis	**<2.3%**	**>2.3%**
Other Economic		
Inflation 1965-80	58.3	16.0
Inflation 1980-87	19.5	11.3
Terms of Trade 1985 (1980=100)	92.2	93.5
Per Capita Income 1987	1372.0	1191.7
Population 1987	17.8	113.0
Debt Variables		
Long Term Debt (% GNP, 1987)	76.8	53.7
Long Term Debt Service (% GNP, 1987)	5.4	5.9
Long Term Debt (% Exports, 1987)	22.5	24.9
Official Development Assistance (% GNP, 1987)	6.7	4.8
Official Devel Assist (per capita, 1987)	43.7	24.5

Military/Economic Variables Significant in Discriminating Groups

Variable	Wilks' Lambda	F
Growth in Private Consumption, 1980-87	0.521	
Growth in Government Consumption, 1980-87	0.410	
Growth in Armed Forces, 1980-87	0.382	
Growth in Private Consumption 1965-80	0.354	
Growth in Gross Capital Formation, 1980-87	0.341	
Growth in Government Expenditure 1970-79	0.331	
Growth in Imports, 1965-80	0.311	
Growth in Military Expenditures, 1970-79	0.289	

Clearly, the high and low growth countries differ in a wide variety of areas, both economic and military. Obviously, a number of these measures are highly correlated, and it is not obvious which (other than growth itself) are critical (in some sort of statistical sense) for distinguishing differentiating the two groups of countries. For this purpose, a step-wise discriminant analysis incorporated all of the variables in Tables 4 and 5. This exercise introduced the variables in a manner so as the variable providing the highest differentiating power was selected first. This procedure continued until it was impossible for an additional variable to make a statistically significant (based on the F statistic) improvement in the group delineation.

The results (bottom of Table 5) of this exercise identified eight variables as statistically significant in splitting the country sample into two groups. In descending order of importance these were: (a) the growth in private consumption, 1980-87, (b) the growth in government consumption, 1980-87, (c) the growth in armed forces, 1980-87, (d) the growth in private consumption 1965-80, (e) growth in gross capital formation, 1980-87, (f) growth in total government expenditure 1979-79, (g) growth in imports 1965-80, and growth in military expenditures 1970-79.

Using these variables, the analysis classified most countries correctly with a very high probability of correct placement (Table 6). The analysis reclassified only one country, the small African country of Benin from the high to the low group. Similarly, just three countries (Tanzania, Venezuela, and Kuwait) were reclassified from low to high. In the case of the latter two countries, slack oil revenues in the 1980s placed them initially in the low group. However their accumulated reserves obviously enabled them to maintain relatively high rates of investment, government consumption and the like.

Interestingly enough one of the variables significant in distinguishing the two groups of countries was the growth in military expenditures during the 1970s, with the high growth countries experiencing considerably greater rates of defense expenditures (7.7 percent per annum versus 4.6). Economically, it is apparent that the high growth countries are those having relatively abundant resources, enabling them to finance fairly high rates of growth in government expenditures and investment.

Table 6

Discriminant Analysis: Country Results

Country	Growth Group	Probability In Growth Group	Discriminant Score
Zaire	Low	100.0	-3.975
Syria	Low	100.0	-3.476
Liberia	Low	100.0	-3.117
Sudan	Low	100.0	-2.969
Uruguay	Low	100.0	-2.770
Jamaica	Low	100.0	-2.178
Nicaurgua	Low	99.9	-2.130
Chile	Low	99.9	-1.995
Nigeria	Low	99.9	-1.887
Zambia	Low	99.9	-1.866
Guatamala	Low	99.9	-1.859
Bolivia	Low	99.9	-1.836
Mexico	Low	99.8	-1.784
Argentina	Low	99.8	-1.703
Gabon	Low	99.8	-1.683
Israel	Low	99.8	-1.655
Phillipines	Low	99.7	-1.611
Zimbabwe	Low	99.6	-1.527
Yugoslavia	Low	99.9	-1.466
Haiti	Low	99.4	-1.385
El Salvador	Low	98.7	-1.121
Niger	Low	97.9	-0.975
Peru	Low	97.6	-0.922
Mauritania	Low	97.5	-0.915
Portugal	Low	97.1	-0.873
Ecuador	Low	97.1	-0.867
Togo	Low	96.9	-0.846
Ivory Coast	Low	96.3	-0.793
South Africa	Low	95.5	-0.727
Somalia	Low	90.7	-0.489
Greece	Low	90.0	-0.463
Ghana	Low	84.8	-0.317
Ethiopia	Low	76.4	-0.149
Central African Rep.	Low	70.2	-0.051
Paraguay	High	66.6	0.002
Costa Rica	High	60.9	0.077
Honduras	High	65.7	0.130
Benin	High	47.4 **	0.182
Tanzania	Low	29.1 **	0.488
Brazil	High	75.3	0.558
Kenya	High	87.4	0.811
Jordan	High	88.2	0.833

Table 6 (contd)

Discriminant Analysis: Country Results

Country	Growth Group	Probability In Growth Group	Discriminant Score
Mauritius	High	90.1	0.895
Venezuala	Low	8.2 **	0.958
Colombia	High	91.8	0.959
Burundi	High	92.3	0.981
Senegal	High	94.2	1.076
Morocco	High	94.3	1.083
Singapore	High	98.4	1.482
Upper Volta	High	98.5	1.498
Rwanda	High	98.7	1.552
Tunisia	High	98.9	1.607
Thailand	High	99.4	1.785
Congo	High	99.4	1.801
Malawi	High	99.5	1.874
Pakistan	High	99.8	2.159
Turkey	High	99.9	2.227
Mali	High	99.9	2.277
Egypt	High	99.9	2.471
Sri Lanka	High	99.9	2.541
South Korea	High	100.0	2.579
Kuwait	Low	0.0 **	2.694
Indonesia	High	100.0	2.734
India	High	99.9	2.913
China	High	100.0	3.071
Algeria	High	100.0	3.278
Yemen Arab Republic	High	100.0	3.403
Cameroon	High	100.0	4.067

Model Specification

To overcome some of the limitations of previous cross-sectional studies, the analysis below systematically incorporates various lags between the defense burden and economic growth. Here emphasis is on examining the timing movements between these two variables. For this purpose, a small structural model was specified. To correct for any simultaneous equation bias, the model was estimated using a two-stage least squares procedure. In this model, economic growth during the 1980-1987 period was regressed on several measures of military expenditure during the previous decade. Here, lagged military expenditures were introduced into the model directly (into the growth equation itself) and indirectly (as a determinant of military expenditures in the 1980-1987 period.[5]

Specifically:

$$\text{(a)}\quad GDPG = f(GDIG^{+},\ MEY(MEYo)^{?\,(?)},\ GCG^{+})$$

$$\text{(b)}\quad GDIG = f(EX^{+})$$

$$\text{(c)}\quad MEY = f(MEYo^{+},\ MEGo^{+},\ MIDEAST^{+})$$

Where:

GDPG = the average annual growth in Gross Domestic Product, 1980-87
GDIG = the average annual growth in gross capital formation, 1980-87
MEY = the average share of military expenditures in GNP, 1980-87
MEYo = the average share of military expenditures in GNP, 1970-79
GCG = the average annual growth in government expenditure, 1977-87
EX = the average annual growth in exports, 1980-87
MEGo = the average annual growth in military expenditures, 1970-79
MIDEAST = dummy variable, with values of 1 for Middle East, North African countries, and 0, other countries

Two variants of the model were tested: (a) the military burden was introduced into equation (a) in lagged form (MEYo), and (b) in the current (1980-87) period (MEY). When MEY was included, it was estimated through equation (c) in terms of its previous level, and the growth in military expenditures during the 1980s. Given the higher military burdens in the middle east, the MIDEAST dummy was also added to improve the estimation. In particular we were interested in determining whether and to what extent the impact of

military expenditures varied by sub-grouping. That is, did growth differ significantly in resource abundant and resource constrained countries with regard to their military burdens?

Main Findings

In terms of the growth equations specified above, a clear picture emerges. Based on the t-statistic, defense expenditures (MEY, Equation 1 Table 7) did not affect growth when considering the entire sample of sixty-eight countries.[6] A similar result (not shown here) occurred using lagged military expenditures (MEYo) in the growth equation.[7]

On the other hand, forming sub-groups based on the country discriminant score (Table 6) did produce a number of statistically significant results. Since discriminant scores have a mean of zero, countries with high negative scores, are likely to be those with severe resource constraints. Gradually dropping the more resource constrained countries from the analysis systematically improved the statistical significance (and coefficient size) of the military expenditure term:

1. Dropping three countries (those with discriminate scores less than -3.0) doubled the size of the coefficient (Table 7 equation 2) on the military expenditure term (from 0.6 to 0.13). The t test for significance, while still not high enough for a 95 percent confidence level, did improve from 0.66 to 1.32.

2. Dropping four more countries (those with discriminate scores less than -2.0) gradually increased the size of the military expenditure coefficient and its t value (and the overall coefficient of determination, r2).

3. Finally, a sub group of countries with discriminant scores greater than -1.0 produced statistically significant results, with the size of the military expenditure term increasing to 0.27, and its t value now over the 95 percent confidence level.

4. This pattern continued (Table 7, equations 5, and 6) when dropping more of the lesser resource endowed countries from the analysis.

5. Eliminating countries with discriminant scores less than 1.0 raised the military expenditure coefficient to 0.39, and the overall coefficient of determination to 62.2 percent.

Table 7

Impact of Military Expenditures on Economic Growth, 1980-87

(Standardized regression coefficients)

Discriminant Score Greater than -4.0
Growth in Income (GNPG)

(1) GNPG = 0.62 GDIG + 0.06 MEY + 0.35 GCG
(3.06) (0.66) (3.40)

r2 = 0.472; F = 18.50; df = 62

Discriminant Score Greater than -3.0
Growth in Income (GNPG)

(2) GNPG = 0.59 GDIG + 0.13 MEY + 0.35 GCG
(3.18) (1.32) (3.42)

r2 = 0.489; F = 18.85; df = 59

Discriminant Score Greater than -2.0
Growth in Income (GNPG)

(3) GNPG = 0.72 GDIG + 0.15 MEY + 0.32 GCG
(3.97) (1.49) (3.23)

r2 = 0.532; F = 20.83; df = 55

Discriminant Score Greater than -1.0
Growth in Income (GNPG)

(4) GNPG = 0.72 GDIG + 0.27 MEY + 0.28 GCG
(3.37) (2.20) (2.24)

r2 = 0.494; F = 13.67; df = 42

Discriminant Score Greater than 0.0
Growth in Income (GNPG)

(5) GNPG = 0.76 GDIG + 0.34 MEY + 0.27 GCG
(3.60) (2.34) (1.91)

r2 = 0.516; F = 10.68; df = 30

Discriminant Score Greater than 1.0
Growth in Income (GNPG)

(6) GNPG = 0.58 GDIG + 0.39 MEY + 0.48 GCG
(3.43) (2.60) (3.40)

r2 = 0.622; F = 9.87; df = 18

Note: Estimated by two stage least squares estimation procedure.

Clearly a number of factors affect the productivity of investment, military expenditures and government expenditures in affecting over-all economic growth. The work of Deger[8] indicates that there may be a number of indirect or spinoff type impacts (both positive and negative) stemming from military expenditures. Within the context of the results presented above (Table 7) it is safe to assume the difference between the estimated and actual values for the growth equations may represent some of these indirect effects.

To determine the manner in which allocations to defense have contributed to this effect, we regressed several measures[9] of military allocations (together with other types of expenditures) on the error term for each of the equations in Table 7. Most of the military expenditure variables covered alternative time periods. For brevity only the period of highest statistical significance appears in the results below (Table 8). Since theory provides no guidance as to the correct specification of the model, we introduced the expenditure variables in a step-wise regression equation (with expected signs) of the form:

$$\text{(d)}\quad \text{ERROR} = f(\underset{+}{\text{GNPG}},\ \underset{?}{\text{EXPENDITURES}})$$

The growth in GNP over the 1980-97 period (GNPG8087) represents a control variable to eliminate any biases stemming from correlations between individual the expenditure terms and the overall rate of growth in the 1980s. The results (Table 8) again indicate several interesting patterns:

1. In all of the equations military expenditure terms were statistically significant in explaining the residuals obtained in Table 7. Similarly none of the non-military expenditure terms accounted for fluctuations in the difference between actual and predicted rates of growth.

2. For country groupings which included many of the low growth countries (and for which military expenditures did not have a direct impact on growth), military expenditures had a negative indirect impact on the residual. That is increases in arms imports as a share of imports (AIZ) and per-capita military expenditures (MEP), tended to reduce the difference between actual and predicted rates of growth during the 1980s (Equations 1-3, Table 8).

3. For countries deriving positive direct impacts from defense expenditures to growth (Equations 4, 5 and 6, Table 7), increases in the average share in military expenditures in the central government budget (MEGE) tended to have a negative indirect impact on overall economic growth. (Equations 4, 5 and 6, Table 8).

Table 8

Factors Affecting Expenditure Effectiveness

(Standardized regression coefficients)

Discriminant Score Greater than -4.0
Actual minus Predicted Value, Equation 1 Table 9 (ERROR)

(1) ERROR = 0.51 GNPG8087 - 0.26 AIZ8087 - 0.25 MEP8087
(5.20) (-2.63) (-2.52)
r2 = 0.445; F = 16.44; df = 58

Discriminant Score Greater than -3.0
Actual minus Predicted Value, Equation 2 Table 9 (ERROR)

(2) ERROR = 0.53 GNPG8087 - 0.31 MEP8087 - 0.24 AIZ8087
(5.20) (-2.63) (-2.52)
r2 = 0.512; F = 19.24; df = 55

Discriminant Score Greater than -2.0
Actual minus Predicted Value, Equation 3 Table 9 (ERROR)

(3) ERROR = 0.41 GNPG8087 - 0.26 AIZ7479 - 0.24 MEP8087
(3.50) (-2.20) (-2.10)
r2 = 0.319; F = 7.97; df = 51

Discriminant Score Greater than -1.0
Actual minus Predicted Value, Equation 4 Table 9 (ERROR)

(4) ERROR = 0.71 GNPG8087 - 0.26 MEGE7479
(4.54) (-2.74)
r2 = 0.347; F = 10.36; df = 39

Discriminant Score Greater than 0
Actual minus Predicted Value, Equation 5 Table 9 (ERROR)

(6) ERROR = 0.75 GNPG8087 - 0.48 MEGE7479
(3.88) (-2.48)
r2 = 0.351; F = 7.55; df = 28

Discriminant Score Greater than 1.0
Actual minus Predicted Value, Equation 6 Table 9 (ERROR)

(6) ERROR = 1.09 GNPG8087 - 0.57 MEGE8087 + 0.43 MEG7079
(5.44) (-3.04) (2.73)
r2 = 0.655; F = 10.13 df = 16

Note: Estimated by step-wise ordinary least squares estimation procedure. GNPG8087=Average annual growth in GNP, 1980-87; AIZ8087=average share of arms imports in total imports 1980-87; MEP8087 = average military expenditure per capita, 1980-87; AIZ7479 = average share of arms imports in total imports 1974-79; MEGE7479 = average share of defense expenditures in total government budget 1974-79; MEGE8087 = average share of defense expenditures in total government budget, 1980-87; MEG7079 = average annual growth in military expenditures, 1970-79.

4. For the first two country groupings (those with discriminant scores greater than -1.0 and 0) the expenditure term with the highest statistical significance was increases in the average share of defense in the central government budget, in the preceding five year interval five year interval (MEGE7479). That is increases in the proportion of government resources allocated to defense in the late 1970s tended to offset somewhat the positive direct impact of military expenditures on growth in the 1980s.

5. This picture changed somewhat for the countries experiencing very high overall growth in the 1980s. For these countries, the negative indirect impact of increases eases in the share military expenditures in the central government budget during the 1980-87 period (MEGE8087) was offset somewhat by the positive indirect impact of higher rates of growth in defense expenditures in the 1970s (MEG7079).

In short, it appears that for low growth countries military expenditures may have impacted negatively and indirectly on their growth in the 1980s. By preempting scarce foreign exchange, arms imports apparently have diverted resources away from productivity enhancing expenditures. The same applies to domestic resources in the form of increased military expenditures per capita. The result has been lower rates of growth associated with investment and overall increases in government expenditures than might otherwise have been the case.

For the high growth countries a slightly different picture emerges. For these countries, excessive shares of military expenditures in the central government budgets (reflecting the general world wide surge in military expenditures in the late 1970s) appear to have diverted significant resources from areas such as human (education and health) and physical capital formation, so that by the 1980s relative deficiencies in these areas were detracting somewhat from the positive direct impact of defense expenditures on growth.

As might have been anticipated, that group of countries with very high rates of growth (discriminant scores over 1.0) and relatively few resource constraints were able to minimize somewhat the negative budgetary effect associated with allocations to defense. For these countries, high rates of growth in defense expenditures in the 1970s, carried over into the 1980s in the form of positive indirect effects on growth. Unfortunately it is impossible to determine from the results presented here to determine the nature of this latter indirect effect.

Conclusions

Conventional wisdom has long posited that heavy outlays on defense divert scarce resources away from directly productive investment (the old guns and butter trade-off) and human capital formation (education, health). While this view makes intuitive sense, it does not necessarily follow that increased military expenditures actually reduce overall economic growth in developing countries as a whole. There is a counter-argument with respect to developing countries that suggests defense expenditures may act as an economic stimulus. They finance heavy industry (armaments); the acquisition of advanced technologies, the provision of employment, and the like. Defense expenditures or a large military establishment may attract investment and thus enhance the country's foreign exchange position.[10]

The results obtained here are consistent with this dual view of defense expenditures. The findings are also consistent with earlier studies for the periods prior to 1980. For example Frederiksen and Looney[11] found that defense outlays bear a high opportunity cost, shifting resources from "high growth development projects." This effect may entail a reduction not only in pubic outlays but in dependent private outlays as well. In their country only countries with buoyant foreign exchange (e.g., Saudi Arabia) showed any positive correlation between defense outlays and economic growth; otherwise, the two compete against each other.

Roughly the same picture has carried over into the 1980s. During this period, the more abundantly resource endowed countries appear to have derived positive net benefits to growth from increased defense expenditures. On the other hand, there is some evidence that (with a lag) the opportunity costs of defense expenditures have gone up as the share of defense expenditures in the central government's budget passes a certain threshold level. In this situation other types of allocations were likely to become relatively more productive in contributing to longer run growth.

However this does not necessarily imply that in the real world reduced defense expenditures would in of themselves necessarily increase economic growth. Theory might indicate that the returns on alternative uses of the monies devoted to defense may be large. However, practically nowhere in the Third World is there any assurance that reduced defense budgets will automatically result in increased outlays on say, social welfare or infrastructure.

1. Based on Francis Tusa, **Middle East Defense Markets: Opportunities for Suppliers and Investors in the 1990s** (London: Middle East Economic Digest, 1990), p. 20.

2. P. C. Frederiksen and R.E. Looney, "Defense Expenditures and Economic Growth in Developing Countries: Some Further Empirical Evidence," **Journal of Economic Development** (July 1982), pp. 113-25; P.C. Frederiksen and R.E. Looney, "Defense Expenditures and Economic Growth in Developing Countries," **Armed Forces and Society** (Summer 1983), pp 633-646; P.C. Frederiksen and R.E. Looney, "Impact of Increased Military Expenditures on Mexican Economic Growth: A Preliminary Assessment," **Journal Informacion-Comercial Espanola** (December 1982), pp 22-35; P.C. Frederiksen and R. E. Looney "Another Loon at the Defense Spending and Development Hypothesis," **Defense Analysis** (September 1985), pp. 205-210; R.E. Looney and P.C. Frederiksen, "Profiles of Latin American Military Producers," **International Organization** (Summer 1986), pp. 745-752; R.E. Looney and P.C. Frederiksen, "Consequences of Military Rule in Argentina," **Comparative Political Studies** (April 1987), pp. 34-46; and R.E. Looney and P.C. Frederiksen "The future Demand for Military Expenditures in Argentina," **Arms Control** (September 1986), pp. 197-211.

3. Selected on the basis on comparable data across a wide number of military and economic indices.

4. A list of the country's and their classification based on rates of growth in the 1980s is given in the Growth Group column of Table 8.

5. A sample of sixty-eight countries classified as developing by the World Bank was used in the analysis. Economic data are from the World Bank, **World Development Report, 1989** (New York: Oxford University Press, 1989). Military expenditure futures are from the United States Arms Control and Disarmament Agency, **World Military Expenditures and Arms Transfers, 1988** (Washington: USACDA, June 1989).

6. For brevity, only the results for equation (a) the growth equation are presented here. A complete set of results, together the underlying data base are available from the author upon request.

7. The same holds for the sub-group analysis. Again for brevity only the results using the average military burden during 1980-87 are presented here.

8. See for example S. Deger and S. Sen "Military Expenditure, Spin-off and Economic Development," **Journal of Development Economics (1985), pp 67-83.**

9. Regressions were step wise, with the order of variables presented in Table 10 presented in the order of their selection. In each equation the variables introduce into the regressions were: the growth in military expenditures, 1970-79, 1980-87, 1977-87; the average share of military expenditures in GNP 1970-79, 1974-79; the average share of military expenditures in the central government budget, 1970-79, 1974-79, 1980-87; the average share of arms imports in total imports, 1970-79, 1974-79, 1980-87; growth in armed forces, 1970-79, 1980-87; average military expenditures per capita 1980-87; the growth in government expenditures, 1970-79, 1974-79; growth in GNP, 1970-79, 1965-80; average armed forces per capita 1980-87, growth in exports 1980-87.

10. Alan Richards and John Waterbury, **A Political Economy of the Middle East: State, Class and Economic Development** (Boulder, Colorado: Westview Press, 1990), p. 360.

11. P.C. Frederiksen and R.E. Looney "Defense Expenditures and Economic Growth in Developing Countries, **Armed Forces and Society** (1983), pp. 633-45.