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The Economic Impact of Military Expenditures

Daniel Landau

Levels of military spending in developing countries have been falling and are relatively low in areas with economic problems. Generally, military spending (typically about 4 percent of GDP) is not associated with lower rates of economic growth, of capital formation, or of government spending on health, education, and infrastructure, or with higher rates of inflation.

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Landau addresses three questions about military spending in developing countries:

- What are levels of (and trends in) military spending as a percentage of gross national product?

- What impact does peacetime military spending have on growth, government spending on social welfare and infrastructure, and other key economic variables?

- What major factors influence the level of military spending?

Landau finds that military spending as a share of GNP generally fell in the 1980s, even in the Middle East and North Africa. The mean level of military expenditure as a share of GNP (MES) was 3.9 percent, well below the peak of 5.3 percent in 1976. In 1989, MES averaged only 2.7 percent in Latin America and 2.0 percent in Sub-Saharan Africa — the two regions with the most severe economic problems.

He finds no evidence of a negative relationship between military spending as a share of GNP and the peacetime growth rate of developing countries — except where military spending is high.

He finds that higher shares of MES are not associated with lower shares of government spending on education, health, and infrastructure. As MES increases, government spending as a share of GNP increases, which allows the level of spending on health, education, and infrastructure to be maintained.

He finds some evidence that increased military spending in the developing countries has a weak negative impact on investment and the balance of trade. He finds no evidence of a statistically significant relationship between military spending and inflation.

The most important determinant of peacetime military spending is the spending level of neighboring countries — in other words, the potential external threat. Regional conciliation and disarmament may be an important step toward reduced military spending.

THE ECONOMIC IMPACT OF MILITARY EXPENDITURES

by

Daniel Landau

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Abstract

Levels of military spending in developing countries have been falling and are relatively low in areas with economic problems. Military spending is mostly motivated by external threats. In general, at typical current levels (about 4 percent of GDP), military expenditure is not associated with lower rates of economic growth, government social and infrastructure spending, or capital formation, or with higher inflation.

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Summary

This paper presents the results of research on three aspects of military spending in the developing countries. What are the levels and trends in military spending as a percentage of national product? What is the impact of peacetime military spending on growth, government social and infrastructure expenditure, and other key economic variables? What are the major factors influencing the level of military spending?

In terms of the levels of military spending, Landau finds that military spending shares in GNP were generally falling during the 1980s, including the highest spending areas of the Middle East and North Africa. The mean level of military expenditure as a share in GNP (MES) in 1989 was 3.9%, much below the peak of 5.3 percent in 1976. In 1989, in the areas with the most severe economic problems, Latin America and Sub-Saharan Africa, MES averaged only 2.7% and 2.0%, respectively.

Landau studies the impact of military spending on economic growth with regressions of the growth rate of real GNP on MES and other important determinants of growth. The regressions use a sample of 71 countries with a population of 2 million or more. The data cover the time period 1969-89. Landau's hypothesis is that the impact of military expenditure (milex) on growth is a combination of three effects: (1) increased security -- positive impact on growth; (2) milex is related to external threat and hence pressure for more efficient government policies in response to external threat (or "policy efficiency effects" -- positive impact; and (3) diversion of resources from productive investment -- negative impact. Further, he hypothesizes that the combination of these effects will produce a non-linear (quadratic) relationship between milex and growth: at low levels of milex, there will be a positive impact on growth due to increased security and efficiency, while at higher levels of milex, the negative resource-use impact will lead to lower growth. For the full sample of 71 countries, he finds a non-linear relationship between MES and the growth rate. Initially increases in MES are associated with faster growth and beyond a certain level they are associated with slower growth. However, this result is being driven by the 24 countries in the sample from Asia, the Middle East, North Africa, and Southern Europe, which account

for one-third of total observations. When the regressions are run without these countries, there is no significant relationship, positive or negative, between MES and the growth rate. Landau concludes that there is no evidence of a negative relationship between the share of military spending in GNP and the growth rate of the developing countries (in peacetime) until the military expenditure share is quite high. However, it is uncertain whether the non-linear milex-growth relationship can be generalized beyond the Eurasia/North Africa region.

Landau also attempts to determine empirically the channels through which military expenditure influences economic growth. He finds evidence for the hypothesized "policy efficiency effect," i.e., military expenditure is associated with more efficient policies in response to an external threat. However, he finds no other statistically significant channels of impact. Specifically, the impact of military spending on growth cannot be explained by its effects on the levels of investment in human or physical capital or by its impact on the balance of payments.

Regarding other economic effects of military spending, he finds that higher levels of MES are not associated with lower levels of government spending on education, health, and infrastructure as shares in GNP. As MES increases, the share of total government spending in GNP increases which allows the spending on health, education and infrastructure as shares in GNP to be maintained although their shares in total central government expenditure are reduced. There is some evidence that increased military spending in the developing countries has a very weak negative impact on investment and the balance of trade. Landau finds no evidence of a statistically significant relationship between military spending and the inflation rate.

The major determinants of military spending as a percentage of GNP are the average level of military spending of neighboring countries (the potential threat), per capita product, and the existence of actual international wars. The most important determinant of peacetime military spending is neighbors' military spending levels. This result suggests that, in general, military spending in the developing

countries is a response to potential foreign threats. This in turn suggests that a country can lower military expenditures if its neighbors do so as well so that regional conciliation and disarmament could be critical positive steps for reductions in military expenditures.

As with all studies of the determinants of growth, this study is constrained to work from an incomplete theoretical basis, using proxies for some explanatory factors and using imperfect data. In addition, these particular findings apply to peacetime military spending in the developing countries and are based on the years studied. War is an economic as well as human disaster. With the changes in the world in the 1990s, the relationship between developing countries' military spending and their economies could also change.

I. INTRODUCTION

In recent years, there has been growing concern about the possibly harmful effects of unfettered military expenditures in developing countries. It is alleged that these expenditures worsen balance of payments deficits, undermine growth and "crowd out" critical economic and social sector expenditures, with adverse implications for the poor. Furthermore, some aid donors fear that development assistance is directly or indirectly financing military spending. While these concerns have been raised in the past, the Gulf War and the collapse of the Soviet Union have brought the debate into sharp focus. Indeed, several observers have suggested making development assistance explicitly conditional on reductions in military expenditures.[1] While defense conditionality is ruled out for the World Bank,[2] some bilateral donors are beginning to impose conditions on military spending. In this context, it is worth asking what the economic effects of military expenditures have been.

This paper studies several aspects of this question. First, it briefly reviews trends in military expenditures over time and across regions to provide background to the magnitude and location of the problem. Second, and most important for policy, it analyzes the effects of military expenditure on the economic performance of developing countries. How does military expenditure affect economic growth? What are the channels, and what evidence do we have that these are the mechanisms? What is the impact of military spending on government social and infrastructure spending and on other key economic variables? The analysis thus provides insights into the desirability of reducing military expenditures. Finally, the paper analyzes the determinants of military expenditure, which need to be taken into account in initiatives to reduce military spending.

The rest of the paper is organized as follows. Section II of the paper discusses trends in military expenditures. Section III analyzes the relationship between military spending and growth. Section IV examines other economic impacts of military spending, and Section V identifies the determinants of military

spending. Section VI summarizes our findings.

II. LEVELS OF MILITARY EXPENDITURE

In order to analyze the economic effects of military expenditures, it is useful to examine trends in such spending. Do some regions spend more on the military than others? Are military expenditures increasing over time? As discussed in detail below, the available data suggest that military expenditure has generally been falling in recent years, that it is particularly high in specific regions, and that the poor-growth regions have relatively low levels of military spending.

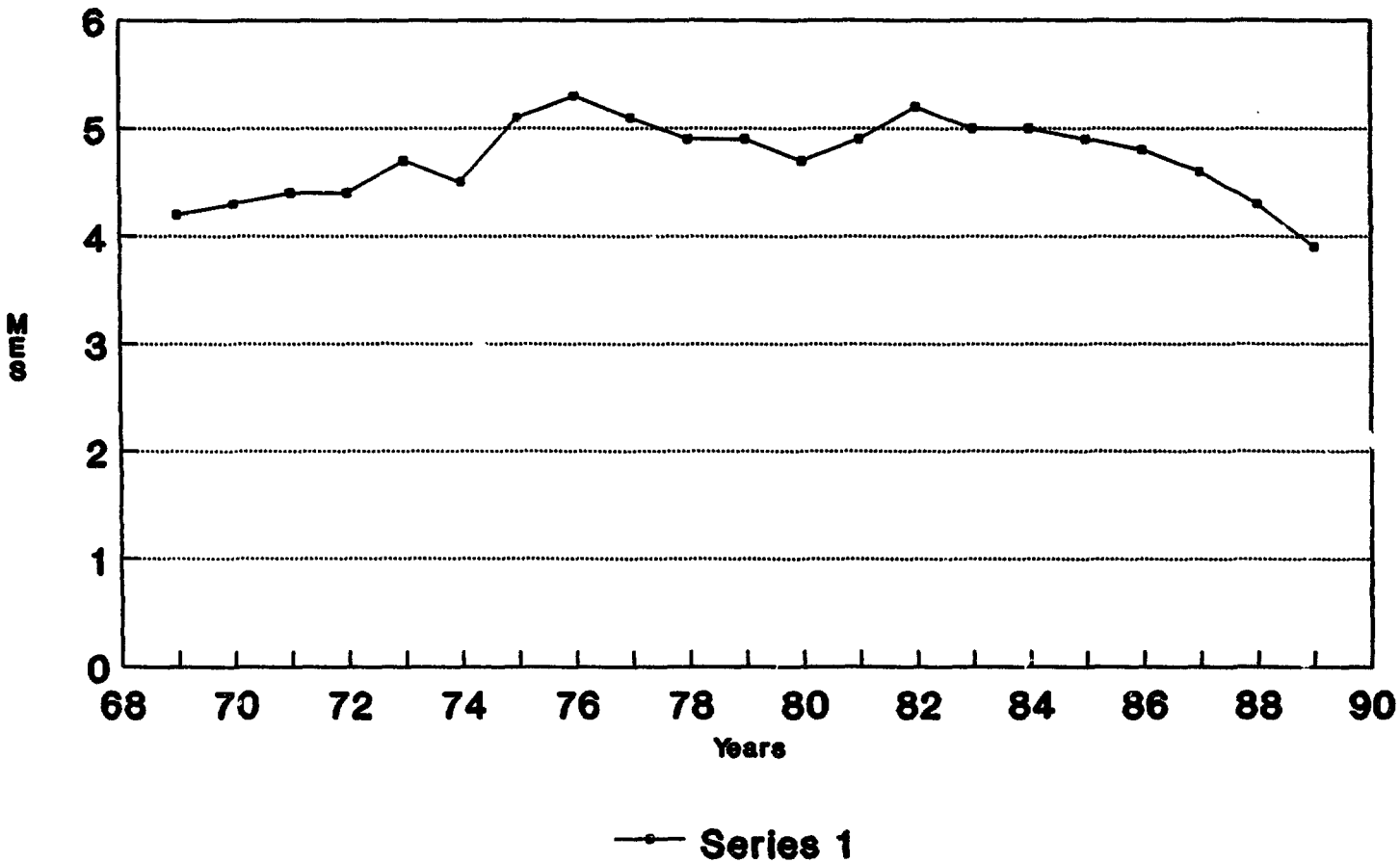
A key problem in analyzing military expenditures is obtaining reliable and accurate data on aggregate military spending. Data from the Stockholm International Peace Research Institute (SIPRI) are generally more comprehensive than those of the IMF's Government Financial Statistics (GFS) or the U.S. Arms Control and Disarmament Agency (ACDA). This paper uses military expenditure data from SIPRI, supplemented by data from ACDA for some earlier years.

Table 1 gives the mean levels of the military expenditure share (percentage) in GNP -- abbreviated MES hereafter -- for seven regions over the period 1969-89. In addition, it provides the mean for all 71 countries in the sample ("Full Sample") and the mean excluding the Middle East and North Africa ("Full Sample 2").[3] As can be seen from Table 1 and Figure 1, the full sample was at its lowest level in 1939 at 3.9 percent of GDP, much below the peak of 5.3 percent in 1976. In the sample excluding the high-spending Middle East and North Africa, military spending has varied very little on average over the years. In the Middle East and North Africa, spending in 1989 was far below their peak levels.[4] More important, from the standpoint of the relationship between military spending and growth, the two regions with the most serious growth problems -- Sub-Saharan Africa and Latin America -- have on average been the lowest spenders on the military. Overall, therefore, the figures show that the biggest

Figure 1

Patterns of Military Expenditure

Full Sample Figures



spenders are spending less and that the average is down from peak levels for the LDCs as a whole and in most regions. Consequently, this initial examination suggests neither a heavy "military burden" on the economy -- outside the Middle East and North Africa -- nor a growing military burden. There are of course regions (South Asia) and countries (Honduras) which are exceptions to these general trends in military expenditure.[5]

III. MILITARY SPENDING AND ECONOMIC GROWTH

There has been considerable research on the relationship between military expenditure ("milex" for short) and economic growth. Most of the work is empirical; attempts to resolve the issues theoretically have not been successful. The empirical studies work with a wide array of specifications, country and time period samples, and estimating methods. They also reach differing conclusions with regard to the impact of military spending on growth.

Annex A presents a brief survey of the existing literature. As further explained therein, the existing literature on military expenditure and economic growth is beset by several problems: (i) there are significant omitted variables in the analysis; (ii) regressors are not lagged; (iii) the studies often cover too short a time period; (iv) the regressors for military expenditure do not allow for non-linear relationships; (v) the regressors include factors influenced by the level of military expenditure; and (vi) military expenditure is treated as a cost which could not possibly be directly beneficial by providing security. Given the problems with the existing literature, we developed our own approach, making use of the results of the author's previous work on the determinants of economic growth (Landau 1986, 1990).

A. Hypothesis

Our hypothesis is that there are three types of effects of military expenditure on economic growth: (i) resource use; (ii) security; and (iii) policy efficiency. One, the resources used for military

expenditures are in general not available for investment; as a result, increased military spending will tend to diminish the growth rate.[6] Two, for any given level of foreign threat, the higher the military expenditure of a country, the more secure the country is. The increased security will tend to increase private investment and accelerate growth. Three, governments of countries under strong foreign threat need a tax base that can provide the tax revenue necessary to build strong armed forces. As a result, developing countries facing strong foreign threats will tend to modify their policies in directions which facilitate faster economic growth.[7]

The combination of the three effects of military spending is hypothesized to produce a quadratic relationship between the level of military spending and the growth rate. The initial impact of low levels of milex will be positive due to the security and policy efficiency effects. Beyond a certain level, the impact of military spending on growth will be negative as the resource use effect comes to dominate. Our measure of military expenditure is the military expenditure share (MES) in the national product. The hypothesis predicts that the coefficient for MES will be positive and that the coefficient for MES squared (MES2) will be negative.

The level of MES and the impact of milex on growth will both depend on the degree of threat a country faces. We measure this threat by the share of military expenditure of neighboring countries (NMES). NMES is the unweighted average of the military expenditure shares for all neighboring countries of over two million population.[8] There are two possible effects of the threat represented by NMES: (i) decreased investment and growth due to the threat to human and physical assets; and (ii) increased policy efficiency in response to the threat. The second effect is the same as that hypothesized for expenditure MES. Our priors were that the first effect would dominate and NMES would have a negative coefficient in the growth regressions.

B. Model Specification

We need to embed our hypothesis about the effects of milex on growth in a general model of the growth process. We can view the growth rate, Y, as a function of six basic economic determinants: labor (L); natural resources (N); physical capital (Kp); human capital (Kh); technology (T); and efficiency (E).

(1) $y = f(L, N, Kp, Kh, T, E)$

The correct functional form for this equation is not known. It would probably depend on the rates of growth of the six factors and also their levels. These six factors are, in any case, only the proximate economic determinants of growth. The real questions concern what determines the levels and rates of change of these six factors for each country in each time period.

We could model each of the six proximate determinants of growth as a function of various fundamental factors. For example, the growth rate of physical capital would depend on the factors which influence the expected return to investment: internal protection of property rights, political stability/instability, threats of civil and international war, the level and rate of growth of human capital, technology and its rate of change, international economic conditions. After we had written down the six functions for the six proximate determinants of growth, we would combine them with the function in equation (1) to come up with a reduced form equation for growth in terms of its fundamental determinants. However, knowledge of the determinants of growth is not sufficient even to specify the six functions for the proximate determinants of growth, let alone the reduced form. In addition, many of the variables have no quantitative measures -- for example, protection of property rights, government-caused market distortions, historical and cultural factors.

In order to test the central hypothesis of this study, the key regressors constituted MES, MES2 and NMES, as discussed above. In addition, those variables were selected as regressors that met the following criteria: (i) quantitative data were available; (ii) previous research has shown them to significantly influence the growth rate (either in the reduced form equation or as proxies for the proximate

determinants of growth); and (iii) they are exogenous with regard to the military expenditure regressors -- MES and MES2. Based on these criteria, the following regressors were chosen: the growth rate of the developed countries (GRW); the change in the terms of trade (CTOT); per capita product (PCP); the debt burden as a share of GDP (DEBTS); the average life expectancy at birth (LIFE); political condition variables -- instability (PI), civil war (CW) and international war (IW); and the share of fuel exports in national product (OILS).[9] The basic OLS regression equation is given below. (CW and IW were not statistically significant in the growth rate regressions.)

$$(2)\ y = b_0 + b_1MES + b_2MES2 + b_3NMES + b_4GRW + b_5CTOT + b_6PCP + b_7DEBTS + b_8LIFE + b_9PI + b_{10}OILS + error$$

Since we are interested in studying the impact of military expenditures on long-term growth, the dependent variable in the regressions must be the average growth rate over multi-year periods rather than single-year growth rates. The change in real product over one year, or even a few years, is a mix of the real long-run growth of the economy and cyclical changes in the level of production. Since we do not have an adequate measure of the cyclical effects for the majority of developing countries, the only way to get a dependent variable which is mainly real growth and to minimize the cyclical element is to use time periods as long as the data allow. Consequently, the dependent variable is the average annual growth rate over six- and seven-year periods of real GNP (in domestic currency at 1987 prices). This variable was used in two forms: the growth rate of total GNP (abbreviated "GRT"), and the growth rate of GNP minus military expenditure (abbreviated "GRNM").

In order to examine the long-term impact of the regressors rather than their current impact, the regressors were lagged.[10] If the regressors are not lagged, no matter how long a period is included in each observation, we are only looking at the average impact of the current level of 'X' on current GNP; we are not looking at the long-run effect of 'X'. But it is the long-run effects we are interested in: if military expenditure increases today, will future GNP be higher or lower? Lagging the regressors avoids

the problem of causality -- current milex could cause changes in the current growth rate or changes in the current growth rate could cause changes in the current level of milex. In this light, the most important regressors -- MES, MES2, NMES, etc. -- are the average of the three years immediately preceding the six- or seven-year period of the dependent variable.[11]

Since the dependent variable is the average growth over six to seven years and since the regressors are typically three-year lagged averages, the regressions using data for 1969-89 basically test the cross-section relationship between military expenditures and growth. There are 71 countries and at most two observations per country. Using multi-year growth rates as the dependent variable, it is difficult to test the time series relationship because the share of milex in GNP changes slowly. To test the effects of changes in MES on the growth rate, we also regressed differences in the growth rates between successive non-overlapping multi-year periods on differences in the regressors.[12] The sample was also broken down by geographic regions: Sub-Saharan Africa (SSA), Latin America, and all other regions (Asia, Middle East, North Africa and Southern Europe -- ASMENASE). Finer breakdowns would result in too few degrees of freedom in the regressions.[13]

C. Data

The data source for the economic, social, and human capital variables was the World Bank's World Tables. This data series provides annual data for the years 1969-89 and defines the time period for the study. As discussed earlier, the military expenditure data were from the SIPRI Yearbook, supplemented by USACDA data when necessary. The political condition variables were created by the author, and consist of dummy variables assessed annually for political instability, civil war, and international war. Further details about data sources and variable definitions are provided in the endnote.[14] The countries in the sample are non-Communist developing countries with a population of over 2 million for which there are data in the World Tables. It is important to note that some of the

countries involved in international wars -- e.g., Iran and Iraq -- have not provided data to the World Tables, and thus are not in the sample.

D. Results

The Relationship Between Milex and Economic Growth. The 'cross-section' regressions for the full sample of 71 countries show the predicted non-linear relationship between military spending and the growth rate, with a statistically significant positive coefficient for MES and a statistically significant negative coefficient for MES2. These results which constitute the basic regressions for the study are presented in Table 2. The results are similar for both the seven- and six-year growth periods and the two forms of the growth rate -- the growth rate of total GNP (GRT), and the growth rate of GNP excluding military expenditures. For the differences regressions that test the 'time-series' relationship between a change in MES and the change in the growth rate, the coefficients show the predicted non-linear relationship in three of the four cases (see Table 3). The numerical values of the coefficients for MES and MES2 predict that increases in milex are associated with faster growth up to 4 - 9 percent of GNP (depending on which regression one uses) and with slower growth thereafter. In view of the lack of robustness of any precise coefficient, no particular importance is attached to the implied point of maximal growth.

Other Regressors. The results for neighboring countries' military expenditures (NMES) are quite unexpected. The coefficients for NMES are positive and statistically significant for all the full sample regressions, the ASMENASE region, and in most of the regressions where regions and outliers are dropped. As discussed further below, this appears to be due to more efficient policies induced by countries facing external threats. In the regressions for the SSA and Latin America regions, NMES is not statistically significant. The results for the other regressors are discussed in the endnote.[15]

Sensitivity Analysis. The results for the full sample support the hypothesis of a non-linear relationship between milex and growth. However, the question arises whether these results are sensitive

to changes in the specification (e.g., inclusion/exclusion of other regressors) and the sample of countries in the data set.

Changing the Specification. Further analysis showed that the results for the full sample of 71 countries are not sensitive to the inclusion or exclusion of other explanatory variables besides MES, MES2, and NMES. Specifically, cross section seven-year growth rate regressions with GRT as the dependent variable were repeated removing successively NMES, PI, DEBT, OILS and CTOT, PCP and GRW. The predicted quadratic relationship remains as the other regressors are removed. The predicted relationship also generally holds for the differences regressions when the only regressors are the changes in MES and MES2.[16] The results are also not sensitive to the addition of other explanatory variables, such as investment, central government expenditure, education, and components of the balance of payments.

Robustness. While the full sample results are not sensitive to the inclusion/exclusion of other regressors in the regression equation, the results are sensitive to changes in the countries in the sample. In particular, the results by the three geographic regions outlined earlier (Latin America, Sub-Saharan Africa and Asia/Middle East/North Africa/Southern Europe - ASMENASE) are mixed. Table 4 presents summary statistics for regression equations for each of the three geographic regions. For the ASMENASE region (Panel A, Table 4), we find the statistically significant quadratic relationship in all cases (regressions 2 and 4). However, Latin America (Panel B, Table 4) shows no statistically significant relationship between MES and the growth rate. Sub-Saharan Africa does not have the quadratic relationship and shows a weak tendency towards a simple linear positive relationship between MES and the growth rate for the six-year growth periods (regressions 1 and 3).

This suggests that the full sample results are being driven by the ASMENASE region. In Table 5, the regions are successively dropped from the sample. The results show that a significant, non-linear quadratic relationship holds when Sub-Saharan Africa or Latin America are dropped from the full sample

(regressions 4 and 5). However, when the entire ASMENASE region is dropped, the coefficients for MES and MES2 become totally insignificant (regression 6). When either the Asia or the rest of the ASMENASE region is dropped, the non-linear relationship exists but one of the coefficients is no longer significant at the 10 percent level.

Based on the above, it would appear that the non-linear relationship between milex and growth holds because of the ASMENASE countries. Without them, there is no statistically significant relationship. The ASMENASE region is generally one of higher military spending and more rapid growth, while Latin America and SSA are, in general, regions of slower growth and lower military spending.

This conclusion can be interpreted in two ways: the non-linear relationship only holds for the ASMENASE region, or the results from these countries are the important ones. The second interpretation would be based on the following arguments. The 24 countries for ASMENASE constitute more than one-third of all the observations, and contain the majority of the population in the total sample. The view that Eurasia/North Africa is the real test of the hypothesis is strengthened if one considers some particular features of Latin America and Sub-Saharan Africa. Latin American countries do not, by and large, face significant threats from one another, and protection has effectively been provided by the United States. As a result, it can be conjectured that levels of military spending are generally too low to exhibit a quadratic relationship. In Sub-Saharan Africa, in countries not in an actual war, we observe relatively low levels of MES due to the combination of low per capita product and small size (see Hewitt, 1991b). Thus SSA is at the left end of the inverted U relationship, and exhibits some tendency towards a simple positive relationship between milex and growth rather than a quadratic one.[17] By this reasoning, SSA and Latin America do not reject the hypothesis; they simply do not test it adequately.

Robustness vis-a-vis Outliers. We further tested the sensitivity of the results by looking at the impact of outliers. The extreme -- highest and lowest -- observations by growth rates (GRT), per capita

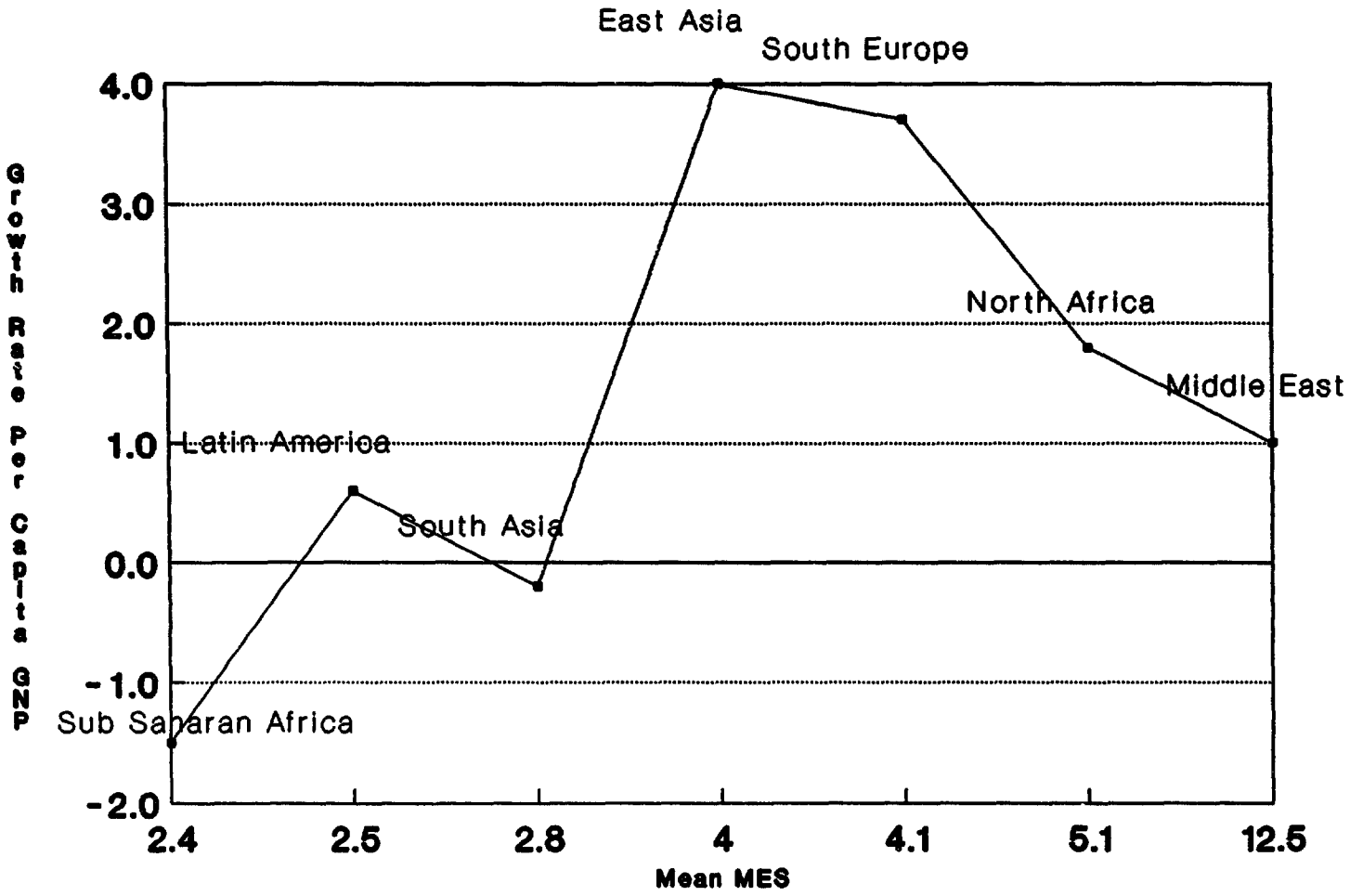
product (PCP), neighbor's military expenditure (NMES), and own military expenditure (MES) were dropped and regressions run without these observations. When the two top and bottom outliers by GRT or MES are dropped, the same non-linear relationship as the full sample holds, with only small reductions in significance levels for some of the regressions. Dropping the 10 highest and lowest outliers by per capita product and NMES also does not change the non-linear relationship. However, if we drop the 10 outliers by growth rates and MES, the hypothesized relationship does not always hold. In sum, dropping individual outlier observations leads to a conclusion similar to dropping regions. A few extreme outlier observations are not producing the full sample results, but a subset of observations are.

Additional, but less rigorous, information is provided by Figure 2 on the next page. It plots the mean MES against the annual growth rate of per capita GNP from 1970-89 for seven regions: South Europe, North Africa, Middle East (minus Saudi Arabia), South Asia, East Asia, Sub-Saharan Africa and Latin America. The plot shows a non-linear relationship with the growth rate by regions increasing with MES up to roughly 4 percent and then decreasing.

In sum, for the full sample of 71 countries, we find a significant, non-linear relationship between milex and the growth rate. The coefficients of MES and MES2 indicate that the change from a positive to a negative relationship between growth and MES comes when MES is between 4% and 9% of GNP, depending on which regression one uses. However, this result is being driven by the 24 countries in the sample from Asia, the Middle East, North Africa and Southern Europe, and the specific coefficients are not robust. When the regressions are run without these countries, there is no significant relationship -- positive or negative -- between MES and the growth rate. The only general conclusion from the growth regressions is that there is no evidence of a negative relationship between milex and growth in peacetime until the military expenditure share is quite high.

Figure 2

Annual Growth Rate of
Per Capita GNP against Mean MES 1970-89



E. Military Expenditures and Growth: Channels of Impact

In order to study the channels through which military expenditures affect growth, we add investment, education, and other key variables to the growth regressions. The test of whether a variable -- e.g., education -- is an important channel of impact involves three elements: (1) causality can be assumed to run from milex to the variable, not the reverse; (2) there is a significant (partial) correlation between the variable and the growth rate; and (3) there is a significant (partial) correlation between milex and the variable. The causality issue must be determined independently of the growth regressions. The relation between the proposed channel of impact and the growth rate is tested by the significance of its coefficient when it is added to the growth regressions. The correlation between the proposed channel of impact and milex is tested by the change in the absolute value and significance of the milex coefficient when the "channel of impact" variable is added to the growth regressions. If there is a major change in the absolute value of the milex coefficient (and especially if the significance of the milex coefficient also changes), and the other two conditions are met, then the variable is indeed a major channel of impact of milex on growth.

In Table 6, six economic variables are added to the growth regressions, first, one at a time and then four variables together. The variables (all shares in GNP except for ED) are: the investment share in GNP - IS; the share of central government expenditure - CGES; the weighted sum of enrollment rates at the secondary and primary levels (see Landau 1986) - ED; the balance of trade - BT; official transfers received (net) - TRANS; and the "overall balance" - OB - which is the sum of the balance of trade, official transfers, and net long-term capital movements. In none of the regressions -- 2 to 9 -- do we see a material change in the coefficients for MES and MES2 from those in regression 1. These results suggest that none of these variables is an important channel of impact of milex on growth.

Our basic hypothesis is that milex should impact growth through resource use, increased security, and increased efficiency of government policies. The results in Table 6 do not support the resource use or increased security explanation, though it is possible the two are canceling each other out. The results of testing the efficiency hypothesis are in Table 7.

We do not have a direct measure of efficiency. However, we can use the ratio of output increase to investment in physical capital as a proxy measure. We measure the ratio of output increase to investment by IOCR -- 'incremental output capital ratio'. The numerator in IOCR is the mean annual increase in real GNP over the 7 years of the growth rate. The denominator is mean annual real investment over the 3 years of the lagged regressors. The higher the ratio of output increase to investment in physical capital, ceteris paribus, the greater the efficiency.

In Panel A of Table 7, we use the full set of regressors, and in Panel B, only MES, MES2, and NMES. Regression 1 in Panel A is the base regression for comparison; in regression 2, IOCR is added to the base regression. The coefficient for IOCR is highly significant and the coefficients for MES and MES2 decrease markedly in absolute value, but their significance does not change. The same test is done in regressions 1 and 2 of Panel B. Here, when IOCR is added in regression 2, not only do the coefficients of MES and MES2 change, they also become statistically insignificant.

These results suggest that an important channel of impact of milex on growth is increased efficiency. This is consistent with our hypothesis that governments which feel threatened tend to increase the efficiency of their economic policies to build the tax base to finance a larger armed forces.

Table 7 also tests whether the positive impact of NMES on the growth rate is due to greater efficiency -- in response to the threat. This is tested in regressions 1 and 2 of Panel A and regressions 4 and 5 of Panel B. In both cases, when IOCR is added to the regression, the absolute value and the significance of the NMES coefficient decrease markedly.[18]

To summarize our results on the channels of the growth impact of milex, we find empirical evidence that increased milex is associated with greater efficiency in the developing countries. We do not find significant impact of milex through the levels of investment, education or the balance of payments.

IV. OTHER ECONOMIC IMPACTS OF MILITARY EXPENDITURES

Military expenditure is thought to hurt economic variables beyond growth. One frequent concern is that increased milex crowds out government social and infrastructure spending. Other economic variables believed to be negatively affected by military spending are the inflation rate, investment, and the balance of payments. The paper also analyzes the impact of military expenditures on these variables.

A. Impact on Government Social and Infrastructure Spending.

Resources used for the military cannot be used for education, health or infrastructure. Accordingly, it would appear that milex must have an opportunity cost of less spending on these three categories which both contribute to growth and poverty alleviation.[19] Data from the IMF's Government Financial Statistics were used to test this hypothesis.[20]

The results are shown in Table 8, and are of two types: (i) the government expenditure shares in GDP regressed on the share of milex in GDP; and (ii) government expenditure category shares in total (central) government expenditure regressed on the share of milex in GDP. The share of expenditure categories in GDP more clearly indicates the impact of milex on the overall level of funding for other public services.

The most important result (regression 1, Table 8) is the positive relationship between the share of central government expenditure in GDP and the share of milex in GDP. The coefficients are statistically significant and numerically large. The coefficients imply that an increase in milex is

accommodated by an increase in total government expenditure -- a 1 percent increase in the milex GDP share would be associated with a 2 percent increase in the government expenditure share in GDP.

Table 8 also shows that the coefficients for the impact of milex on the GDP share of education, health, combined education and health, and infrastructure are all positive, except for the three-year health share. However, only the regression of the education share shows a statistically significant and numerically important coefficient, and that only for the three-year period. Thus, for the full sample, increased military expenditures as a share of GDP does not cause major changes in the shares of education, health or infrastructure expenditure in GDP. Separate regressions were also run for Latin America and Sub-Saharan Africa only. While the results for total government expenditure and for health expenditure were similar to those for the full sample, the coefficients for education and infrastructure were positive and statistically significant.[21] For the sub-sample of Latin America and Sub-Saharan Africa, therefore, increased military spending is associated with increased government expenditure (as a percent of GDP) on both education and infrastructure.

When the dependent variables are the shares of the various expenditure categories (e.g., education, health) in total government expenditures, all coefficients but one are negative, statistically significant and numerically important. When milex is increased, its share in total government expenditure increases and the shares of other types of expenditures are reduced.

In sum, increased milex does not reduce expenditure on education, health, and infrastructure as shares of GDP in developing countries in general. For Latin America and Sub-Saharan Africa alone, it actually increases government spending on education and infrastructure. When milex increases, the shares of these three categories in government expenditure fall, but total government expenditure expands sufficiently to keep their shares in GDP from falling. Again, as with economic growth, there is no evidence of a general negative impact from military spending in the developing countries.

B. Impact on Other Economic Variables.

The impact of milex on other key economic variables was also tested. Inflation, investment, education, and other key variables were regressed on MES and the other regressors used in the growth equations. No claim is made that this is the correct specification of the determinants of these variables. Rather, we are merely looking at the impact of MES on them, holding constant the other factors included in the growth regressions. These same regressions were also run using MES and MES2; in the regressions which included MES2, none of the coefficients for either MES or MES2 as statistically significant. Therefore, these regressions are not discussed here.

Table 9 shows the regression results, and the findings are summarized below:

- Inflation. Military expenditure - as measured by MES - does not have a statistically significant impact on the inflation rate (INF).

- Education. The weighted sum of enrollment rates at the primary and secondary level (ED) was used as an 'output' measure of education (see Landau 1986) as contrasted to the 'input' measure of government expenditure (see above). The coefficient for MES in the equation for ED is insignificant.

- Investment. The coefficient for MES in the equation for the share of investment in GNP (IS) is negative, but statistically insignificant. This suggests any impact of increased military expenditure on the overall level of investment is weak.

- Balance of Trade. In the equation for the balance of trade as a share of GNP (BT), the coefficient for MES is negative but not quite significant. An increase in the milex share in GNP may worsen the balance of trade.

- Official Transfers. The equation for net official transfers in GNP (TRANS), shows that increased military expenditure is associated with increased receipt of transfers.

- Overall Balance. The final variable was a proxy for the 'over all balance' on current and capital accounts. It is the sum of the balance of trade, official transfers, and net long term capital flows as a share of GNP. The coefficient for MES is negative but statistically insignificant.

To summarize, with inflation, investment, education, and the balance of payments, as with growth and government social spending, there is no evidence of a strong negative impact from military spending in the developing countries.

V. DETERMINANTS OF MILITARY EXPENDITURE

The desirability of reducing military spending depends not only on its economic effect but also on what motivates military spending. Understanding the motivation also helps shed light on the feasibility, scope and limits of reducing military spending. We cannot study the motivations for military expenditure directly. However, we can study what empirically measurable factors appear to influence the level of spending. The most comprehensive work on the determinants of military spending is by Hewitt (1991a, 1991b). In this paper, we introduce some additional variables (e.g., NMES, political instability) which provide new and significant results.

Table 10 presents the results of our regressions of the share of military spending in GNP (MES) on key determinants. The variables in the regressions are three- and five-year averages. Our priors were that neighbor's military spending (NMES), political instability (PI), civil war (CW), and international war would increase military spending, as would transfers (TRANS).[22]

As seen from Table 10, the most important determinant of MES is NMES. The coefficient is positive, highly significant and numerically important. Specifically, a 1 percent increase in the average of NMES is associated with roughly a 0.5 percent increase in MES. The relationship between NMES and MES is presumably threat response, with a high level of military expenditure by one's neighbors being either a direct threat or a response to a threat by a large, more distant country. In either case, the increase in the given country's MES in response to a higher NMES could be quite rational.

Among other variables,[23] transfers unexpectedly have no significant impact.[24] International wars, of course, increase the ratio of milex to GNP. The IW regressor is a dummy variable. For the five-year averages, the coefficients predict that the existence of a war increases MES by around 3 percent of GNP. The military expenditure share is also an increasing function of per capita product.[25] One definitely surprising result is that MES is significantly negatively related to political instability (PI). This result could be explained by the observation that large military expenditures are for sophisticated

weapons, which are used for international war rather than internal instability or for controlling dissatisfied civilians.[26]

Overall, the results suggest that a major determinant of levels of military spending is external threats as measured by NMES. These results suggest that for individual countries, military spending is rationally motivated by foreign threats. Such a conclusion is what an economist should expect, given that economics is built on the assumption that people are rational with regard to their expenditures. However, much of the literature assumes military expenditure in the developing countries is not rationally motivated. The threat response nature of military expenditure also implies that while a country can lower its military expenditures ifits neighbors do so as well, regional conciliation and disarmament might be important preconditions for reductions in military spending.

VI. CONCLUSIONS

The purpose of our research was to analyze the economic impact of military expenditures. This entailed reviewing trends in military spending across regions and over time, analyzing the impact of military expenditures on economic growth as well as the channels through which this impact takes place, identifying the impact of military expenditures on other key economic variables, and analyzing the determinants of military spending. The key conclusions are summarized below.

- Levels of Military Spending. The share of military spending in GNP has been generally falling, including in the high spending areas of the Middle East and North Africa. The regions with the most serious economic problems -- Sub-Saharan Africa and Latin America -- spend relatively low shares of GNP on the military.

- The Impact of Military Expenditures on Economic Growth. For the full sample of 71 countries, our hypothesis of a quadratic milex-growth relationship was supported. As

military spending increases, the growth rate at first increases and then decreases. However, this result was being driven by 24 countries in the Eurasia/North Africa region accounting for a third of our observations; these countries have relatively high milex and high growth. When these regions are dropped from the sample, we find no relationship -- positive or negative -- between milex and growth. From these results, we conclude that there is no evidence of a negative relationship between the level of military spending and the growth rate, but it is uncertain if in general there is a non-linear relationship with growth initially increasing and then decreasing as milex increases.

- Channels of Impact of Milex on Economic Growth. We found empirical evidence that increased milex is associated with greater efficiency in the developing countries. The particular channel appears to be external threat (as measured by neighbor's military expenditures) which induces increased military expenditures and also greater efficiency to produce a stronger economy which can support the required spending. We do not find significant impact of milex through the levels of investment, education, or the balance of payments.

- Other Economic Impacts of Milex. Total government spending as a share of GNP increases with MES. As a result, with an increase in milex, the GNP shares of education, health and infrastructure spending do not decrease even though their shares in total government spending decrease. Consequently, as with economic growth, there is no evidence of a negative impact of milex on government social and infrastructure spending. There is no strong or consistent impact of increased milex on other key economic variables; however, there is some evidence of a weak negative impact of milex

on investment and the balance of payments while there is no statistically significant evidence of impact on education or the inflation rate.

- Determinants of Military Spending. The most statistically significant and numerically important determinant of military spending is neighbor's military spending. Neighboring country's military spending represents either a direct threat to any country or a response to a larger, more distant threat. In general, this implies: 1) that military spending by individual countries is rationally motivated; 2) that regional conciliation and disarmament may be more important in determining the feasibility of unilateral reductions in military spending. Other significant determinants of military spending were per capita income and international wars.

The concern about military spending in the developing countries starts from the hypotheses that: 1) there is high and rising burden of military expenditure on the developing countries; 2) such spending is not rationally motivated; 3) the developing country military spending has a negative impact on growth, government social spending, and other key economic variables. We find that all three of these assumptions are inconsistent with the data. Developing-country military spending is: moderate and falling, apparently motivated by external threats, and at typical current levels (about 4%), is not associated with lower rates of economic growth, government social and infrastructure spending, or other economic variables.

As with all studies of the determinants of growth, this study is constrained to work from an incomplete theoretical basis, using proxies for some explanatory factors and using imperfect data. In addition, these particular findings apply to peacetime military spending in the developing countries and are based on the years studied. War is an economic as well as human disaster. With the changes in the

world in the 1990s, the relationship between developing countries' military spending and their economies could also change.

Endnotes

1. In a paper presented at the World Bank Annual Conference on Development Economics, Robert McNamara endorsed a proposal made by the Independent Group on Financial Flows to Developing Countries (chaired by Helmut Schmidt) that "when decisions concerning allocations of foreign aid are made, special consideration be given to countries spending less than 2 percent of their GNP in the security sector." Dennis Healey, the former British defense secretary, was quoted in the Financial Times (July 12, 1991) as advocating G7 nations to link aid to developing countries to cuts in defense expenditures.

2. World Bank, "Military Expenditures." Report No. SecM91-1563 (December 1991). Washington, D. C.

3. The regional (and full sample) means are unweighted averages of the country MESs. There do not appear to be any unambiguously superior weighing mechanisms; consequently, only unweighted averages have been presented.

4. However, it is important to note that Iraq and Iran are not in the sample.

5. In 1988, Saudi Arabia was spending 19.8 percent of GNP on the military compared with 8.4 percent in 1969. Honduras experienced a very rapid increase in MES from 2.8 percent in 1982 to 8.4 percent in 1989. Zimbabwe was spending 7.9 percent of GNP on the military in 1989 compared to 3.2 percent by Southern Rhodesia in 1969. However, these are the exceptions. The more typical trend is of a reduction in military expenditures over time. Egypt, which had reached 36.5 percent of GNP in 1974 was down to 4.5 percent in 1989. Israel was down from 34 percent of GNP in 1973 and 25 percent in 1981 to 9.2 percent in 1989.

6. Some researchers of the relationship between military spending and economic growth attribute significant creation of human capital to the armed services. There are problems with this hypothesis. First, looking at the numbers in the armed forces in most developing countries, it is implausible that the human capital created during military service would significantly change the growth of the civilian economy. It must also be remembered that significant numbers of the more highly trained soldiers are career soldiers whose training does not aid the civilian economy.

7. If threatened governments modify their policies in ways which promote growth, what pattern of policy change would we expect to see in seriously threatened countries? The necessary policy approach to encourage rapid growth is quite well spelled out in the World Development Report (1991) in terms of aiding the efficiency of markets, rather than replacing them, and flexible pragmatic policies.

Historically, we find evidence that at key points in their modernization, and under conditions of serious external threats, Japan and the countries of Western and Central Europe made these changes in their policies. The political scientist Pempel (1982) describes the policies which Japan used to became a developed country before World War Two:

> "When Japan was forced to open to Western commerce in 1854, it had to overcome a 250 year history of centralized feudalism.... The Meiji reformers realized that a strong state apparatus, parallel to that of Prussia, was essential if Japan was to develop the "rich country

> and strong army" designed to preserve national autonomy from the threat of Western imperialism...(emphasis added, p. 12).
>
> Where the prewar Japanese state was most different from totalitarian states was in its toleration, even actual encouragement, of the private sphere. State institutions, while powerful, were not comprehensive in their activities.... Unlike Sweden, however, Japan did not develop a widespread public system of social services. Although the government supported a public system of ... education, private systems developed parallel and in competition with the state.(p. 14).
>
> Private initiative rather than government direction; selective government intervention or direction rather than constant presence; and a small and efficient government rather than a lumbering bureaucratic monstrosity tended to characterize Japanese politics (emphasis added, p. 21)."

Imperial Japan consciously followed the pattern of helping rather than fighting the market in order to build a strong economy as the basis for a strong army which it believed was needed for defense.

Eric Jones (1987) describes how Europe got the market economy first in his book The European Miracle,. He wrote:

> Rulers, whose schemes for glory drove them to prepare for war, began to do so by actively improving the economic base. In addition there were clients for modernization among the 'middle' and merchant classes. What they prayed for was more public order and fewer obstructions to business, ranging from the abolition of legal and customary restrictions on factor mobility to the removal of nuisances like narrow town gates and constricting walls. They desired the enforcement at law of freely negotiated contracts, the improvement of communications, and all measures to unify the market. The wishes of the ruler and of rising group in society were thus in many ways confluent. Internal barriers to trade began to be removed, both institutional and physical ones (p. 135).

Thus like Japan in the first half of the 20th century, or Taiwan, South Korea, and Thailand since World War Two, the rulers of modernizing Europe were forced to facilitate the efficient working of a market economy to build the tax base for their armies.

The explanation for any positive association between military spending and economic growth is not specific policies. Rather it is the pattern of policies - spending, regulatory, etc. - which aided the growth of the market economy rather than hindering it (as is typical in so many LDCs). When the governments of LDCs have felt the need to spend large sums on the armed forces they typically - but not in every case - also have felt the need to facilitate the smoother functioning of the market economy (in order to build a tax base which could finance the military spending). Military spending does not in itself contribute to faster growth; rather, the policy changes made along with the increased military spending accelerate economy growth. Such positive policy changes can offset only so much resource use by the armed forces, therefore, beyond a certain percentage of GNP, the impact of increased military spending turns negative.

8. The best way to measure the threat from neighbors' military expenditure seems to be NMES, the average of their MES's. There is also some evidence that countries respond to threats in terms of shares of GNP spent rather than dollar values (McKinlay, 1989, Third World Military Expenditure). One could find rationales for this response pattern in terms of smaller countries indicating a willingness to fight and thus inflict costs on a larger country, but they are unable to match expenditures in dollar terms. Furthermore, if the smaller country is not technologically superior, and thus unable to substitute quality of arms for quantity of armed men, diminishing returns may set in fairly soon if the smaller country tried to substitute capital for labor. Whatever theoretical qualms one might have about NMES, it works very well both in the growth regressions and in the regressions of the determinants of MES, Table 10. In contrast to the success of NMES, if we measure the foreign threat as the ratio of foreign military expenditure to home country GNP, the variable is insignificant. The sample is 71 non-Communist LDCs with over two million population for which the 1990/91 World Tables (World Bank) has data. China was also tried as an addition to the sample set of 71 countries, but this changed nothing. Some of the neighbors of countries in the sample are over two million population, but are not in the sample either because they are not LDCs, they were communist, or the World Tables do not have data for them - Iran and Iraq for example. The source for MES - SIPRI Yearbook of World Armaments and Disarmament - had data on most of these countries so they could be included in the calculation of average neighbor's MES - NMES. A secondary source - U.S. Arms Control & Disarmament Agency, World Military Expenditures and Arms Transfers allowed filling in a few more.

9. The exogenous and predetermined variables included in the regressions were chosen because they could be expected to influence the growth rate significantly and they are available. The expectation that they would significantly influence the growth rate comes from general theoretical considerations and the literature on growth, especially the author's previous work on the empirical determinants of growth (Landau 1986, 1990). The growth rate of the developed - OECD - countries (GRW) could influence the growth rate of the LDCs in terms of the export opportunities and perhaps also the amount of foreign investment. The change in the terms of trade (CTOT) would influence the returns to an LDC from any given level of exports. The share of oil exports in GNP (OILS) was included because many workers in the field believe major oil exporters can increase MES without a negative impact on growth (Looney).

Per capita product (PCP) is included because of the results in the author's previous work. Allowing for the level of investment in human capital, there is a strong negative relationship between the level of per capita product and the growth rate. There is of course an enormous literature suggesting that debt burdens will slow economic growth both due to the direct impact of the debt service payments and the indirect threat of inflationary or other disruptive government policies if the burden becomes economically or politically unsustainable. Thus the literature predicts a strong negative relationship between the ratio of debt to GNP (DEBTS) and the growth rate. Life expectancy at birth (LIFE) is a proxy for the general level of investment in human capital.

GRW and CTOT are not hypothesized to be basic determinants of long run growth, rather they serve to remove some of the transitory effects on realized levels of production of external conditions. For this reason, they are mean values over the same years as the dependant variable, not lagged.

As indicated above, some of the limited number of regressor we have are proxies for the arguments in equation 1. OILS - the share oil exports in GNP - is a proxy for natural resources. We tried the population growth rate, which is a proxy for the growth of the labor force, but it was insignificant. LIFE - life expectancy - is a proxy for the general level of investment in human capital. It is better proxy than education measures. The two most important forms of investment in human

capital - health and education - are highly correlated, so there is a need to choose one or the other (see Table 7, Panel B). Current levels of investment in education - like enrollment rates - could be influenced by the current level of MES, where as LIFE would not be influenced by current MES.

The other regressors used would be in the reduced form equation influencing a number of the proximate determinants of growth. PCP - per capita product - may influence the rate of technological change. Lower per capita product countries face a larger "shelf" of borrowable technologies than higher per capita product countries, provided they make the necessary investments in human capital. DEBTS - the ratio of debt to national product - will influence investment levels, and probably also efficiency - investors would tend to choose more inflation safe assets as debt levels rise. We would expect the political variables - MES, NMES, PI, CW, & IW - to have an impact on a number of the proximate determinants of growth. The military expenditure regressors have already been discussed. Political instability, civil wars, and international wars would influence investment, efficiency, technological change, etc. The political instability dummy - PI - is the only one of the 3 political conditions variables which turned out to be statistically significant in the growth regressions.

Other possible regressors, besides those mentioned, were seen as potentially endogenous and thus including them in the basic estimate of the MES impact would produce biased estimates. For example, if an increase in military expenditure results in a decrease in the level of investment, then including investment in the basic regressions would bias our coefficient of MES upward. The reader should keep in mind that our purpose here is not to 'explain' economic growth, but rather to estimate the impact of military expenditure on economic growth. We are intentionally omitting from the basic regressions factors which would be influenced either directly by the level of MES, or indirectly by the policy changes induced by the threat which produced a higher level of MES.

10. A secondary benefit of lagged regressors is that it avoids contemporary correlation between the explanatory variables and the residual which would necessitate a simultaneous equation system. The appropriate variables for a simultaneous equation system are far from clear theoretically. In addition, the data to estimate a good simultaneous system for the relationship between military spending and economic growth in the LDCs is simply not available.

11. The regressions were also run for shorter growth periods - 5 & 4 years - and different starting and ending years within the 1969-89 period. These results generally are consistent with those presented in this report, however, as expected, the hypothesis fits longer growth periods better than shorter ones. These other results are available from the author.

12. Thus for 7 year growth rates, the difference in growth rates is the difference between the growth rate from year 't' to year 't+6' and the growth rate from year 't-7' to year 't-1'. For the lagged regressors, their differences would be the difference between their mean for years 't-3' to 't-1' and their mean for the years 't-10' to 't-8'.

13. One reviewer of an earlier version of the paper raised the question, why didn't we use a fixed effects - country dummy model? Since most of the variation in growth and milex is cross sectional, using country intercepts almost guarantees a finding of minor - or no - effects for milex irrespective of the true relationship. Country dummies will capture the effects of cross

section differences in milex along with most other cross section differences.

14. The assessment to define the political conditions variables was done by the author using the capsule political summaries for the post World War Two period in The Europe Year Book 1990 (two volumes). These summaries run 5 - 10 normal sized pages per country. Occasionally The Political Handbook of the World (1989) was used as a supplemental source. The following definitions were used. A time period for country 'X' was considered one of political instability if there were coupes, attempted coupes, violent riots - dozens or more killed, significant guerilla warfare, or major terrorist incidents 5 years or less apart. The situation was defined as one of civil war if regular internal armies fought, there was major guerilla warfare, or the suppression of dissent killed thousands of people - e.g. the peak of the "Dirty War" in Argentina. The situation was defined as international war if the country fought engagements - with significant casualties - with foreign country military forces. For the civil war and international war dummies, the situation was defined to exist only for the years hostilities were active. The years of civil war and international war were relatively few, but political instability, as here defined, existed for some (or all) years for the majority of the countries in the sample.

The regressors formed from the political dummy variables were also the average of 3 annual lagged values. The author had to produce his own political conditions measures because there are no suitable published indexes. Internal World Bank data on Central Government Expenditure - CGE - for the years 1972-88 - was also used. This CGE series was extended back to 1969 using the USACDA data. Where the above sources had missing values, that usually means an observation on that variable is missing. There are two exceptions to that rule. First, for the lagged regressors, they are the mean of available years, so that if one year of the three is missing, the value is the mean of two years. Second, the human capital series - enrollments, etc. - are generally not collected for every year and they would not normally jump around between collection dates. These series were interpolated, but not extrapolated. No other series were either interpolated or extrapolated.

15. The coefficients for PCP - per capita product - have the predicted negative sign and they are significant for the cross section regressions both on the full sample and the regions (full regional regression results are available from the author). In the differences regressions, DPCP has the predicted sign and is usually statistically significant, but the significance levels are lower than the cross section regressions (compare Tables 2 and 3). The negative and significant coefficients are consistent with the findings in Landau (1986) that, holding constant human capital, their is a 'catch up' effect among the LDCs. That is lower per capita countries would tend to grow faster if they invest sufficiently in human capital. The most plausible explanation for the 'catch up effect' is that the available 'shelf' of borrowable technologies is larger for lower per capita income countries.

The human capital regressor is the life expectancy - LIFE. LIFE has positive and highly significant coefficients in virtually all the regressions. The ratio of official debt to GNP - DEBTS - has the expected negative coefficient and is highly significant in most regressions. The results for the change in terms of trade - CTOT, the share of oils exports in GNP - OILS, and the growth rate of the OECD countries - GRW - are mixed. Sometimes the coefficients have the expected signs and they are significant, and sometimes the coefficients are insignificant or the 'wrong' sign.

16. For the differences regressions with only DMES and DMES2 as explanatory variables, the predicted quadratic holds with DGRT as the dependent variable and there is a simple positive linear relationship with DGRNM as the dependent variable. These regressions are not in the Tables with this report, they are available from the author.

17. If we look at shorter growth periods of five and four years for SSA, the simple positive linear relationship is statistically significant.

18. In regressions 3 and 6 of Table 7, IS, the share of investment in GNP is added to the regressions which already include IOCR. In these regressions, IS is statistically significant, whereas, in regression 2 of Table 6, without IOCR in the regression , is not statistically significant. This result underscores the importance of efficiency of investment.

19. Developing country armed forces do spend funds on education and health care for the troops as well as on some infrastructure. However, these expenditures are not the bulk of military spending.

20. While the data includes almost all the 71 countries already used to test the milex-growth relationship, over half of the potential observations during the 1970-90 period are missing. Still, there are up to 191 three-year observations and 119 five-year observations, and regressions were run using three- and five-year averages of the expenditure data.

21. Detailed regression results are available from the author.

22. The major regressors tested (besides population - POP) are per capita product (PCP), neighbor's average military expenditure share (NMES), the dummies for political instability (PI, CW and IW), and the share of official transfers received in national product (TRANS). The civil war regressor was dropped because it proved insignificant. PCP tests whether richer countries are willing to spend a higher share of GNP on the military.

23. Without India (and China), population is not a statistically significant determinant of MES for the multi-year periods. Regressions were also run with annual observations, though these are not reported in the table. For the annual observations, population and population squared influence MES; these are scale effects, but the coefficients are reversed with and without India. The annual regressions were run including and excluding India. India changes the effects of population on MES, but does not change other coefficients materially. Since India is obviously a population outlier, the multi-year period regressions reported here exclude India.

24. However, with annual observations, TRANS has positive and statistically significant coefficients.

25. In these regressions, PCP is measured in thousands of 1987 U.S. dollars. In some of the other tables and regressions, PCP is in 1987 U.S. dollars.

26. Janowitz (1977) noted that the developing countries experienced much greater increases in para-military forces (militia, political police, etc.) from 1966 to 1974/75 than in active duty regular forces. He also discusses the preference among military governments to use para-military forces rather than the regular army for internal control.

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Variable List

Symbol	Definition
BT	Balance of Trade as share of GNP
CGES	Share of central gov. exp. in GNP
CTOT	annual % change terms of trade, same years as GRT
DEBTS	foreign debt as share GNP
ED	Weighted sum of enrollment rates
GRT	annual growth rate total GNP
GRNM	annual growth rate GNP excluding military expenditure
GRW	annual growth rate OECD countries, same years as GRT
INF	inflation rate
IOCR	Incremental Output Capital Ratio
IS	Share of investment in GNP
IW	dummy active war that year
LIFE	life expectancy at birth in years
MES	military expenditure as share GNP
MES2	MES squared
NMES	mean MES neighboring countries
OB	Sum balance trade, capital account balance & transfers as share of GNP
OILS	oils exports as share of GNP percent
PCP	Per Capita Product in 1987 U.S. $
PI	dummy variable for political instability
POP	population
TRANS	Official Transfers Received as Share of GNP

TABLE 1
Patterns of Military Expenditure

Year	South Europe	North Africa	Mid East	South Asia	East Asia	Sub-Sahara Africa	Latin America	Full Sample	Full Sample2
1969	5.8	2.4	13.6	1.4	3.0	2.1	1.9	4.2	2.9
1970	4.5	2.6	14.3	2.7	3.5	2.2	1.8	4.3	2.9
1971	4.6	2.7	14.4	3.0	3.8	2.3	1.8	4.4	3.1
1972	3.9	2.7	13.8	3.0	4.0	2.2	1.7	4.4	3.1
1973	3.9	2.8	19.5	2.2	3.7	2.2	1.7	4.7	2.6
1974	4.5	2.9	17.2	2.2	3.5	2.3	1.7	4.5	2.7
1975	4.6	3.7	18.6	2.5	4.8	2.3	2.3	5.1	3.1
1976	4.2	4.8	19.0	2.5	4.4	2.4	2.2	5.3	3.0
1977	4.1	5.1	17.3	2.4	4.4	2.4	2.4	5.1	3.0
1978	4.0	6.3	14.4	2.3	4.3	2.8	2.3	4.9	3.0
1979	3.8	5.7	15.8	2.4	4.0	3.1	2.2	4.9	3.0
1980	3.8	5.2	14.0	2.5	4.3	2.7	2.6	4.7	3.1
1981	4.3	6.3	13.0	2.5	4.5	2.8	3.0	4.9	3.4
1982	4.2	7.3	13.5	2.7	4.5	2.7	3.2	5.2	3.5
1983	4.0	6.6	13.5	2.8	4.2	2.6	2.9	5.0	3.3
1984	4.3	6.4	13.9	2.8	3.9	2.6	2.9	5.0	3.3
1985	4.2	7.1	12.7	3.2	4.0	2.4	2.8	4.9	3.2
1986	3.9	6.4	12.3	3.7	3.9	2.4	2.7	4.8	3.2
1987	3.9	5.8	11.6	3.9	3.7	2.5	2.5	4.6	3.2
1988	3.9	4.9	10.3	3.4	3.7	2.3	2.8	4.3	3.2
1989	4.3	4.6	7.2	3.7	3.5	2.0	2.7	3.9	3.2

Notes:
1. Regional means are simple average of MES for countries in the region.
2. "Full Sample" is the mean for all 71 countries in the sample, "Full Sample2" excludes the Middle East & North Africa.
3. Panel D: Countries in Regions

Southern Europe:	Greece, Portugal, Spain
North Africa:	Algeria, Libya, Morocco, Tunisia
Middle East:	Egypt, Israel, Jordan, Saudi Arabia, Syria, Turkey
South Asia:	Bangladesh, India, Nepal, Pakistan, Sri Lanka
East Asia	Indonesia, Republic of Korea, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand
Sub-Saharan Africa:	Benin, Burkina Faso, Burundi, Cameroon, Central Africa Rep., Chad, Cote D'Ivorie, Ghana, Kenya, Liberia, Madagascar, Mali, Malawi, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zaire, Zambia, Zimbabwe
Latin America:	Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Panama, Paraguay, Peru, Uruguay, Venezuela

TABLE 2

Cross Section Regressions

	Growth over 7 Year Periods		Growth over 6 Year Periods	
Reg. No.	1 GRT	2 GRNM	3 GRT	4 GRNM
INT	-13.7 (3.62)	-11.4 (2.89)	-9.28 (3.64)	-9.05 (3.56)
GRW	3.39 (3.49)	2.67 (2.65)	2.30 (4.0)	2.19 (3.84)
PCP	-0.0012 (3.80)	-.0012 (3.70)	-.0016 (4.05)	-.0015 (3.93)
CTOT	0.63 (1.88)	.067 (1.93)	.039 (1.27)	.040 (1.32)
DEBTS	-0.32 (3.54)	-.032 (3.35)	-0.32 (2.82)	-.033 (2.95)
LIFE	.127 (4.64)	.133 (4.69)	.123 (3.82)	.122 (3.81)
OILS	.060 (1.63)	.060 (1.59)	.114 (2.26)	.116 (2.32)
PI	-1.00 (2.55)	-1.06 (2.60)	-1.02 (2.26)	-1.04 (2.32)
NMES	3.54 (4.25)	.323 (3.77)	.346 (3.54)	.330 (3.39)
MES	.388 (2.03)	.342 (1.74)	.409 (1.83)	.479 (2.17)
MES2	-.032 (2.66)	-.025 (2.02)	-0.33 (2.64)	-.037 (2.61)
R2	.462	.439	.462	.422
D.F.	110	105	112	111
D.W.	2.03	2.00	1.98	1.97

TABLE 3
REGRESSIONS OF THE DIFFERENCE IN GROWTH RATES BETWEEN SUCCESSIVE MULTI-YEAR PERIODS ON THE DIFFERENCES IN THE REGRESSORS

	7 Year Growth Periods		6 Year Growth Periods	
Reg. No.	1	2	3	4
	DGRT	DGRNM	DGRT	DGRNM
DGRW	.0078	.010	.0088	.010
	(3.42)	(3.72)	(5.80)	(5.93)
DPCP	-4.2E-6	-5.4E-6	-6.4E-6	-7.1E-6
	(1.57)	(1.80)	(2.29)	(2.37)
DCTOT	.050	.036	.022	.033
	(2.49)	(1.71)	(1.30)	(1.84)
DDEBTS	-.038	-.040	-.033	-.035
	(6.55)	(5.88)	(6.18)	(5.62)
DLIFE	.00059	.00083	.00068	.00079
	(2.17)	(2.55)	(2.59)	(2.65)
DOILS	-.033	-.0010	-.092	-.040
	(1.00)	(.02)	(2.77)	(1.06)
DPI	-.0026	-.0075	.0011	-.0012
	(.74)	(1.92)	(.33)	(.36)
DNMES	.0027	.0023	.0034	.0033
	(3.96)	(2.85)	(5.31)	(4.54)
DMES	.0035	.0036	.0028	.0022
	(3.49)	(3.34)	(2.66)	(1.93)
DMES2	-.00012	-7.3E-5	-9.5E-5	-3.0E-5
	(3.20)	(1.88)	(2.32)	(.69)
R2	.305	.336	.247	.279
D.F.	272	227	398	352

Note: Each variable is the difference between the multi-year average for the current t and the multi-year average starting in year t-7. No intercept is used in the regressions. All regressions are GLS - SAS Proc Autoreg - due to autoregressive errors.

Table 4

Summary of Regressions by Geographic Regions

PANNEL A: Asia, Middle East, North Africa, and Southern Europe

	Seven-year Growth Periods				Six-year Growth Periods			
Reg. No.	1	2	3	4	1	2	3	4
	GRT	GRT	GRNM	GRNM	GRT	GRT	GRNM	GRNM
NMES	.365	.356	.331	.323	.346	.341	.302	.297
	(3.33)	(3.79)	(3.06)	(3.35)	(2.95)	(3.17)	(2.61)	(2.87)
MES	-.123	.677	-.035	.674	-.107	.617	-.100	.683
	(1.12)	(2.46)	(.33)	(2.39)	(.91)	(1.93)	(.87)	(2.22)
MES^2		-.047		-.042		-.043		-.046
		(3.09)		(2.67)		(2.40)		(2.70)
R^2	.346	.517	.318	.456	.329	.440	.273	.424
D.F.	24	23	24	23	24	23	24	23
D.W.	2.01	1.96	1.90	1.90	2.13	2.15	2.03	2.11

PANEL B: Latin America

	Seven-year Growth Period				Six-year Growth Periods			
Reg.No.	1	2	3	4	1	2	3	4
	GRT	GRT	GRNM	GRNM	GRT	GRT	GRNM	GRNM
NMES	.586	.525	.502	.395	.058	.143	.138	.224
	(1.18)	(.97)	(.91)	(.67)	(.09)	(.21)	(.21)	(.32)
MES	.267	-.098	.279	-.563	.0002	.395	-.024	.583
	(.83)	(.08)	(.77)	(.42)	(.0001)	(.41)	(.06)	(.40)
MES^2		.060		.133		-.101		-.103
		(.32)		(.65)		(.43)		(.43)
R^2	.424	.402	.352	.335	.410	.391	.375	.355
D.F.	25	24	22	21	26	25	26	25
D.W.	1.81	1.77	2.25	2.17	1.68	1.77	1.68	1.79

PANEL C: Sub-Saharan Africa

	Seven-year Growth Periods				Six-year Growth Periods			
Reg. No.	1	2	3	4	1	2	3	4
	GRT	GRT	GRNM	GRNM	GRT	GRT	GRNM	GRNM
NMES	-.114	-.114	-.109	-.111	-.216	-.255	-.114	-.160
	(.50)	(.49)	(.47)	(.47)	(.86)	(.99)	(.43)	(.59)
MES	.131	.118	.112	.198	.367	.882	.363	.886
	(.54)	(.19)	(.46)	(.30)	(1.53)	(1.35)	(1.50)	(1.34)
MES^2		.0018		-.012		-.060		-.061
		(.02)		(.14)		(.85)		(.85)
R^2	.138	.113	.107	.081	.213	.207	.189	.180
D.F.	36	35	34	33	37	36	36	35
D.W.	2.39	2.39	2.23	2.23	2.17	2.16	2.17	2.17

Note: For presentational simplicity, the coefficients for other regressions are not shown for the above regressions in this table.

TABLE 5

DROPPING VARIOUS REGIONS

Reg. No.	1 Full Sample	2 Drop Asia	3 Drop ME/NA/SE	4 Drop SSA	5 Drop LA	6 Drop AS/ME/ NA/SE
INT	-.136	-.146	-.149	-.106	-.126	-.155
	(3.62)	(3.41)	(3.56)	(2.12)	(2.80)	(3.04)
GRW	.033	.038	.035	.029	.028	.039
	(3.49)	(3.40)	(3.34)	(2.57)	(2.47)	(3.12)
PCP	-1.2E-5	-1.2E-5	-1.3E-5	-1.0E-5	-1.3E-5	-1.4E-5
	(3.80)	(3.23)	(3.75)	(3.16)	(2.70)	(3.26)
CTOT	.063	.056	.050	.078	.055	.040
	(1.88)	(1.55)	(1.29)	(2.09)	(1.28)	(.94)
OILS	.060	.061	.094	.073	.013	.103
	(1.63)	(1.48)	(1.88)	(1.88)	(.30)	(1.70)
DEBT	-.032	-.029	-.032	-.050	-.022	-.029
	(3.54)	(2.93)	(3.19)	(4.30)	(2.05)	(2.60)
LIFE	.0012	.0012	.0014	.0010	.0014	.0013
	(4.63)	(3.75)	(4.63)	(2.24)	(4.38)	(3.65)
PIS	-.010	-.011	-.010	-.006	-.011	-.011
	(2.55)	(2.46)	(2.26)	(1.32)	(2.49)	(2.10)
MMES	.0035	.0030	.0036	.0035	.0032	.0026
	(4.24)	(2.70)	(3.41)	(4.11)	(3.75)	(1.34)
MES	.0038	.0026	.0045	.0061	.0033	.0030
	(2.03)	(1.20)	(1.58)	(2.91)	(1.51)	(.87)
MES^2	-.00032	-.00023	-.00041	-.00045	-.00027	-.00029
	(2.66)	(1.74)	(1.61)	(3.60)	(2.10)	(1.01)
R^2	.462	.386	.424	.631	.463	.300
D.F.	110	90	96	64	75	76
D.W.	2.03	2.04	2.04	2.10	1.96	2.02

TABLE 6

Channels of Impact

Reg. No.	1	2	3	4	5	6	7	8	9
INT	-14.3	-14.0	-14.3	-16.0	-7.3	-13.4	-13.3	-14.0	-15.5
	(3.52)	(3.38)	(3.56)	(3.80)	(1.83)	(3.05)	(3.01)	(3.41)	(3.65)
GRW	3.22	3.12	3.31	3.19	3.02	3.02	3.07	3.13	2.93
	(3.12)	(2.93)	(3.23)	(3.11)	(2.72)	(2.74)	(2.87)	(2.98)	(2.73)
PCP	-.0013	-.0013	-.0013	-.0013	-.0006	-.0013	-.0013	-.0013	-.0013
	(3.82)	(3.81)	(3.77)	(3.79)	(1.98)	(3.84)	(3.84)	(3.96)	(3.79)
CTOT	.068	.069	.073	.062	.082	.068	.066	.068	.068
	(1.72)	(1.74)	(1.86)	(1.57)	(1.93)	(1.73)	(1.65)	(1.71)	(1.71)
DEBT	-.041	-.043	-.033	-.038	-.045	-.038	-.040	-.039	-.031
	(4.17)	(3.98)	(3.05)	(3.76)	(4.21)	(3.38)	(4.07)	(3.81)	(2.57)
LIFE	.150	.148	.156	.202		.148	.143	.151	.217
	(4.81)	(4.66)	(5.00)	(4.23)		(4.73)	(4.32)	(4.81)	(4.44)
OILS	.066	.062	.075	.066	.043	.060	.063	.061	.061
	(1.65)	(1.52)	(1.86)	(1.66)	(1.01)	(1.45)	(1.56)	(1.47)	(1.42)
PI	-.98	-.96	-1.07	-.95	-1.14	-1.01	-.96	-1.00	-1.02
	(2.36)	(2.28)	(2.56)	(2.30)	(2.55)	(2.40)	(2.27)	(2.37)	(2.42)
NMES	.377	.378	.364	.399	.368	.383	.377	.382	.403
	(4.27)	(4.27)	(4.15)	(4.48)	(3.82)	(4.29)	(4.27)	(4.29)	(4.45)
MES	.419	.414	.466	.411	.429	.400	.389	.420	.450
	(2.13)	(2.10)	(2.36)	(2.10)	(2.02)	(2.00)	(1.90)	(2.13)	(2.28)
MES2	-.034	-.033	-.034	-.033	-.034	-.032	-.031	-.034	-.032
	(2.77)	(2.72)	(2.78)	(2.70)	(2.61)	(2.60)	(2.34)	(2.75)	(2.61)
IS		.0093							.020
		(.43)							(.91)
CGES			-.038						-.041
			(1.50)						(1.55)
ED				-.0077	.0094				-.0093
				(1.44)	(2.54)				(1.55)
BT						.020			
						(.54)			
TRANS							-.046		
							(.56)		
OB								.028	.039
								(.53)	(.71)
R2	.518	.514	.524	.523	.437	.514	.514	.514	.527
D.F.	94	93	93	93	94	93	93	93	90
D.W.	1.99	1.92	2.00	1.98	1.88	2.09	1.98	2.15	2.09

TABLE 7

Testing the Efficiency Hypothesis

Panel A; Full Set of Regressors, 7 year Growth Rates, GRT Dependent Variable

Reg. No.	1	2	3
Dep. Var.	GRT	GRT	GRT
INT	-14.2	-5.50	-2.0
	(3.71)	(1.92)	(.77)
GRW	3.63	1.06	-.11
	(3.71)	(1.43)	(.16)
PCP	-.0012	-.0005	-.0004
	(3.79)	(2.14)	(1.91)
CTOT	6.92	2.95	3.43
	(1.86)	(1.10)	(1.42)
DEBTS	-3.46	-1.15	-2.07
	(3.73)	(1.65)	(3.18)
LIFE	.124	.072	.047
	(4.63)	(3.68)	(2.56)
OILS	6.15	3.78	.01
	(1.58)	(1.35)	(.35)
PI	-.98	-.74	-.52
	(2.51)	(2.63)	(2.01)
NMES	.375	.155	.129
	(4.47)	(2.43)	(2.24)
IS			.073
			(5.10)
IOCR		.078	.092
		(10.1)	(12.3)
MES	.358	.258	.223
	(1.88)	(1.90)	(1.82)
MES2	-.031	-.022	-.019
	(2.64)	(2.60)	(2.45)
R2	.497	.743	.793
D.F.	105	104	103
D.W.	2.03	1.90	1.91

Panel B; MES, MES2, NMES only, 7 year Growth Rates, GRT Dependent Variable

Reg. No.	1	2	3	4	5	6
Dep Var.	GRT	GRT	GRT	GRT	GRT	GRT
INT	2.46	2.12	..99	2.56	2.11	1.14
	(5.02)	(5.34)	(1.58)	(6.57)	(6.52)	(1.97)
NMES				.237	.096	.083
				(3.11)	(1.48)	(1.29)
IS			.046			.039
			(2.32)			(2.03)
IOCR		.040	.043		.039	.042
		(8.27)	(8.68)		(8.08)	(8.36)
MES	.442	.152	.127			
	(2.52)	(1.04)	(.88)			
MES2		-.0084	-.0074			
	-.020					
	(2.42)	(1.19)	(1.07)			
R2	.032	.364	.385	.061	.371	.385
D.F.	129	128	127	131	130	129
D.W.	2.02	1.54	1.65	2.10	1.58	1.65

TABLE 8
Impact of Nilex On The Level and Composition of Central Government Expenditure 1970-89

Dep. Var.	1 TOTAL S.GDP	2 EDUC. S.GDP	3 EDUC. S.G.E	4 HEALTH S.GDP	5 HEALTH S.G.E.	6 INFRA S.GDP	7 INFRA S.G.E	8 ED.+HE S.GDP	9 ED + HE S.G.E.
3 Year Averages									
INT	.179	.029	.153	.014	.068	.017	.097	.043	.220
	(13.3)	(10.0)	(15.7)	(8.93)	(13.0)	(9.24)	(13.1)	(10.9)	(17.3)
DEF.S.GDP	2.00	.100	-.48	-.026	-.456	.037	-.485	.078	-.932
	(6.99)	(1.97)	(2.52)	(.78)	(4.11)	(.98)	(3.10)	(1.07)	(3.79)
R2	.199	.015	.027	-.002	.076	.000	.045	.001	.065
D.F.	191	191	191	191	191	184	184	191	191
5 Year Averages									
INT	.186	.030	.152	.014	.069	.015	.088	.045	.221
	(12.7)	(10.1)	(15.2)	(8.18)	(12.3)	(7.55)	(11.7)	(10.5)	(16.9)
DEF.S.GDP	1.93	.068	-.523	.030	-.455	.068	-.309	.038	-.989
	(5.46)	(1.04)	(2.28)	(.70)	(3.29)	(1.43)	(1.71)	(.40)	(3.29)
R2	.193	.001	.034	-.005	.075	.010	.017	-.008	.076
D.F.	119	119	119	119	119	115	115	119	119

TABLE 9

Impact of MES on Key Economic Variables

Reg. No.	1	2	3	4	5	6	7
Dep.Var	INF	ED	CGES	IS	BT	TRANS	OB
INT	-.080	47.6	.162	.214	-.105	.023	-.0003
	(1.11)	(4.52)	(11.0)	(12.9)	(7.45)	(3.87)	(.03)
GRW	.022	3.61	-.007	-.0004	.014	.0002	.0034
	(1.39)	(2.62)	(2.82)	(.15)	(5.22)	(.16)	(1.39)
PCP	.00008	.055	.000037	.000032	.000014	-.00001	.000004
	(3.22)	(14.1)	(6.65)	(5.03)	(2.92)	(5.68)	(1.19)
POP	9.5E-11	4E-9	6E-12	-4E-11	1.1E-10	-2.2E-10	-6.6E-13
	(.43)	(.11)	(.12)	(.65)	(2.24)	(1.07)	(.02)
OILS	.008	145	.227	.258	.131	-.056	.070
	(.02)	(2.21)	(2.55)	(2.46)	(1.73)	(1.57)	(1.32)
PI	.053	8.86	-.014	-.018	.017	.0040	.0032
	(1.44)	(1.90)	(1.92)	(2.08)	(2.42)	(1.42)	(.60)
DEBT	.234	47.4	.093	-.022	-.072	.022	-.050
	(5.47)	(7.36)	(10.7)	(2.07)	(8.99)	(6.57)	(7.82)
NMES	-.0016	5.50	-.0043	-.0006	-.0028	.0005	-.0022
	(.22)	(5.58)	(2.93)	(.33)	(2.04)	(.85)	(2.05)
MES	-.0033	.24	.013	-.0013	-.0020	.0015	-.00087
	(.48)	(.25)	(8.89)	(.69)	(1.54)	(2.57)	(.85)
R2	.080	.464	.382	.099	.242	.188	.151
D.F.	421	392	408	405	413	421	406

Note: These regressions were also run using MES and MES2, that is testing a non-linear relationship between milex and these variables. None of the coefficients for MES or MES2 were statistically significant, so these regressions are not in the table.

TABLE 10

The Determinants of Military Expenditure - MES

Reg.	1	2	3	4
	3 Year Averages		5 Year Averages	
INT	.601 (1.69)	.443 (1.25)	.423 (1.08)	.302 (.75)
POP	.0061 (1.03)			
POP2	-.0000075 (1.05)			
PCP	.557 (7.11)	.603 (7.14)	.640 (6.42)	.648 (6.12)
NMES	.534 (12.4)	.547 (12.5)	.545 (11.1)	.552 (11.1)
PI	-6.37 (2.51)	-.494 (1.91)	-.541 (1.50)	-.511 (1.42)
IW	2.08 (4.38)	1.93 (3.85)	3.04 (4.38)	2.75 (3.76)
TRANS		.025 (.76)		.024 (.57)
R2	.404	.398	.501	.489
D.F.	465	461	268	265

Note: All regressions GLS due to autocorrelation. For the means, standard deviations, and unit of variables, see last Table.

Annex A

Review and Critique of Major Existing Studies

The first influential empirical study, which set off a wave of work in reaction, was by Benoit (1978). He used a sample of 44 LDCs with available data from 1950-65. He regressed the growth rate of civilian product on the shares of military spending, investment, and net bilateral aid in GNP. His results were that the 'military burden' had a statistically insignificant positive correlation with growth rates when all 3 regressors were included in the equation, and a statistically significant positive correlation when either of the other two regressors was excluded.

Benoit had a decent sized sample, but he did not include any regressors for human capital, technology, natural resources, or efficiency in his regressions. The econometric work may have simultaneity problems since he used single equation OLS regressions with the regressors from the same multi-year time period as the dependent variable. Benoit also has no regressors for political conditions. His milex regressor is entered only linearly and it is unlagged.

Lim (1983) is one of a series of studies done in reaction to Benoit's results. Lim used a sample of 54 LDCs for the years 1965-73, and regressed the estimated - least squares - growth rate over the period on the mean of the 1965, 70, & 73 values for the incremental capital output ratio, the share of military expenditure in GDP or government spending, and ratio of capital inflow to domestic savings. He found a statistically significant negative relationship between the share of milex in government spending for his whole set of 54 countries and most geographic sub-sets. He found a statistically insignificant negative relationship between milex as a share of GDP and growth for his whole sample, but the relationship was statistically significant when 8 Middle East and Southern European countries were eliminated.

Lim's work has all the problems of Benoit's (see above) and in addition his sample is only 8 years.

Faini, Annez, & Taylor (1984) regressed annual changes in GDP on the growth rate of exports, the growth rate of population, the change in the share of arms spending in GDP, the change in capital inflows from abroad, the growth rate of the capital stock, and per capita product in a fixed effects model with 558 annual observations covering various years between 1952 - 79, from 50 some LDCs. The coefficient for the change in military expenditure share is negative for the LDCs as a whole and the African & Asian sub-samples with a "$t > 1.5$". (The reporting of the regression results does not include either standard errors or t values.) $t > 1.5$ would be significant at roughly the 7.5% level in a one tailed test or the 15% level in a two tailed test.

The work by Taylor et. al has the problem that it is measuring annual changes in GDP, not long run growth. They tested for simultaneity problems, but it is not clear about auto-correlation. The regressors for capital inflow, investment, and exports could be influenced by the level of milex, so including them could bias the coefficient for milex. Political factors are ignored, and the milex regressor is linear and unlagged. Robert Looney (frequently with P. C. Frederiksen) has published a number of empirical studies of the relationship between milex and economic growth in the LDCs. However, the thrust of his work directly on the MEEG issue is summed up in his 1988 book. Looney works with a

sample of 71 LDCs and data for the years 1970-82. He breaks his sample up into arms producers - 21, and non-producers - 50.

For both sub-samples he regresses the growth rate of real GDP over the whole period on the growth of investment 1970-81', a regressor for milex, and a variety of other regressors. For the arms producers he uses milex in two forms per capita and as a share of GDP. The investment regressor is always included along with a milex regressor and one or more of the following: the inflation rate, foreign resource balance, government budgetary balance, and the share of public consumption in GDP (all 1970-82 period averages). For the arms producers, both milex regressors always yield a statistically significant positive coefficient.

For the non-arms producers he uses only the per capita milex regressor and includes with it in the regressions, the investment regressor, and one or more of the following: the inflation rate, resource balance, public external debt, public debt service ratio, government budgetary balance, and public external borrowing commitments. For the non-producers the milex regressor always has a significant negative coefficient. All of Looney's results reported in the book are single equation OLS regressions, thus there may be simultaneity problems. His other regressors are mostly factors likely to be influenced by the level of milex, especially averaged over a 12 year period. Looney has no regressors which control for natural resource endowments, technology, or human capital. He has no variables which allow for political conditions like international wars, etc., and his milex regressors are only entered linearly and unlagged.

Biswas & Ram (1986) did a study of 58 LDCs for the years 1960-77. They broke their sample down into middle and low income countries, and separated the two decades. They regressed the growth rate on the investment share, the growth rate of the labor force, the growth of military expenditure and/or the growth rate of military expenditure times the share of military expenditure in GDP. Their milex coefficients were usually statistically insignificant, however for the full sample and middle income sub-sample for the 1970s decade, the coefficient for the growth of military expenditure times its share in GDP was positive and statistically significant at the 10% level. They conclude there is no strong evidence for any relationship positive or negative between milex and economic growth.

The Biswas & Ram study is very limited in the range of influences on growth considered; technology, natural resources, human capital, and external conditions are all ignored. No political factors are considered, and while there are several variations in the form of the milex regressor, a non-linear relationship is not tried and the milex regressor is not lagged.

Perhaps the most sophisticated empirical study of the MEEG relationship in the literature is Deger's (1986). The same study, with small modifications appeared several times earlier since the late 1970s. Deger estimates by three stage least squares a 4 equation simultaneous equation model for a cross section of 50 LDCs for the time period 1965-73. The left hand variables in the 4 equations are the growth rate, the saving rate, the balance of trade, and the milex GDP ratio. The growth equation includes - besides the 3 other left hand variables, per capita product, and the growth rate of agriculture. The result of the estimation is that the direct effect of increased milex on growth is positive, but allowing for the effects on savings and trade, the total - direct and indirect - effect is negative.

Besides using a simultaneous equation model, Deger's study has the advantage over other studies of allowing for the effects of per capita product on technical change - a "catch up effect" (Landau, 1986). Unfortunately, the study still has serious defects. Deger refuses to use data past 1973 because,

> "The latest issue ... gives data for 1970-81 averages for most LDCs. However, these include the pre-oil and post oil-shock period, thus various distortive influences are present. Results using such data cannot be fully trusted. It is hoped that data for the early 1980s, when the international system has been able to absorb the traumatic supply shocks of the last decade, will be available in the future..."

Of course the 1980s brought bigger shocks - wasn't this clear before 1986? - so that by Deger's approach, in 1992 we should still only look at 8 out of the last 25 years. The study has other problems as well. The dummy for major oil exporters and the growth of government expenditure variable are in the equations for the balance of trade and the milex share, but not the savings or growth equations. One would expect them both to influence savings & growth. There is no regressor for human capital in the model. Also missing is an allowance for internal political instability. The milex regressor is linear and unlagged in the growth equation.

One problem, which appears in all of the existing studies, is treating military expenditure like a fixed cost which could not possibly be beneficial in itself, because it provides security. The various authors allow that perhaps there are derived or 'spin-off' benefits from military expenditure like investment in human capital or infra-structure, etc., but, that military expenditure could be beneficial in itself, is not considered. As indicated above, a little thought would indicate almost any country needs a certain minimum defense force. Lack of minimum protection for lives and property is likely to discourage investment & growth - e.g. Lebanon. One would expect that, since resources used for military hardware can not be used for consumption or investment, beyond a certain level, the impact of increased milex would be negative. In sum, consideration of the reasons for military expenditure would suggest a non-linear relationship between milex and growth. Implicit - or explicit in some cases - in the existing empirical literature is the assumption that all military expenditure is irrational, that none of it is motivated by legitimate security considerations (Grober & Porter, 1989). Another important weakness of all the existing literature in this field is the use of regressors which are not lagged. As pointed out in the text of the paper, this means they are estimating the impact of current military expenditure on current national product, not the long run effect. In addition, the use of current regressors creates questions of causality; with lagged regressors, causality is clear.

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