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WP/91/54

INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

Military Expenditure:
International Comparison of Trends

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May 1991

Abstract

This paper analyzes trends in world military expenditure by examining the shares of different country groups and the ratio to GDP of individual nations. The coverage is military expenditures in 125 countries from 1972 to 1988. The study also compares military expenditures as a proportion of central government expenditures; analyzes the budgetary trade-off between military, social, and development expenditures; and discusses the impact of military expenditures on economic development.

JEL Classification Numbers

H56

* The author wishes to thank Tarja Papavassiliou for assistance with data preparation, and Vito Tanzi and Ke-young Chu for guidance on the subject matter. Thanks are also due to Ehtisham Ahmad, Richard Hemming, Alan Heston, Ashok Lahiri, Peter Stella, and Somnath Sen for their comments and to Elisa Diehl and Theresa Garrison for editorial assistance.

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Summary

Military expenditures absorbed 5 percent of world resources annually from 1972 until 1988. The proportion of military expenditures to GDP in industrial nations was somewhat below the world average, and the proportion to GDP in Eastern European nations was nearly double the world average. Military expenditures accounted for about 5.5 percent of developing countries' combined GDP and 20 percent of central government expenditure.

In some developing countries, up to one fourth of GDP and as much as one half of central government expenditures were allocated annually to the military in the past two decades. Such high levels of military expenditure certainly contributed to low growth and domestic economic hardship in some countries by diverting funds from social programs, economic development projects, and the private sector. However, country rankings indicate that developing nations that spent heavily on the military tended to be the wealthier net creditor nations. For instance, the ratio of military expenditures to GDP of the net creditor nations was double the world average. The ratio of military expenditures to GDP of the small low-income economies and the heavily indebted middle-income nations was half the world average. However, even for the heavily indebted and low-income countries, cutbacks in military expenditures represent a significant potential source of development funds. Although the opportunity cost of government funds in these countries is much higher than in higher-income countries, low-income countries still allocated in excess of 10 percent of government expenditures to the military.

Analysis of central government budgetary allocations from a more limited sample consisting of over 50 developing countries indicates that many of these nations lowered their military expenditures as a proportion of central government expenditures in recent years. Owing in part to higher interest costs, developing nations had to alter their allocations of central government expenditures between different sectors in the 1980s. In general, governments accommodated the higher interest costs by both increasing overall central government expenditures somewhat and by reducing expenditures on other items, primarily military expenditures and expenditures on economic services (or development expenditures). In contrast, social expenditures were insulated from retrenchment in the majority of these countries. On average, the share of social expenditures in the budget did not change, and in many countries expenditures on social services increased as a share both of the budget and of GDP. However, the pattern is not identical in all regions: for instance, in Latin America and the Caribbean social expenditures were also cut.

These findings and associated econometric results confirm that military expenditures are, on average, sensitive to financial constraints. This implies that, in a macroeconomic context, external financial assistance indirectly supports military expenditures.

I. Introduction

Following the virtual cessation of the cold war, major decreases in military expenditures seem to be a certainty in Eastern Europe, while the disposition of military expenditures in industrial countries remains uncertain. It is even more uncertain whether or not the developing nations will realize a "peace dividend," although considerable scope exists in developing nations to release resources from the military.

This study examines military expenditures in 125 nations from 1972 until 1988 with the object of providing a description of the pattern and trend of expenditures. The shares of different country groups provide insight into the distribution of world military expenditures between categories of nations and geographic regions. Country rankings of the proportion of military expenditure to GDP provide insight into the allocation decisions of individual nations. Examination of the interaction between the level of military expenditures, central government expenditures, and other budgetary items provides insight into budgetary and economy-wide trade-offs.

While the trends and determinants of military expenditures describe behavioral choices, economic theory offers limited insight regarding what nations should do or on the optimal level of military expenditure. Inherent informational difficulties and welfare interdependencies render traditional public goods analysis of the optimal level of expenditure nearly futile (see Appendix II). Therefore, the primary purpose of this study is to describe the economic consequences of political choices. No attempt is made to analyze the political reasons behind the allocation decisions of individual countries or to offer normative judgments of the actions of particular governments.

A detailed analysis of the data and the economic literature on military expenditures follows. Section II is an overview of world military expenditures. Section III discusses the country rankings. Section IV investigates the budgetary trade-off between military, social, and development expenditures. Section V is a summary. Appendix I describes the data; Appendix II analyzes the economic theory of defense; and Appendix III discusses the effect of military expenditures on economic growth. A number of well-written books review the existing economic literature on defense and military expenditures, including Ball (1988), McKinlay (1989), and Deger and Sen (1990).

II. An Overview of World Military Expenditures

1. The military expenditure data

Comprehensive military expenditure data are available from a number of different sources. The Government Finance Statistics (GFS), the most widely used source for government expenditures data, is inadequate for the present

purposes. 1/ Fortunately, two alternative data sources exist that provide comprehensive estimates: the U.S. Arms Control and Disarmament Agency (ACDA) and the Stockholm International Peace Research Institute (SIPRI). The **SIPRI military expenditures**, in local currency, are the primary data source for this study. Estimates of U.S.S.R. expenditures are based on Steinberg (1990) and China expenditures on ACDA because SIPRI does not provide figures for these two countries (Appendix I).

The SIPRI figures represent total government outlays on the military, including paramilitary expenditures but excluding police. To the extent feasible, SIPRI excludes items in the defense budget that are civilian in nature and includes military-related items from other ministry budgets, for example, paramilitary forces. Furthermore, SIPRI follows the NATO convention of including military aid to other nations in the military expenditures of the donating country, and does not include aid receipts from other nations in the military expenditures of the recipient countries,

SIPRI military expenditures =

Ministry of Defense budget
less: nonmilitary expenditures of the defense ministry
plus: military outlays of other ministries
plus: military aid to other nations
less: military aid receipts from other nations.

Thus, the SIPRI military expenditures represent the domestic opportunity cost of military appropriations plus military aid to allies, or the total level of resources allocated for military purposes by a nation, excluding expenditures funded by aid from foreign governments. 2/

The SIPRI figures, so defined, are not necessarily an accurate indication of the total level of military expenditures in a country for two reasons. First, SIPRI figures underreport military expenditure in such countries as Cuba, Egypt, and Israel that have received high levels of military aid. Second, many countries that obtain supplier's credit and other forms of commercial credit to purchase foreign military equipment do not report these acquisitions in the Ministry of Defense budget. Therefore,

1/ Military expenditure figures for nearly 40 percent of the countries is missing from GFS because certain countries are not Fund members and because of incomplete reporting from member countries. Furthermore, the data are based only on government-reported figures, which are at times unreliable.

2/ Tracing military exports and imports within this definition is quite complicated. Military imports purchased with domestic funds are included, imports funded by foreign aid are not; the disposition of imports funded by commercial financing is uncertain, but it is likely they are also missed (Appendix I). Purchases of domestically produced military equipment are included in the defense budget. Military exports purchased by foreign government are not recorded in the military budget. However, when a nation provides military aid to finance its own arms exports, these expenditures are part of the military budget.

it is reasonable to assume that, for many countries, the SIPRI figures seriously underreport purchases of foreign military equipment.

To correct for this measurement error, an alternative set of military expenditures has been calculated -- the **Adjusted SIPRI** figures. Because of data limitations, these figures are constructed on a formula basis and must be viewed as simulations rather than concrete estimates. The exact methodology, which is more thoroughly described in Appendix I, is to assume that most purchases of foreign military equipment and supplies are excluded from the Ministry of Defense budgets in net debtor developing nations. Therefore, to construct the Adjusted SIPRI figures, foreign military purchases are added to SIPRI military expenditures; the level of foreign military purchases is estimated from ACDA data using a three-year moving average. The Adjusted SIPRI figures estimate total resources available for military purposes, regardless of the source of funding, and therefore correspond to the IMF definition of expenditures. The SIPRI figures represent the level of domestic resources used by the military for current year expenditures, or the domestic opportunity cost, assuming military aid is not fungible. Both sets are used throughout the study. 1/

In all fairness to the countries involved, errors are likely to exist in the country rankings because they are based on military expenditure figures of unknown reliability. In fact, there is undoubtedly a bias that penalizes the more forthright governments that have reported their military expenditures fully and rewards the more clandestine governments that have successfully fooled both the public and the organizations that collect the data. For these reasons, the reader should be cautious when using the results and, if possible, should check with country-specific data. Those in a country that are intimately familiar with government policy are in the best position to assess a particular country's military spending.

2. Trends in world military expenditures

Tables 1 and 2 list several indicators of the distribution of world military expenditures among categories of nations (Appendix Table 6) and the proportion of GDP these groups of countries expended on the military. Figures 1-3 illustrate the yearly fluctuations (see Appendix Tables 7, 8, and 9 for more details).

1/ The main data sources for central government expenditure, GDP, and imports are the IMF's International Financial Statistics and Government Finance Statistics, supplemented by externally published sources. For non-Fund member countries, the main data sources are World Bank and United Nations publications and published national accounts.

Table 1. SIPRI Military Expenditures, 1972-88

	1972-88	1972-79	1980-88	1972-88	1972-79	1980-88	Population	GDP
	----- Average -----			----- Average -----			1980	1980
	(In percent of world military expenditures)			(In percent of GDP)			(As percent of total)	
Industrial	53.9	49.9	57.4	3.9	3.8	4.0	17.2	67.4
Eastern Europe	26.2	30.3	22.6	9.6	9.4	9.9	9.2	11.9
Developing countries	19.9	19.8	20.0	5.3	5.7	5.0	73.6	20.7
Asian developing	7.8	8.8	6.9	6.0	7.3	4.9	51.3	6.8
Middle East	7.0	5.9	8.0	10.1	10.0	10.1	3.2	3.8
North Africa	1.5	1.6	1.3	7.6	9.5	5.8	2.1	1.1
Sub-Saharan Africa	1.2	1.2	1.3	3.1	3.2	3.1	8.8	2.6
Latin America and Caribbean	2.4	2.2	2.5	2.1	2.0	2.2	8.2	6.3
Total	100.0	100.0	100.0	5.0	5.1	4.9	100.0	100.0
Miscellaneous categories of developing countries:								
Net creditor nations	5.2	4.3	5.9	9.1	9.5	8.7	1.7	3.1
Heavily indebted	3.2	3.5	2.9	2.6	2.9	2.3	11.2	7.0
Small low-income economies	0.4	0.4	0.4	2.7	2.7	2.8	7.2	1.0

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

Table 2. Adjusted SIPRI Military Expenditures,
1972 - 1988

	1972-88	1972-79	1980-88	1972-88	1972-79	1980-88
	-----Average -----			-----Average -----		
	(In percent of world military expenditures)			(In percent of GDP)		
Industrial	52.7	48.8	56.1	3.8	3.7	3.9
Eastern Europe	25.4	29.8	21.4	9.2	9.1	9.2
Developing countries	22.0	21.4	22.5	5.9	6.2	5.7
Asian developing	8.1	9.1	7.3	6.3	7.6	5.2
Middle East	8.0	6.7	9.1	11.6	11.5	11.6
North Africa	1.8	2.0	1.7	9.6	11.5	7.8
Sub-Saharan Africa	1.5	1.4	1.5	3.7	3.5	3.8
Latin America and Caribbean	2.5	2.3	2.8	2.3	2.1	2.4
Total	100.0	100.0	100.0	4.9	5.0	4.9
Miscellaneous categories of developing countries:						
Net creditor nations	5.4	4.5	6.1	9.4	9.9	9.1
Heavily indebted	3.5	3.7	3.2	2.8	3.1	2.6
Small low-income economies	0.6	0.6	0.6	3.6	3.4	3.8

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

Among the 125 countries covered in this study, the United States and the U.S.S.R. together accounted for nearly one half the world's total military expenditures, and the 5 next largest -- China, France, United Kingdom, Federal Republic of Germany, and Saudi Arabia -- accounted for about 20 percent of the total (Appendix Table 7). 1/ Thus, the overall share of world military expenditure of **industrial countries** averaged 55 percent annually from 1972-88. This was maintained with a ratio of military expenditure to GDP of less than 4 percent, compared to the world average of 5 percent, because these countries accounted for over two-thirds of world production. The overall share of the **Eastern European countries** was 30 percent in the 1970s and 23 percent in the 1980s; the ratio of military expenditures to GDP averaged 9.5 percent in this region.

The rest of the world consists of **developing nations** of varying income levels (data for some, primarily smaller, nations is missing). Their share of total military expenditures averaged 20 percent, but was considerably higher at times. Based on the Adjusted SIPRI data, the peak share was 26 percent in 1981; the lowest level in the time period covered was 15 percent in 1972, while the share was down to 17 percent in 1987-88. On average, developing countries spent 5 to 6 percent of their combined GDP on the military, depending upon which data set is used.

The regions with the lowest levels of military expenditures in proportion to GDP were Latin America, the Caribbean, and sub-Saharan Africa. In **Latin America and the Caribbean** the proportion of GDP allocated to the military averaged 2.3 percent (Adjusted SIPRI data), and the share of world military expenditures averaged 2.5 percent. In **sub-Saharan Africa** the proportion of GDP spent on the military averaged 3.7 percent and the share of world military expenditures averaged 1.5 percent.

Military expenditures in the **Middle East and North Africa** were higher. The proportion of GDP expended on the military in the Middle East averaged 12 percent and its share of world military expenditures rose from 3 percent in 1972 to 11 percent in 1982-84 and then fell back to 7 percent in 1988 (Adjusted SIPRI data). In North Africa, the proportion of GDP devoted to the military averaged 12 percent in the 1970s and 8 percent in the 1980s and its share of total world military expenditures averaged 1.8 percent.

The final general geographic group is the **Asian developing nations** (outside the Middle East), whose proportion of GDP devoted to the military fell steadily from 8 percent in 1972 to 4 percent in 1988. This decrease was due almost entirely to a precipitous fall in Chinese military expenditures as a percentage of GDP. Nominal expenditures in China were nearly constant and, since nominal GDP grew rapidly, the proportion of GDP allocated to the military fell from 12 percent to 4 percent. 2/ The share

1/ The shares are calculated by converting military expenditures to US dollars at official exchange rates.

2/ The reliability and comparability of this result is questionable. Since SIPRI did not provide data, China military expenditure figures are based on ACDA.

Figure 1

Share of World Military Expenditure -- SIPRI Data, 1972-88

(In percent of total)

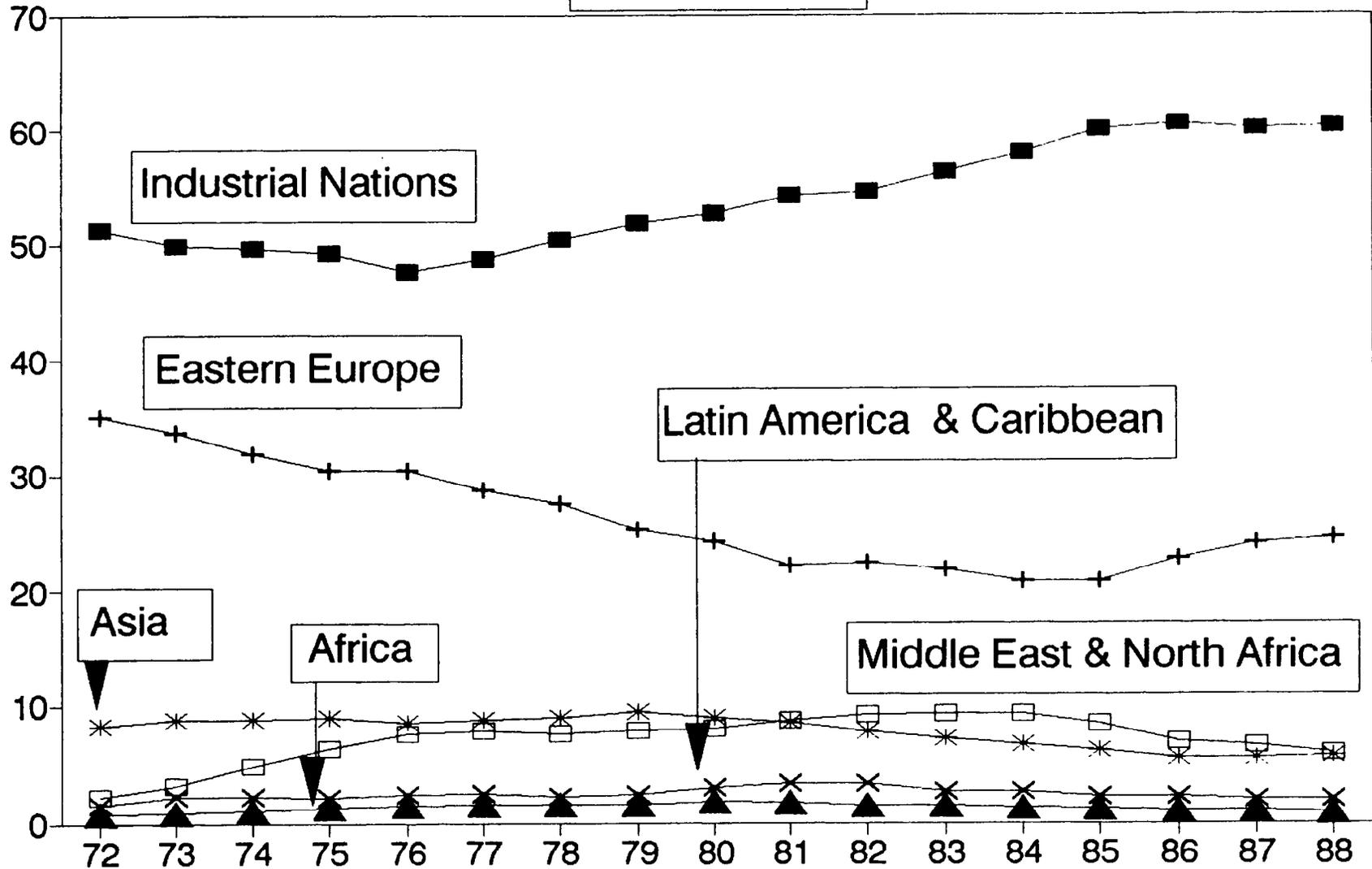


Figure 2

SIPRI Military Expenditure as Proportion of GDP, 1972-88

(In percent of GDP)

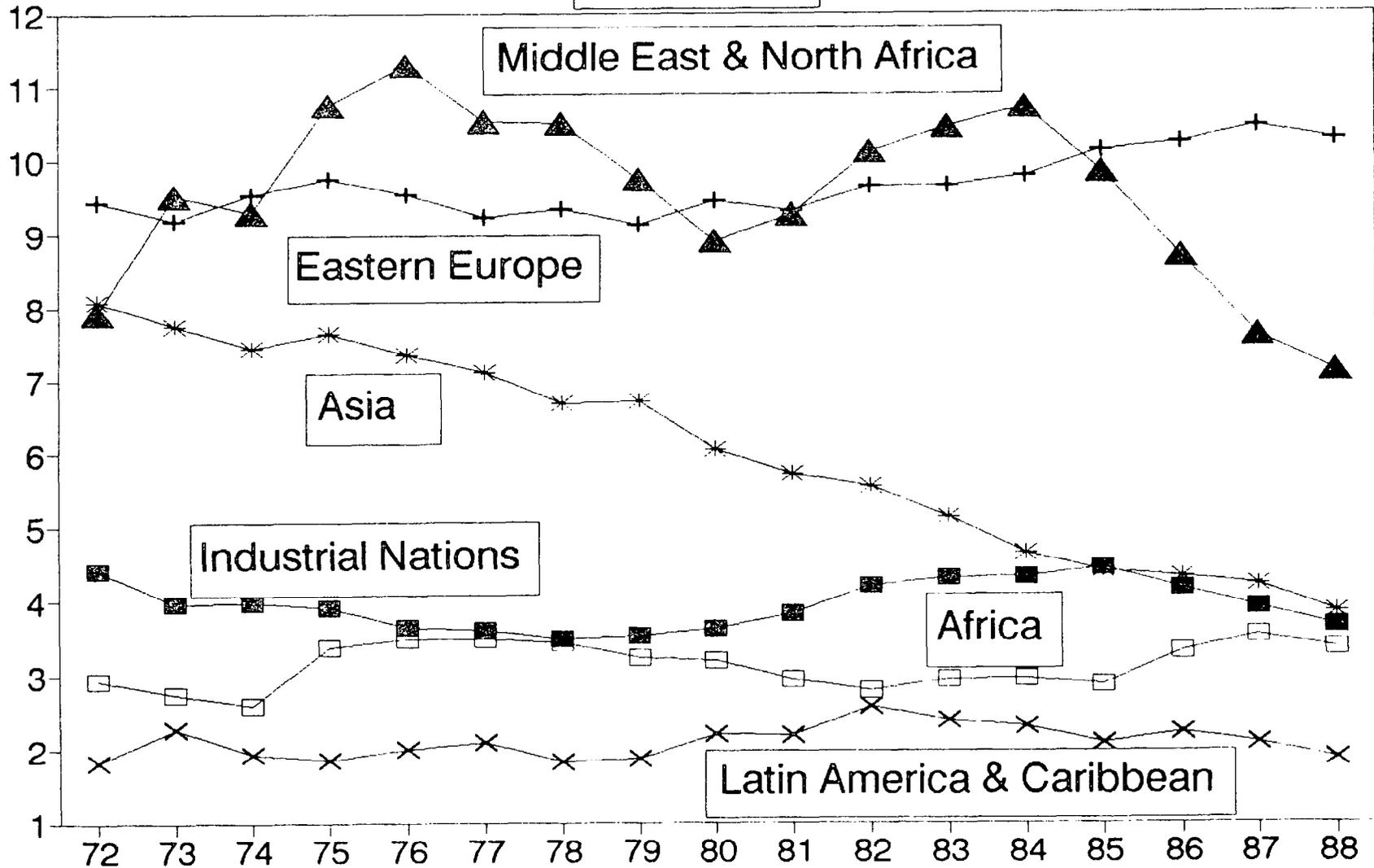
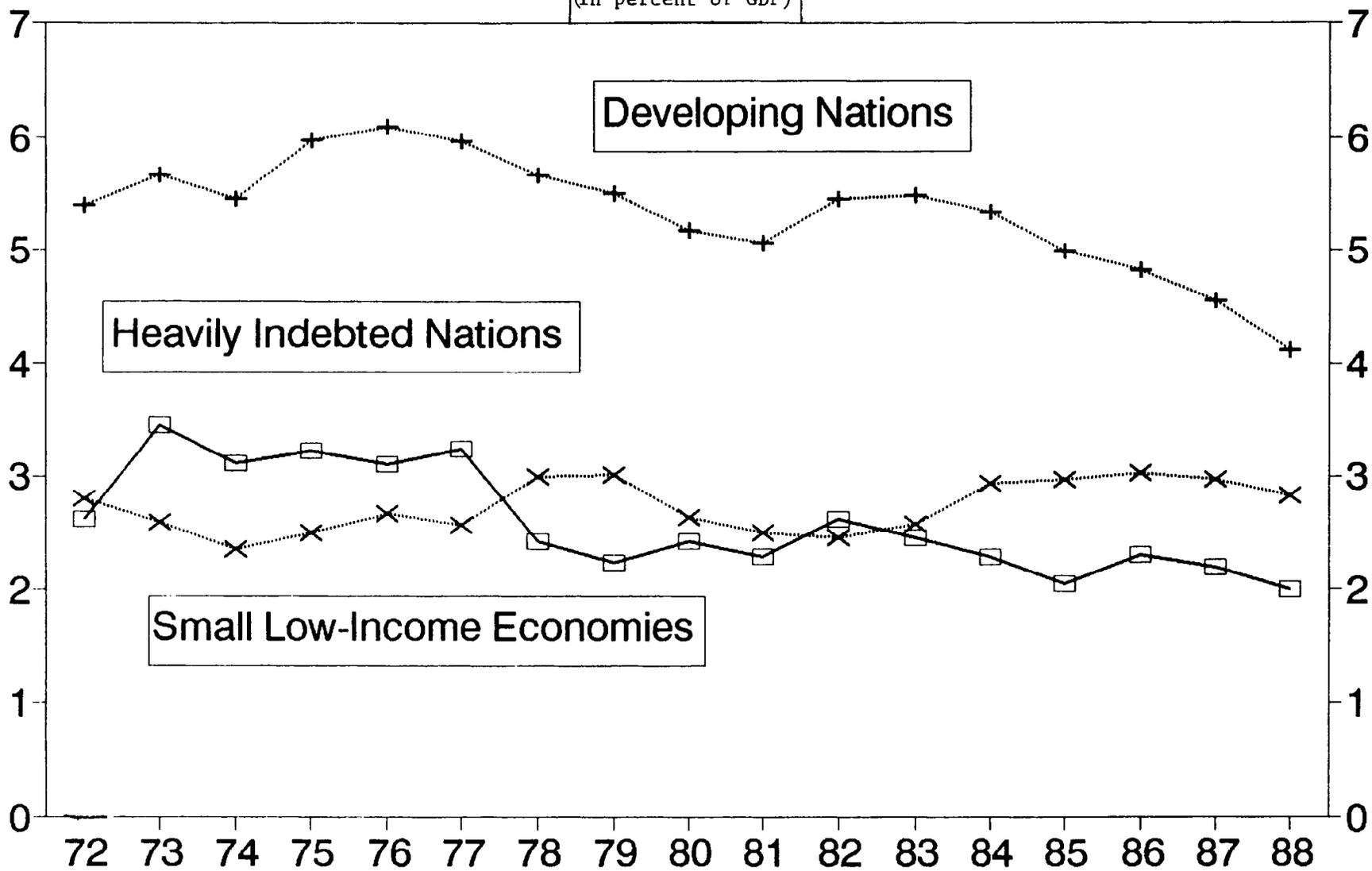


Figure 3

SIPRI Military Expenditures as Proportion of GDP, 1972-88

(In percent of GDP)



of world military expenditures of the Asian developing countries based on purchasing power parity weights is discussed in Appendix I.

Finally, the average proportion of GDP spent on the military by the 31 small low-income economies was 3.5 percent and their share of world military expenditures was 0.6 percent. ^{1/} The proportion of GDP spent on the military in the 15 most heavily indebted nations was 3 percent and their share of world military expenditures was 3.5 percent. The military expenditures of the 7 net creditor nations were higher: their share of GDP allocated to the military was 10 percent, and they accounted for over one fourth of the entire military expenditures of the developing nations in this sample (Figures 2 and 3).

III. International Comparisons of Military Expenditure

1. Country rankings

Alternative rankings of military expenditures as a percentage of GDP provide a basis for identifying the nations that have chosen to spend a large amount on the military. By implication, such an approach serves only to show where countries stand relative to other countries. On an absolute basis, average levels of military expenditures could be inordinately high or low.

Two alternative rankings of the ratio of military expenditures to GDP are derived from two different data sets, the SIPRI military expenditure figures and the Adjusted SIPRI figures (which take into account foreign arms purchases and military aid receipts that are presumed not to be incorporated into the SIPRI figures). Table 3 provides an alphabetical listing of the 125 countries and a numerical ranking based on their ratio of military spending to GDP. The table also lists the mean of the ratio of military expenditure to GDP for each country and the variance divided by the mean. Appendix 8 lists the rankings for 1972-79 and 1980-88 separately.

^{1/} This group consists of countries with a per capita income below \$400 in 1980 (official exchange rates) and populations below 50 million (Appendix Table 6).

Table 3. Country Rankings of Military Expenditures
Based on Proportion of GDP, 1972-88

	Rankings		Averages		Variance/Mean	
	SIPRI	Adjusted SIPRI	SIPRI	Adjusted SIPRI	SIPRI	Adjusted SIPRI
	(In percent of GDP)					
Algeria	89	76	2.0	3.0	0.05	0.15
Angola	3	2	17.2	29.1	0.85	0.97
Argentina	40	47	4.6	4.6	0.19	0.19
Australia	71	82	2.7	2.7	0.03	0.03
Austria	113	114	1.2	1.2	0.01	0.01
Bahrain	42	51	4.5	4.5	0.61	0.61
Bangladesh	111	110	1.4	1.6	0.09	0.07
Belgium	65	73	3.1	3.1	0.01	0.01
Benin	98	75	1.8	3.0	0.06	0.24
Bolivia	58	58	3.4	3.7	0.33	0.35
Botswana	59	61	3.4	3.6	0.15	0.20
Brazil	112	113	1.3	1.3	0.09	0.09
Bulgaria	44	39	4.3	5.3	0.10	0.17
Burkina Faso	74	70	2.6	3.2	0.19	0.30
Burundi	72	69	2.7	3.2	0.09	0.13
Cameroon	97	95	1.8	2.1	0.05	0.11
Canada	92	100	2.0	2.0	0.01	0.01
Central African Rep.	88	96	2.1	2.0	0.05	0.17
Chad	39	29	4.6	6.1	0.36	1.29
Chile	19	20	7.1	7.6	0.30	0.32
China	14	18	9.1	9.1	1.19	1.19
Colombia	105	102	1.6	1.8	0.15	0.18
Congo	55	50	3.6	4.5	0.27	0.20
Costa Rica	122	122	0.6	0.7	0.02	0.03
Cote d'Ivoire	115	112	1.1	1.4	0.01	0.04
Cuba	16	15	7.9	11.7	0.80	1.99
Cyprus	104	94	1.7	2.1	0.18	0.09
Czechoslovakia	38	43	4.6	4.9	0.00	0.01
Denmark	80	87	2.3	2.3	0.01	0.01
Dominican Republic	107	106	1.6	1.6	0.03	0.02
Ecuador	93	79	1.9	2.8	0.07	0.14
Egypt	8	8	14.8	17.6	7.20	6.51
El Salvador	67	56	2.9	3.9	0.58	1.48
Ethiopia	18	10	7.1	14.0	1.29	3.10
Fiji	124	124	0.4	0.4	0.05	0.06
Finland	100	104	1.8	1.8	0.04	0.04
France	49	57	3.9	3.9	0.00	0.00
Gabon	84	83	2.2	2.6	0.56	0.61
German Democratic Rep.	31	37	5.2	5.6	0.03	0.03
Federal Rep. of Germany	60	67	3.3	3.3	0.01	0.01
Ghana	117	116	1.0	1.1	0.21	0.21
Greece	24	24	6.3	7.1	0.12	0.16
Guatemala	94	93	1.9	2.1	0.32	0.27
Guinea-Bissau	45	19	4.2	8.3	0.50	0.76
Guyana	21	22	6.5	7.2	1.36	1.04
Haiti	110	111	1.4	1.5	0.01	0.01
Honduras	63	60	3.1	3.6	0.87	1.08
Hungary	75	65	2.6	3.3	0.10	0.04
India	61	63	3.1	3.6	0.02	0.05
Indonesia	50	54	3.8	4.0	0.22	0.21
Iran	23	31	6.3	6.1	2.10	2.18
Iraq	7	7	16.3	22.3	3.77	4.00
Ireland	106	109	1.6	1.6	0.03	0.03
Israel	2	3	19.6	27.1	1.36	2.05
Italy	81	88	2.3	2.3	0.01	0.01
Jamaica	116	117	1.0	1.0	0.10	0.10
Japan	120	120	0.9	0.9	0.00	0.00
Jordan	5	4	16.8	25.5	0.69	0.74
Kenya	68	64	2.9	3.5	0.32	0.42
Korea, South	33	35	5.1	5.9	0.08	0.07
Kuwait	27	36	5.7	5.7	0.43	0.43
Lebanon	30	33	5.2	6.0	0.88	1.29
Liberia	90	89	2.0	2.3	0.71	0.78
Libya	11	12	10.3	13.9	1.32	1.81
Luxembourg	119	119	0.9	0.9	0.02	0.02
Madagascar	85	84	2.2	2.6	0.12	0.20
Malawi	91	92	2.0	2.2	0.58	0.77
Malaysia	25	26	6.2	6.7	0.16	0.15
Mali	48	42	4.0	5.0	0.79	0.82
Mauritania	15	17	8.2	9.5	3.05	4.04
Mauritius	125	125	0.2	0.3	0.04	0.07
Mexico	123	123	0.6	0.6	0.01	0.01
Morocco	34	27	4.9	6.2	0.27	0.54

Table 3. Country Rankings of Military Expenditures
Based on Proportion of GDP, 1972-88 (concluded)

	Rankings		Averages		Variance/Mean	
	SIPRI	Adjusted SIPRI	SIPRI	Adjusted SIPRI	SIPRI	Adjusted SIPRI
	(In percent of GDP)					
Mozambique	17	14	7.6	12.6	0.16	0.61
Myanmar	51	28	3.8	6.1	0.10	1.32
Nepal	114	115	1.1	1.2	0.14	0.12
Netherlands	62	71	3.1	3.1	0.00	0.00
New Zealand	99	103	1.8	1.8	0.02	0.02
Nicaragua	13	13	9.5	12.7	10.97	14.38
Niger	121	121	0.7	0.8	0.01	0.09
Nigeria	78	80	2.6	2.8	0.60	0.46
Norway	64	72	3.1	3.1	0.01	0.01
Oman	1	5	23.2	23.2	0.74	0.74
Pakistan	20	25	6.5	6.9	0.03	0.06
Panama	108	108	1.4	1.6	0.17	0.19
Paraguay	109	107	1.4	1.6	0.05	0.03
Peru	32	30	5.2	6.1	0.54	0.53
Philippines	83	85	2.2	2.4	0.23	0.20
Poland	53	53	3.7	4.3	0.03	0.03
Portugal	47	52	4.1	4.3	0.43	0.36
Romania	103	98	1.7	2.0	0.08	0.11
Rwanda	102	99	1.7	2.0	0.02	0.08
Saudi Arabia	4	9	17.0	17.0	1.24	1.24
Senegal	76	78	2.6	2.8	0.15	0.21
Sierra Leone	118	118	0.9	1.0	0.05	0.07
Singapore	29	38	5.5	5.5	0.05	0.05
Somalia	56	21	3.5	7.3	0.52	1.23
South Africa	54	62	3.6	3.6	0.13	0.13
Spain	86	90	2.1	2.2	0.07	0.08
Sri Lanka	95	97	1.9	2.0	0.77	0.80
Sudan	77	66	2.6	3.3	0.12	0.09
Swaziland	87	91	2.1	2.2	0.14	0.12
Sweden	66	74	3.0	3.0	0.04	0.04
Switzerland	96	101	1.9	1.9	0.01	0.01
Syrian AR	9	6	14.3	22.4	0.43	0.80
Taiwan Province of China	22	23	6.4	7.1	0.07	0.07
Tanzania	43	41	4.3	5.2	0.46	0.67
Thailand	46	46	4.2	4.8	0.20	0.20
Togo	82	77	2.2	2.9	0.16	0.24
Trinidad & Tobago	101	105	1.7	1.8	0.55	0.55
Tunisia	57	55	3.5	4.0	0.99	1.15
Turkey	36	40	4.7	5.3	0.10	0.07
Uganda	70	68	2.8	3.3	0.21	0.23
U.S.S.R.	10	16	11.7	11.7	0.02	0.02
United Arab Emirates	41	48	4.6	4.6	1.81	1.81
United Kingdom	35	44	4.8	4.8	0.02	0.02
United States	26	34	5.9	5.9	0.05	0.05
Uruguay	73	81	2.6	2.8	0.12	0.14
Venezuela	79	86	2.3	2.3	0.08	0.08
Yemen, AR	12	11	9.6	13.9	2.21	4.24
Yemen, PDR	6	1	16.3	37.2	0.59	5.16
Yugoslavia	37	45	4.6	4.8	0.09	0.09
Zaire	69	59	2.8	3.7	1.05	0.95
Zambia	52	49	3.8	4.6	0.45	0.56
Zimbabwe	28	32	5.7	6.1	0.30	0.36

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

The top and bottom twenty countries, based on the average of the SIPRI and Adjusted SIPRI ranking, 1/ are:

<u>Top 20:</u>	<u>Bottom 20:</u>
(In rank order)	(In reverse rank order)
Israel	Mauritius
Angola	Fiji
Oman	Mexico
Yemen PDR	Costa Rica
Jordan	Niger
Saudi Arabia	Japan
Iraq	Luxembourg
Syrian AR	Sierra Leone
Egypt	Ghana
Libya	Jamaica
Yemen AR	Nepal
USSR	Austria
Nicaragua	Cote d'Ivoire
Ethiopia	Brazil
Mozambique	Haiti
Cuba	Bangladesh
China	Panama
Mauritania	Paraguay
Chile	Ireland
Guyana	Dominican Republic

Among the top twenty countries, Israel's expenditures exceeded 25 percent of GDP and all the top ten nations allocated 15 percent or more of their GDP to the military; in contrast Chile and Guyana allocated about 7 percent of GDP to the military. There are no industrial countries among the top twenty nations, whereas four are low-income nations: Ethiopia, Mozambique, China, and Mauritania. 2/ Among the countries that spent the least, military expenditures varied between 0.5 percent and 1.5 percent of GDP; four are industrial nations and six -- Niger, Sierra Leone, Ghana, Nepal, Haiti, and Bangladesh -- are low-income nations. 3/

1/ In constructing the Adjusted SIPRI data, no offsetting adjustment was made to U.S. or U.S.S.R military expenditures. At most, their military aid to other nations amounts to only 2 or 3 percent of their military expenditure. An adjustment was made in Table 2 in order to maintain the same level of total world military expenditures.

2/ Nations with less than \$400 per capita in 1980, at official exchange rates.

3/ The use of GDP instead of GNP does not materially affect the results. In 90 percent of the countries, GNP and GDP were nearly equal. In ten countries, GDP exceeds GNP by over 10 percent; however, since nearly all of these are small low-income economies, a substitution of GNP for GDP would only further emphasize observed tendencies.

The reasons why certain countries spent more and others spent less are explored in numerous empirical studies. In a companion study, Hewitt (1991), econometric estimates are able to explain 55 percent of the variation. Among the economic variables, military expenditures are found to rise nearly proportionally to GDP and to rise somewhat less than proportionally to central government expenditure. Small low-income economies are found to allocate less to the military than the average; the heavily indebted countries also spent less and apparently cut back in the 1980s relative to the 1970s. Furthermore, financial assistance to a developing nation tended to engender increased military spending. This latter result indicates that by increasing the resources available to the government, financial assistance increases military spending. Among the political factors, the presence of international war or civil war led to higher levels of military spending; nations governed by monarchies, military governments, and socialist governments tended to spend more than multiparty democracies. Finally, the results confirm that the geographical characteristics of a nation, such as size and border length, tended to influence the level of military spending.

The last columns in Table 3 show the variance divided by the mean. This is a measure of the degree of volatility in country military expenditures -- a high value indicates countries that undertook drastic policy changes or whose military spending fluctuated widely. Fifteen countries more than doubled their spending as percent of GDP between the 1970s and the 1980s; 1/ half of these nations experienced increased internal or external conflict in the 1980s. Eleven countries more than halved their expenditures from 1972-79 compared to 1980-88. 2/ The countries that showed almost no variation in their level of military expenditures as a proportion of GDP were primarily industrialized nations or countries with very low military expenditures.

The country rankings based on SIPRI and Adjusted SIPRI military expenditures, columns 1 and 2 in Table 3, prove to be reasonably consistent. The arms import/military aid adjustment to the SIPRI figures had only a minor impact on the rankings. Although the aid was often quite important to the recipient countries, accounting for as much as half of total military expenditures, these countries tended to devote extensive domestic resources to the military. 3/ In a few countries the shift in rank is quite large:

1/ These are in order of importance: Nicaragua, U.A.E., Liberia, El Salvador, Tunisia, Trinidad and Tobago, Gabon, Honduras, Iraq, Chad, Ethiopia, Guatemala, Sri Lanka, Guyana, and Cuba.

2/ These are, in order of importance, Egypt, Iran, Zaire, Nigeria, Mali, Ghana, China, Somalia, Israel, Jordan, and the Philippines.

3/ To a large extent, the adjustment to the military expenditure figures serves to reinforce the existing rankings rather than alter them. For instance, Iraq is ranked 7th in both cases, while in the first its proportion of GDP spent on the military is 16 percent, and in the latter it is 22 percent; Greece is ranked 24th in both with levels of 6.3 and 7.1 percent respectively; Bolivia is ranked 58th in both with proportions of 3.4 and 3.7 percent.

Somalia's proportion of military expenditure to GDP rises from 3.5 percent to 7 percent, and its rank rises from 56th to 21st; the proportion in Myanmar rises from 3.8 percent to 6.1 percent, and its rank rises from 51st to 28th; Yemen PDR rises from a rank of 6 to 1 with a change from 16 percent to 37 percent of GDP. However, the questionable reliability of the data requires cautious interpretation of these results.

2. Rankings based on share of central government expenditure

Another means of ranking countries is via the proportion of central government expenditures allocated to the military. The ratio of military expenditure to central government expenditures for country groups from 1972 to 1988 is summarized in Table 4. ^{1/} The first three columns indicate the ratio of SIPRI military expenditures to central government expenditures. The last three columns show the ratio of central government expenditures to GDP.

Turning first to the share of government expenditures in the economy, the average ratio of central government expenditure to GDP was 30 percent. In Eastern Europe the average was higher (45 percent), and the industrial and developing countries averages were slightly below the world average. Among the developing nations, the Middle East and North Africa averages were well above the world average. This pattern reflects a number of well-known factors such as explicit political policies, level of development, and uneven distribution of revenues from natural resources.

The world average ratio of military expenditure to central government expenditures was 16.5 percent. The industrial country average was somewhat lower (14 percent), while Eastern European and developing countries had an average of 20 percent. Among the developing nations, Latin America, the Caribbean, and sub-Saharan Africa averages were well below the world average, while Middle East and Asian developing nations were well above.

Rankings based on the proportion of central government expenditure allocated to the military are an alternate measure of resource allocation decisions and the relative burden of the military. However, the results must be interpreted carefully because they depend on the size of the government and the level and nature of decentralization, as well as on the size of the military. Thus, the Taiwan Province of China had the highest ratio in the world because of its relatively small public sector; Yugoslavia ranked third because of the extreme decentralization of its government (Appendix Table 13). Additional examples where a relatively small level of central government expenditures caused a high ranking are Korea (15) and the United States (19). Most of the other countries that were at the top of the

^{1/} The figures in Table 4 reflect SIPRI military expenditures only; Adjusted SIPRI figures are not used in this case. To the extent that purchases of foreign military equipment are not recorded as part of military expenditure in a given country, there is a great possibility that they also were not recorded as part of central government expenditures.

Table 4. Central Government Expenditure Allocations
to the Military and Ratio to GDP

	SIPRI Military Expenditures			Central Government Expenditures		
	1972-88 ----- Average	1972-79 Average	1980-88 -----	1972-88 ----- Average	1972-79 Average	1980-88 -----
	(In percent of Central Government Expenditures)			(In percent of GDP)		
Industrial	14.3	14.9	13.7	27.7	25.8	29.5
Eastern Europe	20.7	20.9	20.6	46.5	44.9	47.9
Developing countries	20.0	22.2	18.0	26.5	25.4	27.4
Asian developing	27.2	33.4	21.7	21.5	22.1	21.0
Middle East	23.1	25.4	21.0	42.2	39.7	44.5
North Africa	17.1	21.8	13.0	44.2	43.8	44.4
Sub-Saharan Africa	12.8	13.4	12.2	24.5	23.4	25.4
Latin America and Caribbean	8.6	9.0	8.2	22.2	19.4	24.6
Total	16.5	17.6	15.6	30.1	28.9	31.1
Miscellaneous categories of developing countries:						
Heavily indebted	10.9	13.6	8.5	24.2	21.7	26.4
Small low-income economies	12.2	12.3	12.0	22.2	21.4	23.0

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

ranking of military expenditures to central government expenditure were also among the top twenty in the ranking of the ratio of military expenditures to GDP. Those countries that had a high ratio of military expenditure to central government expenditures but are not in the top twenty countries in Table 3 are the United Arab Emirates, ranked 6th with a ratio of military expenditure to central government expenditure of 35 percent; Chad, ranked 9th with a ratio of 32 percent; Peru, ranked 12th with a ratio of 29 percent; and Pakistan, ranked 14th with a ratio of 29 percent.

3. Military imports in developing nations

Another interesting issue is the extent to which imports of military equipment have used up scarce foreign exchange in developing nations. Appendix Table 11 indicates that the ratio of military imports to total imports averaged 7 percent among developing countries. The ratio of military imports to total imports was generally below average in sub-Saharan Africa, Latin America and the Caribbean, and Asian developing nations, while the ratio was nearly double the average in the Middle East and North Africa.

Certainly there are individual countries whose arms imports have been a high ratio of total imports. ^{1/} However, particularly for low-income and heavily indebted countries, the actual cash payment for arms imports has often been a very low proportion of the assessed value. According to Brzoska (1990), much of the military equipment purchased by these countries had a high grant element and favorable financing arrangements. Brzoska estimates that half the purchases from the United States and U.S.S.R. were financed through loans or grants and half were paid for in cash. Since most of the cash payments came from the net creditor nations, the evidence indicates that the others made only modest cash payments and reveals, in retrospect, that a high proportion of military-related debt has been forgiven. There are, undoubtedly, major exceptions to this tendency (see ACDA for more details). Furthermore, in a country that has severe foreign exchange restraints, purchases of foreign military equipment and supplies have an extremely high opportunity cost.

IV. Central Government Expenditure and Military Expenditure

The previous sections examine national military expenditures in proportion to GDP and in proportion to central government expenditures. The purpose of this section is to investigate how nations tended to finance military expenditures. Since resources available to the economy are fixed in the medium term, a nation that spends heavily on the military has to make choices between which other items to forgo. When a government undertakes to increase military expenditures, how does it finance the increase? Alternatively, when a government undertakes severe expenditure cutbacks, which types of expenditures bear the burden?

^{1/} For some countries, the average is well over 100 percent, an indication that arms imports were not fully reported in the official trade data.

A related issue is the effect of military expenditures on the economic growth of a nation. In industrial nations, it is widely believed that military spending benefits the economy. Benoit (1973, 1978) extended this idea to developing countries. Although Benoit found a weak positive association between high military expenditures and high economic growth in developing nations, subsequent testing of the Benoit thesis has produced substantially contradictory evidence (Appendix III). A less ambiguous approach to the issue of how military expenditures affect economic growth is provided by microeconomic analysis. Military expenditures promote growth by contributing to national productive capacity, such as construction of general-use public infrastructure, demobilization of trained personnel, or possibly by promoting modernization in civilian production. However, in the developing nations that import a substantial proportion of their military equipment, the scope for beneficial economic spinoffs is quite limited. Therefore, substitution of military expenditures for development expenditures is almost always detrimental to growth and economic development. Alternatively, substitution of military expenditures for private consumption may very well be growth promoting (see Appendix III). In any case, for countries that depend on military imports, the justification for military expenditure must come solely from demands for security benefits, not from incidental growth-promoting benefits.

When governments increase military expenditures, the methods of financing can be categorized into three basic options. Government can:

1. decrease social expenditures
2. decrease expenditure on economic services
3. increase the budget.

Although it is difficult to determine the exact incidence associated with each option, one can draw some simplified conclusions. Decreasing expenditures on social services will cause the poorer segments of society to pay a higher proportion of the costs, to the extent that they benefit from these expenditures. Decreasing expenditures on productive economic services (or development expenditures) will lead to lower levels of economic growth. Finally, increasing the overall size of the budget will lower private consumption in proportion to individual tax payments (current and future).

1. The mix of central government expenditures

Evidence on the pattern of trade-offs will be drawn from various sources. The military expenditure data in Tables 1 and 4 provide an indication of how expenditure patterns have changed in the past two decades. Three interesting changes in the pattern of government expenditures are apparent. First, world military expenditures as a proportion of GDP were lower in the 1980s than in the 1970s. Second, the proportion of central government expenditures to GDP increased in the 1980s relative to the 1970s. Finally, the proportion of military expenditures to central government expenditures fell (which follows automatically from the first two trends). Among the developing nations, military expenditures fell as a proportion of central government expenditures in all regions.

These patterns might at first seem paradoxical. Why did central government expenditures rise and military expenditures fall simultaneously? Table 5, which summarizes the mix of government expenditures for 51 developing countries during 1975-87, based on GFS data, provides an answer. 1/ The primary conclusion is that government expenditures rose to accommodate increased interest costs. The share of interest payments in central government expenditures increased nearly 80 percent for the entire sample and the increase ranged from 35 percent to 100 percent for the different country groups. Therefore, changes in expenditure patterns between the 1970s and 1980s present an instance of retrenchment; governments had to seek ways of funding their higher interest liabilities. This retrenchment exercise presents a very interesting case study. 2/

The basic conclusion that emerges from Table 5 is that social expenditures were protected in the majority of cases while military expenditures and expenditures on economic services were cut back. The share of central government expenditures allocated to the military fell 23 percent on a weighted average basis. 3/ Among the 51 countries, military expenditures fell in 21, did not change in 13, and increased in 17. 4/ The share allocated to economic services fell 17 percent; the share fell in 27 of the countries, did not change in 16, and increased in 8. In contrast, the average share of expenditures allocated to social services rose slightly; the share of social expenditures fell in 16 countries, stayed the same in 17 and rose in 18.

Although there was a great deal of variation among the regions, the same general pattern is observed in the Middle East, North Africa and Asian developing nations. In the Middle East and North Africa, the ratio of government to GDP fell 24 percent; the share of social expenditure in the budget increased nearly 19 percent; the share of military expenditure fell nearly 28 percent; and the share of economic services fell 33 percent. In the Asian developing nations, the ratio of government to GDP increased 10 percent; the share of social expenditures in the budget increased 7 percent, the share of military expenditures fell 10 percent, and the share

1/ The sample size is smaller because industrial countries are not included in the analysis in this section and because GFS coverage is more limited.

2/ The behavior of central government spending in this sample of 51 developing nations differs somewhat from the pattern observed in the larger sample. In Table 4, the level of central government expenditure to GDP rises in all the country groups except the Asian developing nations. For the countries covered in Table 5, the ratio of central government expenditures to GDP fell in the Middle East and Africa (see below).

3/ The weighted average was calculated by converting all expenditures into U.S. dollars, calculating the annual expenditure shares, and then averaging the annual shares.

4/ The "no change" designation is assigned when the average share from 1975-79 compared to 1980-86 changed less than 8 percent.

Table 5: Functional Mix of Central Government Expenditure, 1975-87
(In percent of central government expenditure)

	1975-79 Average	1980-87 Average	Percent Change	1975-82 Average	1983-87 Average	Percent Change
Developing countries (51) 1/						
Military expenditure	16.6	13.2	-23.1	15.2	13.6	-11.6
Social expenditure 2/	24.7	25.4	2.9	25.0	25.4	1.3
Economic expenditure	25.2	21.3	-17.0	25.0	19.9	-22.5
General public services and other 3/	33.4	39.6	16.8	34.7	41.1	16.9
Of which: interest	5.1	11.7	78.7	5.8	13.4	79.6
Asian developing nations (11)						
Military expenditure	18.5	16.8	-10.0	17.9	16.7	-6.8
Social expenditure	13.7	14.6	6.7	13.8	15.0	8.2
Economic expenditure	23.9	22.7	-5.2	24.2	21.6	-11.4
General public services and other	43.9	45.5	3.7	44.1	46.7	5.8
Of which: interest	6.1	9.4	42.1	6.5	10.8	49.8
Middle East and North Africa (12)						
Military expenditure	21.4	16.1	-28.0	19.5	16.0	-20.0
Social expenditure	25.3	30.7	19.2	26.6	31.9	18.0
Economic expenditure	26.0	18.6	-32.9	23.9	17.5	-31.1
General public services and other	27.3	34.7	23.7	30.0	34.7	14.5
Of which: interest	3.2	6.0	60.3	3.6	7.0	63.7
Sub-Saharan Africa (16)						
Military expenditure	14.0	10.6	-28.1	12.9	10.3	-22.9
Social expenditure	22.0	20.1	-9.4	21.4	20.0	-6.6
Economic expenditure	26.7	32.2	18.6	30.8	29.0	-5.8
General public services and other	37.2	36.2	-2.7	35.0	40.7	15.2
Of which: interest	6.2	12.6	68.7	6.8	15.6	78.9
Latin America and Caribbean (12)						
Military expenditure	6.5	5.5	-17.2	6.1	5.6	-8.4
Social expenditure	38.7	32.9	-16.0	37.8	30.9	-19.9
Economic expenditure	24.4	20.7	-16.5	24.3	18.6	-26.4
General public services and other	30.4	38.8	24.3	31.9	44.9	33.9
Of which: interest	6.8	21.7	104.2	7.9	29.0	114.8
Heavily indebted nations (10)						
Military expenditure	9.4	7.9	-17.2	8.6	8.4	-2.4
Social expenditure	30.4	28.3	-7.1	30.3	27.8	-8.6
Economic expenditure	25.5	21.7	-16.0	26.4	19.3	-31.0
General public services and other	34.6	40.5	15.6	34.7	44.5	24.7
Of which: interest	6.3	19.4	102.2	7.2	23.5	106.4
Small low income economies (14)						
Military expenditure	10.9	11.5	5.4	11.2	11.5	2.4
Social expenditure	30.4	26.7	-13.1	29.1	26.5	-9.5
Economic expenditure	21.8	25.8	16.8	22.6	26.9	17.4
General public services and other	36.8	35.9	-2.4	37.0	35.1	-5.4
Of which: interest	5.6	8.0	34.7	6.4	8.2	24.8

Source: Government Finance Statistics Yearbook.

1/ The figure in parentheses is the number of countries in each group.

2/ Includes expenditures on education, health, housing, and social security.

3/ Includes expenditures on general public services, recreation, and unclassified expenditure.

of economic services fell 5 percent. Thus, in these two regions, social services were found to be the highest-priority sector; the share allocated to military expenditures and economic services was cut substantially.

In sub-Saharan Africa a somewhat different pattern emerges. The ratio of government to GDP fell 6 percent; the share of social expenditures in the budget fell 9 percent; the share of military expenditures fell 28 percent; and the share of economic services rose 19 percent. Thus, in this region social services were cut and economic services increased. In Latin America and the Caribbean, the ratio of government to GDP increased 17 percent; the share of social expenditures in the budget fell 16 percent; the share of military expenditures fell 17 percent; and the share of economic services fell 17 percent. The heavily indebted nations displayed a similar pattern. However, the small low-income economies were able to increase expenditures on economic services while increasing military expenditures somewhat and decreasing social expenditures substantially; the ratio of government to GDP rose 3 percent.

The results derived in this section should be treated cautiously. Since allocation decisions of governments are political in nature, they are not necessarily amenable to generalizations. What happens in one country in one particular year may have no bearing on what will happen in another year or another country. For instance, a comparison of 1975-82 to 1983-87 in the last 3 columns of Table 5, using the same countries, produces a slightly different conclusion. Military and economic expenditures still fall and social expenditures rise on average. However, the adjustment in economic services now exceeds that of military expenditures.

A recent study by De Masi and Lorie (1989) examined countries with Fund programs and reached different conclusions. Their review of the level of military spending in countries undergoing economic adjustment found that military spending was somewhat resilient. The proportion of military spending in the total budget fell in countries where government spending increased, and the proportion rose in countries where government spending fell. The different findings are attributable to the considerable differences in country coverage and the different time frames of the studies -- the present study covers a much longer time period. Also De Masi and Lorie did not examine the other government expenditure items.

Another set of studies, Hicks (1984, 1988, 1989), found support for the conclusion that social expenditures were more resilient than military and development expenditures. These studies investigated the pattern of expenditures in countries that decreased real government expenditures in the 1980s, in one case, and the pattern in highly indebted countries in another. Governments were found to have placed a disproportionate share of the burden of adjustment on capital expenditures, thus economic services were found to carry a higher share of adjustment. In contrast, current expenditures, which consist of military, social, and general public services, were more resilient. Among current expenditures, social expenditures were found to be more resilient vis-à-vis military expenditures.

2. Budget level and the share of the military

Econometric studies add further insight into government policies. The empirical results reviewed in Hewitt (1991) indicate that the proportion of military expenditure in central government budgets is basically stable; when governments expand or diminish overall spending, the share allocated to the military does not change a great deal. The results obtained in Hewitt (1991), using the full sample of 125 nations, indicate a somewhat different relationship. The elasticity of military expenditures with respect to central government expenditures is found to be 0.75, indicating that military expenditures adjust slightly less than proportionally to central government expenditure changes. A decrease or increase in central government expenditures leads to a less than proportional decrease or increase in military expenditures, a finding that is consistent with De Masi and Lorie.

An additional result in Hewitt (1991) is obtained from an equation with central government expenditure divided by GDP as the dependent variable. The elasticity of central government expenditures with respect to military expenditures is estimated to be 0.18. This implies that when military spending rises or falls, central government expenditures rise or fall by less than one fifth the amount, in percentage terms. This level is surprisingly close to the average proportion of military expenditures to central government expenditures (Table 4). Thus, the result can be interpreted as indicating that autonomous changes in military expenditures are accommodated by an equal increases in the budget, in absolute terms. The budget expands to accommodate increases in military expenditures without crowding out other types of expenditures (Hewitt (1991)).

The overall conclusions are hardly definitive. When the central government budget expands, the military expands, but by a slightly smaller ratio. When external events cause an autonomous increase in the military budget, the central government budget expands to accommodate these excess military expenditures, and the level of other types of government expenditure remain unchanged. The limited GFS sample of developing nations indicates that developing countries in the 1980s reacted to increased interest costs by increasing overall expenditure levels somewhat and reallocating expenditures within the central government budget. Among the items whose share was cut back, military expenditures and expenditures on economic services (development expenditures) were the primary targets. In the majority of cases, the most resilient sector proved to be social services.

V. Conclusions

The most basic message from economic analysis is that there are opportunity costs associated with support of the military. Countries that allocate a large portion to the military -- for instance, the ten countries that have consistently allocated over 15 percent of their GDP and other countries that have spent over one fourth of their central government budget

on the military -- are spending more on the military than on development or capital formation, and in some cases more than on food or housing.

The facts and issues covered in these studies have important policy implications. Military expenditures divert resources from other areas, such as social and economic services. While some have argued that military expenditures enhance economic growth, there is no question that more efficient alternative means of using the resources exist that would provide greater benefits to the economy (see Appendix III). Justification for military expenditures must be based on security needs and the security benefits such expenditures provide to a nation, not on incidental economic-growth benefits. For these reasons, military expenditures can be designated as "unproductive expenditures."

Additionally, from a worldwide perspective, there is a strong case for coordinated decreases in military expenditures. Although military expenditures may provide benefits to a given nation, they have a negative impact on the welfare of rival nations, and therefore on a worldwide basis national military expenditures do not enhance global welfare. A coordinated reduction in military expenditures that does not change the strategic balance will increase economic well-being in the world (Appendix II).

Finally, the evidence indicates that military expenditures are quite reactive to financial constraints. Therefore, without controls or pressure, foreign financial assistance both enables and encourages a nation to spend more on the military.

The Data

The data sources for this study are the World Bank, the United Nations, the Stockholm International Peace Research Institute (SIPRI), the US Arms Control and Disarmament Agency (ACDA), and the U.S. Central Intelligence Agency, in addition to external Fund publications. In a number of cases, published national accounts were used as a supplement. The military expenditure figures are derived primarily from SIPRI. The SIPRI estimates are useful because they are provided in local currency. Furthermore they are more reliable because their coverage is clearly defined, comprehensive, and consistently applied to each country. Two types of modification to the SIPRI data are applied. First, a number of countries are omitted from the SIPRI data. Most of these countries are small enough that their exclusion is unlikely to materially affect the findings. However, SIPRI does not provide estimates of military expenditures of the U.S.S.R. and China, two extremely important military powers.

The data base uses ACDA estimates for China military expenditures, the only known time series source. In the case of the U.S.S.R., estimates of military expenditures are based on Steinberg (1990). The main advantage of Steinberg's estimates is that they are provided in current rubles, whereas the ACDA data are in U.S. dollars. Furthermore, Steinberg's definition is comprehensive and compatible with SIPRI's definition. Steinberg's methodology starts with published U.S.S.R. military expenditures and adds unpublished military expenditures, estimated by attributing unaccounted expenditures in the U.S.S.R. national accounts to the military. Since this methodology produces upper-limit estimates of military expenditures, an adjustment is made. On the basis of alternative annual estimates of U.S.S.R. military expenditures -- see Deger and Sen (1990), SIPRI Yearbooks, ACDA -- a reasonable figure for 1989 military expenditures is 105 to 110 billion rubles. Since Steinberg's figure for that year is 120 billion rubles, this implies a 10 percent overestimation. 1/ Therefore, on the basis of this comparison, a 10 percent downward adjustment was applied to the entire Steinberg time series of U.S.S.R. military expenditures. The reader is cautioned that the military expenditure figures of both the U.S.S.R. and China are not as reliable as the other figures. However, it seems likely that they provide a credible estimate of the trend.

The second major modification to the SIPRI data concerns the coverage or definition of military expenditures. As explained in Section II, the SIPRI figures do not include foreign aid financed expenditures in the military expenditures of the recipient nations. The reasons for this are probably practical; many nations do not include foreign-financed military expenditures in their government budget and, therefore, accurate estimates would be difficult to compile. The SIPRI figures therefore are meant to

1/ The official U.S.S.R. military expenditures figure is 77 billion rubles for 1989. However, this explicitly does not account for paramilitary expenditures of government and off-budget military costs, such as subsidized production of military equipment and supplies for use by the Defense Ministry and for foreign sales.

indicate the domestic opportunity cost of government appropriations to the military. Foreign aid-financed military expenditures are deemed to have no domestic opportunity cost.

There are a number of inherent weaknesses in the SIPRI definition that lead to potentially serious underestimates of even the domestic cost of the military in the long run. One problem stems from the fact that a certain portion of military aid is given in the form of loans to be repaid in the future and therefore carry an interest cost. For the SIPRI definition to be fully consistent, the costs of military loan repayments and interest payments must be added. However, such adjustments are inherently difficult to make because foreign-interest payments and loan repayments tend to be lumped together in government accounts. In most countries, it is impossible to follow the progress of individual loans.

There are two additional problems with the SIPRI figures. It is likely that a large portion, if not all, of foreign-financed acquisitions of military equipment and supplies are not covered in the SIPRI definition of military expenditure because many governments treat all foreign-financed military expenditures as off-budget items. Thus, in developing countries it is likely that military purchases financed by commercial foreign credit as well as military aid are not contained in the government accounts and are therefore missed in the SIPRI figures. An additional problem is that, in a macroeconomic sense, it is very likely that there is an indirect domestic opportunity cost for military expenditures financed through military aid. Military aid is to some degree fungible. A nation that receives military aid can divert funds formerly intended for the military to other uses simply by lowering domestic military expenditures below originally planned levels. Furthermore, the exact distinction between economic assistance and military assistance is at times murky.

For these reasons, it is preferable to define the military expenditures of a nation as consisting of all military expenditures, regardless of the means of financing, consistent with Fund accounting methods. Ideally, this can be accomplished by adding the off-budget military expenditures to the SIPRI figures. There are reasonably reliable figures from ACDA on the level of foreign military purchases. Furthermore, in a number of cases the foreign purchases exceed the SIPRI military expenditures. It is quite clear in these cases that they have been excluded and that an adjustment to the SIPRI military expenditure figures is warranted. However, there is no sure way of knowing to what extent foreign purchases are off-budget items for individual countries. Therefore, one is faced with the dilemma of using SIPRI military expenditure figures that are known to systematically underestimate military expenditure or of relying on imperfect means of adjusting the data to offset the error.

To correct for the measurement error, an alternative set of military expenditure figures has been constructed on a formula basis. The resulting estimates, the **Adjusted SIPRI** figures, must therefore be viewed as simulations rather than as concrete estimates. They are not meant to be interpreted as actual military expenditure figures in individual cases but

are an estimate of the total funds made available to the military, provided the assumptions delineated below are reasonably accurate.

The Adjusted SIPRI military expenditures are constructed from arms imports data provided by ACDA, supplemented with U.S. foreign military aid figures. A three-year moving average is used to diffuse any problems associated with the timing of deliveries. The following assumptions are then applied.

1. Net creditor nations that purchased military goods from industrial countries are assumed to have paid for the equipment and to have reported these purchases within their military budgets, therefore no adjustment is needed. The same assumption is applied to purchases by industrial countries. 1/
2. For other developing nations that acquired military goods from industrial countries, it was assumed that 80 percent of the arms purchases are unrecorded in the SIPRI figures, due to grant and credit financing. Brzoska (1990) estimates that 50 percent of arms sales by the U.S. are funded either through grants or credits. Since these figures include sales to other industrial nations and net creditor nations as well as developing nations, they are consistent with the 80 percent assumption used herein.
3. Owing to the way SIPRI military expenditures are estimated, as outlined in the text, the larger figure of aid versus arms imports was used for major U. S. military aid recipients.
4. The valuation of Eastern European military equipment presented a problem because most transactions are not subject to market influences. In order to avoid too much reliance on politically sensitive information sources, it is assumed that the total value of unrecorded arms transfers from Eastern Europe to developing nations equaled the total unrecorded arms transfers from the industrial countries to developing nations in 1972-88. This assumption relies on the notion that the military balance of power between the Eastern bloc and the Western bloc has on average been at parity with respect to supplying arms to the third world on a concessional basis. Applying this assumption leads to an average yearly transfer of \$5.9 billion from 1972 to 1988 to developing nations from both sides. The implied weight on the ACDA valuation of Eastern European arms transfers to developing nations is 52.5 percent. Compared with the 80 percent factor used for industrial countries, this is an effective discount of 35 percent on the ACDA valuations of Eastern European military arms. See Brzoska (1990) for a discussion of the valuation problems associated with arms transfers from Eastern European countries.

1/ With the exception of Portugal and Spain, which received US military assistance in certain years and therefore an adjustment was made to account for the aid.

5. An adjustment was also made for transfers between the U.S.S.R. and other Eastern European nations based on the same formula (52.5 percent).

One of the primary conclusions that is derived from the analysis of the SIPRI data as opposed to the Adjusted SIPRI data is that the seemingly major adjustment has only a minor impact on the results. To the extent that the adjustment for foreign acquisitions of military equipment does not change the findings, the adjustment confirms that the SIPRI estimates are a workable basis for assessing the level of military expenditures. In the few cases where there is a large impact, the reader is cautioned to confirm the accuracy of the Adjusted SIPRI estimates for the country before drawing any policy conclusions. One desirable outcome of this research would be the generation of studies that check the accuracy of the estimates of military expenditures in a variety of countries.

All the share figures in the text are based on official exchange rates. Official exchange rates do not always provide a reliable means of comparison for a number of reasons. Serious differences exist between the price structures in different countries. The official rates of exchange are often administered prices rather than market clearing prices. Finally, the market clearing exchange rate does not necessarily reflect real purchasing power of incomes within each country. An alternative measure, purchasing power parity (PPP), designed to indicate real purchasing power of currencies, has been developed over the years. Table 7 shows four alternative comparisons of the share of world military expenditure in 1980 based on PPP estimates from Summers and Heston (1988), using real growth rates to update their figure for 1986, 1987, and 1988. Column 1 shows SIPRI military expenditure shares based on official exchange rates, column 2 Heston's (1990) data based on official exchange rates, column 3 the converted SIPRI military expenditure shares based on PPP exchange rates, and column 4 Heston's data based on PPP. 1/

The PPP conversion leads to a substantial share decrease for industrial countries (by one fourth) and a tripling or doubling of the share for the Asian developing countries. The relative shares of the other groups are reasonably invariant between the two methods. These results indicate that the real GDP of Southeast Asian countries is under-represented by official exchange rates. However, the degree of correction is questionable. For instance, behind the Column 3 shares, the PPP valuations of U.S.S.R., U.S. and Chinese military spending in 1980 are virtually equal, a most unlikely coincidence. Thus, although PPP conversions indicate the direction of error that the official exchange rates engender, they clearly exaggerate the extent of the error with respect to military expenditure. There may be a problem with cost versus value.

1/ The SIPRI figures and Heston's raw data differ somewhat, primarily because Heston used an extremely low figure for the U.S.S.R. and China. Heston's estimates of PPP military expenditure shares adjust for the relative proportion of current versus capital expenditures in the military budget.

Economic Theory of Defense and Military Expenditure

This appendix provides a review of the public finance theory of defense, along the lines of Stiglitz (1988). First, the relationship between military expenditures and defense needs clarification. Economists generally consider military expenditures to be an input or a cost of providing defense. Defense is therefore an output, ideally measured by the level of security from external attack provided by alternative levels of military expenditures, given the external political environment. However, much like the notion of utility, the notion of defense is somewhat fictitious and cardinal numerical scales of the level of security probably have little meaning. Furthermore, the level of defense is a monotonic function of military expenditures and military expenditure is a suitable proxy for the level of defense, provided the efficiency factor remains constant.

Traditional public finance theory offers an extensive analysis of the optimal level of government expenditures on public goods. Since defense is a textbook example of a pure public good that exhibits the characteristics of nonrival consumption and nonexcludability, it appears to be an ideal case for the application of this theory. ^{1/} However, defense combines a series of separate market failures and therefore does not lend itself to traditional public finance treatment. In essence, the optimal level of military expenditure is a political, normative, and moral issue and is not amenable to economic analysis. These factors lead to the conclusion that the role of economics in analyzing military expenditures is somewhat different from other areas of public policy. Economic analysis is well suited to measuring the economic costs of the military; for instance, the types of economic trade-offs that exist and the impact of military expenditures on economic growth. Economic and statistical techniques can be used to analyze the political and economic factors that appear to influence the demand for military spending and thus provide a better understanding of the motivations involved in choosing a given level of defense. The area where economics is quite limited is in determining the proper level of military expenditure.

One can see the difficulty in applying the traditional theory of public goods to military expenditures by examining some of the details of the theory. The optimal expenditure on a public good is the level that equates total marginal willingness to pay with marginal cost of supply. This implies that the mix and size of the budget should be based upon aggregate demand for military expenditures and other government goods, in conjunction with technical cost data. Whether or not the government chooses to follow policies that reflect the wishes of the population will depend upon the efficacy of the political choice mechanism. Furthermore, the social demand for government goods is meaningful only when consumer preferences are

^{1/} Nonrival consumption means that when a nation admits another citizen or loses a citizen, the costs of national defense are unaltered. Non-excludability means that a new citizen cannot be denied protection from external threat, even if the person manages to evade payment.

reasonably exogenous to the political process and consumers are sufficiently well informed to form meaningful demand functions for the various potential items of public expenditure.

One of the most serious problems in applying the above theory to defense arises from the difficulty of making assessments of the personal utility impact of military expenditures. There is little agreement among experts regarding the link between military expenditures and defense benefits. The major points of disagreement are on the dangers of invasion, the impact of military expenditures in preventing invasion, the defense value of alternative weapons systems, and the extent to which military expenditures promote other national goals. Furthermore, the public at large is notoriously poorly informed about the level and composition of military spending. 1/ Given these severe informational problems, it is not clear whether popular perceptions, as indicated by public demand, are relevant to the optimal level of military expenditures -- summing the individual demand for defense does not carry the same kind of compelling interpretation as with park expenditures or roads.

Another complicating factor is that demand for military expenditures is to a large extent **endogenous in the political system**. The stance and actions of a nation's political leaders influence perceived demand for military expenditures. Furthermore, the level of military expenditure and the political stance of neighboring states can also have an effect. Explicit endogeneity of demand and interdependence violates a major premise behind the economic analysis of the optimal level of government expenditure.

A further complication results from uncertainties regarding the eventual use of military power. Since defensive capabilities can be used for **internal control**, military expenditures can be beneficial to certain groups in a country while being detrimental to other sectors of the population. When the military functions primarily to influence domestic political events, defense loses its justification as a public good and the standard analysis of optimal supply has no relevance. Instead, there is likely to be a zero-sum game or an overall decrease in social welfare (a negative-sum game).

Finally, the **global perspective** on military expenditures is almost the polar opposite of the domestic perspective. Internationally, defense expenditures are welfare diminishing. In a simple two-state world, military expenditures of one nation have negative utility consequences for the other nation. In this manner, just like trade barriers, noncooperating states will spend too much on the military. There is a prisoner's dilemma -- a simultaneous decrease in military expenditures that does not alter the strategic balance will increase the welfare of both nations. This conclusion can easily be extended to more complicated settings where competing alliances exist in the context of many nations. Although allies

1/ In fact, it is rational for the public to remain uninformed because each citizen has very little power to influence defense policy and many defense facts are officially secret.

will benefit from military expenditures, the welfare losses of rivals will on average outweigh these gains. This international aspect of defense means that defense is indeed an unusual public good. While infrastructure and human capital expenditures increase the world productive capacity and therefore unambiguously improve global welfare, the domestic benefits of military expenditures are generally offset by the disutility they impose on those living outside the security zone.

To understand the implications of the international negative externality, consider a new nation that is contemplating the guidelines for its new government. Domestically, defense is both a public good and a merit good. If the nation chooses to rely on individual initiative to support defense, the projected support from voluntary private contributions would be relatively low. Government technocrats could increase social welfare by funding defense with tax revenue and increasing total expenditures. However, an even greater welfare-improving solution would be for the technocrats to negotiate with technocrats in other nations to agree on a mutually beneficial low level of military expenditures in each country. Ironically, the international cooperative solution could conceivably result in lower levels of defense expenditure than would have arisen from voluntary contributions. However, the international cooperative solution is very difficult to obtain. It is similar to a cartel arrangement and carries all the difficulties involved as such, including natural incentive to cheat (or, equivalently, remaining outside the cartel can be welfare improving for any single country).

In the absence of a cooperative solution, economic theory suggests a hypothetical correction for the negative externality. A global international agency with the proper authority could improve global welfare by imposing a military fine on each nation. The agency could then simply return the money to national governments on a formula basis. Under fairly reasonable assumptions, national defense budget decreases would be sufficient to pay the national fines, even if the revenue were not returned. 1/ Therefore, each and every country would be better off.

1/ If the price elasticity of demand is unity, this result would occur. To the extent that desired military spending is influenced by the level of military spending in other nations, a much weaker condition would suffice.

Military Expenditures and Economic Growth

The controversial issue of how military expenditures affect the economic growth of a nation has given rise to numerous theoretical and empirical studies. Appendix Table 13 reproduces the results of four cross-section empirical studies of the relationship between defense spending and economic growth. Benoit is credited with first proposing the thesis that military expenditures are not necessarily detrimental to national growth. For instance in Benoit (1978), the dependent variable is the average annual growth rate between 1950 and 1965 (Table 13.B). The independent variables -- private investment as a proportion of GDP, net economic assistance, and defense spending -- all have a positive impact on growth; however, defense spending is significant only at the 80 percent level of confidence. From this latter result, one can conclude with a 90 percent level of confidence that the effect of defense spending is non-negative. This disproves Benoit's maintained hypothesis that defense expenditures have a negative impact on growth. Frederiksen and Looney (1982) derive virtually identical results in a retest of Benoit's hypothesis using data from 1960-78 (Table 13.C). Investment and military expenditures are positively associated with growth, but the t-ratio for military expenditure is marginally insignificant.

The econometric formulation of these two studies has been widely criticized. In a simple OLS model, there is no attempt to analyze the transmission mechanism between military expenditure and growth. Deger and Smith (1983) carried out a much more sophisticated analysis of growth in a well-formulated simultaneous equations model (Table 13.D). The three dependent variables in the system are GDP growth, the ratio of savings to GDP, and the ratio of military expenditures to GDP. In summary, their findings show that the direct impact of military expenditures on growth is indeed positive and significant. However, the effect of military expenditures on the savings ratio is negative and significant, and the latter's impact on growth is positive and significant. Therefore, in total, military expenditures have a negative effect on growth because the negative indirect effect is of a higher order of magnitude than the positive direct effect.

On the basis of these three studies, statisticians would tend to support the finding that the correlation between growth and the military is negative since the simultaneous equations model is more sophisticated. However, the causes of growth are still an unsolved mystery to economists and in all likelihood, the simultaneous equations model is also misspecified -- as indicated by the R-square of 23 percent in the growth equation, which is much lower than that associated with their other equations. An alternative specification could reverse the results again. Until it is possible to adequately explain growth, it is impossible to provide definitive empirical conclusions as to the impact of military expenditures on growth.

An alternative method of investigating the growth implications of military expenditures is a micro approach, which involves a disaggregated

examination of the composition of military expenditures. The object is to determine which elements of the military budget might have growth-enhancing effects and which elements exclusively provide defense benefits. Such an approach, explained in more detail below, is more compelling than the macro approach because it focuses on the resource allocation issue in a long-run context -- how military expenditure will affect growth in a long-run context when sustained high or low levels of military expenditure are maintained.

The methodology is relatively straightforward, though tedious, and involves measuring how or to what extent expenditures increase civilian productivity. In this manner, a certain percentage of military expenditure can be identified as investment expenditure and the remaining portion is definitionally regarded as consumption expenditure. The first-round growth-enhancing expenditures of the military are as follows. The military can increase civilian productivity by providing public infrastructure, such as roads or port facilities that are used by private businesses or consumers. 1/ These infrastructure expenditures should be discounted to the extent that they are not available for private use or to the extent that they are not useful to the public (such as an isolated border road). The next channel through which the military can enhance civilian output is through training. The discounted value of the human capital of demobilized soldiers enhances civilian productivity. Finally, research and development activities of the military can enhance civilian productivity provided they have civilian applications.

The extent to which military expenditure is equivalent to government provision of economic services depends upon the composition of military expenditure. The decomposition process will undoubtedly find that in most countries military expenditures are more productive than government consumption expenditures (e.g., government administrative costs and transfer programs), but less productive than government provision of economic services (e.g., support of development projects). There are numerous secondary considerations that might shift the weighting factor in one direction or the other. For instance, to some extent the military has preferential access to scarce resources. There may also be some more remote ways in which military expenditure enhances civilian productivity that would become apparent in conducting the analysis.

The final impact of military expenditures on growth will then depend upon the alternative use of military funds. All growth benefits attributed to the military can be achieved more efficiently and at a lower cost with a program that directly sets out to achieve that purpose -- for instance, education and health expenditures are more efficient means of enhancing human capital; public works programs are more efficient means of providing rural infrastructure. Therefore, defense spending can promote growth if it

1/ Housing or other accommodations for military personnel, although counted as investment in the GDP, should not be counted as growth-enhancing expenditure in this case because these expenditures represent a form of compensation to soldiers. They are either in-kind factor payments or transfers.

crowds out (or replaces) private consumption or government consumptive expenditures; however, its impact on growth will be negative if the alternative use of funds is either private investment or reasonably efficient government infrastructure. 1/ Furthermore, the impact of military expenditures on growth will vary in time and place. Inconsistent empirical findings, as in fact exist, are predicted.

In line with the micro approach, Aschauer (1989) conducted an empirical test of the productivity of military expenditure (Table 13.A). These results indicate that in the United States, government expenditure on infrastructure is found to have a positive and significant effect on growth while defense capital expenditures have virtually no impact. Thus, these initial findings indicate that the positive impact of military spending on civilian production is insignificant. However, these results are subject to verification in other countries and in other time periods.

Finally, a major distinction must be made between countries that are net importers of military goods and those that are net exporters of military goods. In net exporting countries, the military increases the level of available foreign exchange for alternative uses. From the perspective of the economy, profit-making arms for export industries are an effective means of increasing the country's productive capacity. However, governments tend to subsidize the arms industry, in which case, as with any other subsidized industry, such actions represent an inefficient use of resources, and the contribution of such businesses to the economy is likely to be negative.

1/ See Eberts (1990) for empirical research that establishes the importance of infrastructure for determining civilian output.

Table 6. Categories of Countries

Net Creditor	Heavily Indebted Middle-income <u>1/</u>	Small Low-income Economies <u>2/</u>	Industrialized <u>3/</u>	Sub-Saharan Africa <u>5/</u>	North Africa <u>5/</u>	Latin America and The Caribbean	Eastern Europe <u>4/</u>	Asian Developing	Middle East
Iran	Argentina	Benin	Australia	Angola	Algeria	Argentina	Bulgaria	Bangladesh*	Bahrain*
Kuwait	Bolivia	Burkina Faso*	Austria	Benin	Egypt*	Bolivia	Czechoslovakia	China	Cyprus*
Libya	Brazil	Burundi	Belgium	Botswana*	Libya	Brazil	German Democratic Republic	Fiji*	Iran*
Oman	Chile*	Cameroun*	Canada	Burkina Faso*	Morocco*	Chile*	Republic	India*	Iraq
Saudi Arabia	Congo	Central African Republic	Denmark	Burundi	Tunisia*	Colombia	Hungary	Indonesia*	Israel*
Taiwan	Costa Rica*	Chad	Finland	Cameroon*		Costa Rica*	Poland	Korea*	Jordan*
Province of China	Côte d'Ivoire	Ethiopia*	France	Central African Republic		Cuba	Romania	Malaysia	Kuwait*
United Arab Emirates	Egypt*	Ghana*	Federal Republic of Germany	Chad		Dominican Republic*	USSR/Lavla	Myanmar*	Lebanon
	Mexico*	Guinea-Bissau	Greece	Congo		Ecuador*	Yugoslavia	Nepal*	Oman*
	Morocco*	Guyana	Ireland	Cote d'Ivoire		El Salvador*		Pakistan*	Saudi Arabia
	Nicaragua	Haiti	Italy	Ethiopia*		Guatemala*		Philippines*	Syrian AR
	Nigeria*	Kenya*	Japan	Gabon		Guyana		Sri Lanka*	Turkey*
	Peru*	Liberia*	Luxembourg	Ghana*		Haiti		Taiwan	United Arab
	Philippines*	Madagascar	Netherlands	Guinea-Bissau		Honduras		Province of China	Emirates
	Venezuela*	Malawi*	Norway	Kenya*		Jamaica		Thailand	Yemen AR <u>6/</u> *
		Mali*	Portugal	Liberia*		Mexico*			Yemen PDR
		Mauritania	Singapore	Madagascar		Nicaragua			
		Mozambique	Spain	Malawi*		Panama*			
		Myanmar*	Sweden	Mali*		Paraguay*			
		Nepal*	Switzerland	Mauritania		Peru*			
		Niger	United Kingdom	Mauritius*		Trinidad & Tobago			
		Rwanda	United States	Mozambique		Uruguay*			
		Senegal		Niger		Venezuela*			
		Sierra Leone		Nigeria*					
		Somalia		Rwanda					
		Sri Lanka		Senegal					
		Sudan		Sierra Leone					
		Tanzania		Somalia					
		Togo*		South Africa					
		Uganda*		Sudan					
		Zaire		Swaziland*					
		Zambia*		Tanzania					
				Togo*					
				Uganda*					
				Zaire					
				Zambia*					
				Zimbabwe*					

1/ Heavily indebted countries are nations with an external debt to exports ratio in excess of 3 and an external debt to GDP ratio in excess of 0.8. Nations that met these criteria that are not in the WED list were Congo, Costa Rica, Egypt, and Nicaragua. The countries that were deleted from the WED list were Colombia, Uruguay, and Yugoslavia.

2/ Small low-income economies: This category consists of nations with a per capita income of less than US\$400 in 1980 and a population less than 50 million. Bangladesh and Pakistan were eliminated from the WED list of small low-income economies group since they rank eighth and ninth in population among the world nations.

3/ Industrial nations: Singapore was added to the WED list.

4/ Eastern Europe: This is another category that was created to replace "other Europe." It includes Yugoslavia in addition to the Warsaw treaty organization members.

5/ North Africa and sub-Saharan Africa replace the WED category of Africa.

6/ These two countries are now united.

* Countries included in the GFS data, Table 5.

Note: The term "country" used in this report does not in all cases refer to a territorial entity that is a state as understood by international law and practice. The term also covers some territorial entities that are not states but for which statistical data are maintained and provided internationally on a separate and independent basis.

Table 7. Alternative Estimates of Relative Shares of World Military Expenditure, 1980

	<u>SIPRI Military Expenditures</u>		<u>Heston's Raw Data</u>		<u>Purchasing Power Parity Estim. Using SIPRI Data</u>		<u>Heston's Purchasing Power Parity Estimates</u>	
	Billion US\$	Share of Total	Billion US\$	Share of Total	Billion US\$	Share of Total	Billion US\$	Share of Total
Industrial	280	50.0	333	57.4	240	38.7	301	43.9
Eastern Europe	129	24.2	114	19.6	146	23.6	173	25.3
Developing countries	123	23.1	134	23.1	234	37.7	211	30.8
Asian developing	47	8.9	50	8.5	147	23.7	108	15.8
Middle East	42	8.0	58	9.9	46	7.3	69	10.0
North Africa	8	1.4	6	1.1	10	1.6	9	1.3
Sub-Saharan Arica	10	1.8	11	1.8	12	2.0	14	2.1
Latin America and Caribbean	16	3.0	10	1.6	19	3.1	11	1.6
Total	531	100.0	584	100.0	621	100.0	685	100.0
<u>Miscellaneous categories of developing countries</u>								
Net creditor	35	6.5	38	6.5	32	5.2	35	5.1
Net debtor	88	16.6	96	16.5	202	32.5	176	25.7
Heavily indebted	23	4.4	18	3.1	31	4.9	22	3.3
Small low-income economies	3	0.6	4	0.8	5	0.7	7	1.0
<u>Large countries</u>								
China	27	5.2	30	5.2	117	18.8	77	11.2
France	26	5.0	29	5.0	21	3.3	24	3.5
India	5	0.9	5	0.9	9	1.5	11	1.6
United Kingdom	25	4.8	31	5.3	26	4.3	32	4.6
United States	144	27.1	185	31.9	127	20.4	173	25.3
USSR	112	21.2	89	15.4	122	19.7	135	19.7
Total	341	64.1	369	63.7	422	68.0	451	65.8

Sources: Heston (1990), Hewitt (1991), Summers and Heston (1988).

Table B. Military Expenditures as Proportion of GDP, 1972-79 and 1980-88

	1972-79				1980-88			
	Rankings		Averages		Rankings		Averages	
	SIPRI	Adjusted SIPRI	Adjusted SIPRI (In percent of GDP)	SIPRI	Adjusted SIPRI	Adjusted SIPRI (In percent of GDP)	SIPRI	Adjusted SIPRI
Algeria	75	64	2.2	3.1	97	80	1.9	2.8
Angola	...	...	...	...	5	2	17.2	29.1
Argentina	34	26	4.7	4.7	42	49	4.6	4.6
Australia	63	72	2.7	2.7	75	84	2.6	2.6
Austria	107	110	1.2	1.2	114	116	1.2	1.2
Bahrain	52	54	3.6	3.6	34	43	5.2	5.2
Bangladesh	109	106	1.2	1.3	106	106	1.6	1.8
Belgium	61	67	3.0	3.0	63	73	3.1	3.1
Benin	97	71	1.6	2.8	92	74	2.0	3.1
Bolivia	68	68	2.6	3.0	49	51	4.1	4.3
Botswana	46	42	4.1	4.9	58	63	3.2	3.5
Brazil	103	108	1.3	1.3	113	115	1.2	1.2
Bulgaria	49	48	3.8	4.5	40	35	4.6	6.0
Burkina Faso	71	76	2.3	2.5	68	59	2.9	3.7
Burundi	72	73	2.3	2.7	65	61	3.0	3.6
Cameroon	91	94	1.7	1.8	95	93	2.0	2.3
Canada	87	92	1.9	1.9	91	97	2.0	2.0
Central African Rep.	77	80	2.2	2.3	93	104	2.0	1.8
Chad	54	52	3.5	3.8	31	20	5.7	8.4
Chile	17	21	6.2	6.7	15	21	7.9	8.3
China	8	9	12.2	12.2	27	33	6.3	6.3
Colombia	106	107	1.2	1.3	90	91	2.1	2.3
Congo	41	36	4.4	5.1	73	55	2.8	4.0
Costa Rica	119	119	0.7	0.7	122	122	0.6	0.7
Cote d'Ivoire	110	104	1.1	1.4	116	113	1.1	1.4
Cuba	19	18	5.8	7.3	13	13	9.8	15.7
Cyprus	82	86	2.0	2.1	110	96	1.4	2.1
Czechoslovakia	36	44	4.6	4.8	41	45	4.6	5.0
Denmark	73	81	2.3	2.3	86	92	2.3	2.3
Dominican Republic	90	96	1.7	1.7	107	109	1.4	1.5
Ecuador	76	60	2.2	3.2	101	87	1.7	2.5
Egypt	2	3	23.8	26.7	20	16	6.9	9.5
El Salvador	92	91	1.7	1.9	48	37	4.1	5.7
Ethiopia	38	15	4.5	9.7	14	10	9.4	17.7
Fiji	121	121	0.3	0.3	124	124	0.4	0.4
Finland	98	98	1.6	1.6	94	98	2.0	2.0
France	50	51	3.8	3.8	50	54	4.0	4.0
Gabon	104	99	1.3	1.5	66	62	3.0	3.6
German Democratic Rep.	30	34	4.8	5.2	32	36	5.5	6.0
Federal Rep. of Germany	55	55	3.5	3.5	57	69	3.2	3.2
Ghana	101	101	1.3	1.5	121	121	0.7	0.8
Greece	18	20	6.0	6.9	23	23	6.5	7.4
Guatemala	105	103	1.2	1.4	79	82	2.6	2.7
Guinea-Bissau	42	23	4.2	6.3	45	17	4.2	9.5
Guyana	24	30	5.4	5.4	16	18	7.6	9.2
Haiti	100	102	1.5	1.5	111	110	1.3	1.5
Honduras	86	79	1.9	2.3	44	46	4.3	5.0
Hungary	70	61	2.3	3.2	69	65	2.9	3.5
India	60	57	3.1	3.4	59	57	3.2	3.8
Indonesia	39	47	4.5	4.6	56	64	3.3	3.5
Iran	11	16	9.5	9.5	61	75	3.1	3.1
Iraq	10	7	10.3	14.8	1	3	21.5	28.9
Ireland	99	100	1.5	1.5	104	107	1.7	1.7
Israel	3	1	23.4	32.5	6	5	16.3	22.2
Italy	74	82	2.3	2.3	87	94	2.3	2.3
Jamaica	117	118	0.8	0.8	115	114	1.2	1.3
Japan	114	115	0.9	0.9	118	118	1.0	1.0
Jordan	4	4	19.9	25.6	9	4	14.1	25.4
Kenya	67	66	2.6	3.1	60	56	3.2	3.8
Korea	28	25	4.9	6.1	35	38	5.2	5.7
Kuwait	26	39	5.1	5.1	26	31	6.3	6.3
Lebanon	35	38	4.6	5.1	21	19	6.8	8.5
Liberia	111	111	1.0	1.1	67	66	3.0	3.5
Libya	13	10	8.1	11.5	10	12	12.2	15.9
Luxembourg	115	117	0.8	0.8	117	117	1.0	1.0
Madagascar	84	83	2.0	2.2	85	78	2.3	2.9
Malawi	95	93	1.6	1.8	88	88	2.3	2.5
Malaysia	21	24	5.8	6.3	24	27	6.5	7.0
Mali	20	19	5.8	7.0	83	70	2.4	3.2
Mauritania	12	13	8.5	10.1	18	22	7.5	8.2
Mauritius	122	122	0.2	0.2	125	125	0.3	0.3
Mexico	120	120	0.6	0.6	123	123	0.6	0.6

Table 8. Military Expenditures as Proportion of GDP, 1972-79 and 1980-88 (concluded)

	1972-79				1980-88			
	Rankings		Averages		Rankings		Averages	
	SIPRI	Adjusted SIPRI	SIPRI	Adjusted SIPRI (In percent of GDP)	SIPRI	Adjusted SIPRI	SIPRI	Adjusted SIPRI (In percent of GDP)
Morocco	33	25	4.7	6.0	36	32	5.1	6.3
Mozambique	...	...	...	...	17	14	7.6	12.6
Myanmar	44	43	4.2	4.9	54	24	3.4	7.3
Nepal	116	114	0.8	0.9	108	112	1.4	1.4
Netherlands	59	63	3.1	3.1	62	71	3.1	3.1
New Zealand	96	97	1.6	1.6	96	99	1.9	1.9
Nicaragua	78	78	2.2	2.3	7	6	16.0	21.9
Niger	118	116	0.7	0.9	120	120	0.7	0.8
Nigeria	51	53	3.7	3.8	105	103	1.6	1.9
Norway	58	62	3.1	3.1	64	76	3.0	3.0
Oman	1	5	25.1	25.1	2	7	21.5	21.5
Pakistan	16	22	6.5	6.5	22	25	6.5	7.2
Panama	108	109	1.2	1.2	102	102	1.7	1.9
Paraguay	94	95	1.6	1.8	112	111	1.3	1.4
Peru	37	27	4.5	5.6	30	30	5.8	6.5
Philippines	64	69	2.7	2.9	100	101	1.7	1.9
Poland	48	49	3.8	4.3	52	52	3.5	4.3
Portugal	27	35	5.0	5.1	55	60	3.3	3.7
Romania	79	77	2.1	2.4	109	108	1.4	1.6
Rwanda	93	90	1.7	2.0	99	100	1.8	1.9
Saudi Arabia	6	8	13.9	13.9	3	9	19.8	19.8
Senegal	65	70	2.6	2.8	76	79	2.6	2.8
Sierra Leone	113	113	1.0	1.0	119	119	0.9	1.0
Singapore	23	29	5.5	5.5	33	40	5.4	5.4
Somalia	43	14	4.2	9.9	70	47	2.9	4.9
South Africa	56	56	3.4	3.4	51	58	3.7	3.7
Spain	85	88	1.9	2.0	84	89	2.3	2.4
Sri Lanka	102	105	1.3	1.4	82	83	2.5	2.6
Sudan	66	59	2.6	3.2	80	67	2.6	3.4
Swaziland	...	...	...	...	89	95	2.1	2.2
Sweden	57	58	3.3	3.3	74	81	2.7	2.7
Switzerland	81	87	2.0	2.0	98	105	1.8	1.8
Syrian AR	5	6	14.0	23.9	8	8	14.6	21.2
Taiwan Province of China	15	17	6.7	7.4	29	28	6.1	6.9
Tanzania	40	32	4.5	5.3	46	44	4.2	5.0
Thailand	53	50	3.6	4.1	39	41	4.8	5.4
Togo	89	74	1.8	2.7	77	72	2.6	3.1
Trinidad & Tobago	112	112	1.0	1.0	78	85	2.6	2.6
Tunisia	88	84	1.8	2.1	37	39	4.9	5.6
Turkey	29	33	4.9	5.3	43	42	4.5	5.3
Uganda	62	65	2.8	3.1	71	68	2.9	3.4
U.S.S.R.	8	11	11.3	11.3	11	15	12.0	12.0
United Arab Emirates	84	89	2.0	2.0	19	29	6.9	6.9
United Kingdom	32	45	4.7	4.7	38	48	4.9	4.9
United States	23	28	5.6	5.6	28	34	6.2	6.2
Uruguay	69	75	2.4	2.5	72	77	2.8	3.0
Venezuela	80	85	2.1	2.1	81	86	2.5	2.5
Yemen, AR	14	12	7.9	10.3	12	11	11.1	17.0
Yemen, PDR	7	2	13.7	31.9	4	1	18.6	42.0
Yugoslavia	25	31	5.1	5.4	47	50	4.1	4.3
Zaire	45	37	4.2	5.1	103	90	1.7	2.4
Zambia	47	40	4.1	5.0	53	53	3.5	4.2
Zimbabwe	31	41	4.8	5.0	25	26	6.5	7.0

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

Table 9. Adjusted SIPRI Military Expenditures as Proportion of GDP, 1972-88

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	(In percent of GDP)																
Industrial	4.3	3.9	3.9	3.8	3.6	3.5	3.4	3.4	3.5	3.7	4.0	4.1	4.2	4.3	4.0	3.8	3.6
Eastern Europe	9.3	9.1	9.4	9.6	9.3	8.9	8.9	8.6	8.9	8.6	8.9	8.8	9.0	9.4	9.7	10.0	9.8
Developing countries	5.8	6.1	5.8	6.4	6.5	6.5	6.3	6.1	5.8	5.7	6.2	6.3	6.1	5.7	5.5	5.2	4.7
Asian developing	8.3	7.9	7.6	7.8	7.6	7.3	6.9	6.9	6.3	6.0	5.8	5.4	4.9	4.7	4.7	4.6	4.2
Middle East	9.5	11.2	10.1	12.1	12.6	11.8	12.9	11.9	11.3	11.4	12.6	13.5	13.8	12.6	11.0	9.5	8.9
North Africa	10.1	12.6	12.5	12.1	11.9	12.3	10.6	10.0	8.3	9.4	9.8	9.0	8.4	7.5	6.7	5.8	5.5
Sub-Saharan Africa	3.1	2.9	2.8	3.6	3.8	4.0	4.0	3.8	3.7	3.5	3.4	3.7	3.8	3.7	4.1	4.3	4.2
Latin America and Caribbean	1.9	2.3	2.0	1.9	2.1	2.2	2.0	2.0	2.4	2.4	2.8	2.7	2.6	2.3	2.5	2.3	2.1
Total	5.6	5.2	5.2	5.2	5.0	4.9	4.7	4.6	4.6	4.7	5.0	5.1	5.1	5.1	4.9	4.7	4.4
Miscellaneous categories of developing countries:																	
Net creditor nations	7.3	7.4	7.6	10.1	11.4	10.8	12.8	11.7	10.4	10.2	10.5	10.2	9.8	9.6	8.1	6.4	6.3
Net debtor nations	6.3	6.7	6.2	6.5	6.4	6.6	6.2	6.1	5.9	5.9	6.6	6.8	6.5	6.0	6.0	5.8	5.1
Heavily indebted	2.9	3.7	3.3	3.4	3.3	3.4	2.6	2.4	2.6	2.5	2.9	2.8	2.6	2.3	2.6	2.4	2.2
Small low-income economies	3.2	2.9	2.7	3.0	3.4	3.8	4.2	4.2	3.5	3.4	3.4	3.8	4.3	4.0	3.9	3.8	3.8
Middle East and North Africa	9.7	11.6	10.6	12.1	12.5	11.9	12.4	11.5	10.6	11.0	12.0	12.5	12.6	11.4	10.0	8.7	8.1

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

Table 10. SIPRI Military Expenditures as Percent of Central Government Expenditures, 1972-88

	1972-88	1972-79	1980-88
Algeria	5.4	5.8	5.2
Angola	33.0	...	33.0
Argentina	22.4	24.9	20.0
Australia	10.5	11.3	9.8
Austria	3.2	3.3	3.1
Bahrain	12.7	9.8	14.7
Bangladesh	11.0	10.3	11.7
Belgium	6.2	6.8	5.7
Benin	7.7	6.3	8.6
Bolivia	21.5	22.5	20.6
Botswana	7.4	9.3	7.0
Brazil	5.4	6.5	4.2
Bulgaria	6.3	5.9	6.6
Burkina Faso	18.3	17.7	18.7
Burundi	11.6	10.7	12.3
Cameroon	9.3	9.5	9.3
Canada	8.6	8.6	8.5
Central African Rep.	9.0	9.7	8.1
Chad	32.3	23.1	40.4
Chile	22.6	18.7	26.0
China	34.2	41.7	27.6
Colombia	12.0	9.9	14.0
Congo	10.2	13.8	7.0
Costa Rica	3.0	3.1	3.0
Cote d'Ivoire	3.6	4.1	3.1
Cuba	...	...	...
Cyprus	5.8	7.3	4.5
Czechoslovakia	7.2	7.2	7.3
Denmark	6.1	6.7	5.6
Dominican Republic	9.6	9.9	9.3
Ecuador	14.4	18.0	11.1
Egypt	26.8	42.3	13.0
El Salvador	18.4	12.2	24.6
Ethiopia	26.3	23.5	28.9
Fiji	1.4	1.2	1.5
Finland	6.0	5.4	6.4
France	9.8	10.5	9.1
Gabon	5.6	2.8	7.4
German Democratic Rep.	10.6	11.2	10.2
Federal Rep. of Germany	11.3	12.4	10.3
Ghana	6.2	6.9	5.6
Greece	17.1	18.8	15.5
Guatemala	16.7	11.1	21.6
Guinea-Bissau	9.2	11.5	7.7
Guyana	11.2	11.6	10.7
Haiti	8.9	8.9	9.0
Honduras	16.8	13.4	20.1
Hungary	4.6	3.8	5.2
India	17.6	20.1	15.3
Indonesia	17.8	21.5	14.6
Iran	17.8	24.5	11.9
Iraq	30.7	25.6	35.2
Ireland	3.3	3.5	3.1
Israel	27.1	34.6	20.5
Italy	5.5	6.4	4.8
Jamaica	2.6	2.1	3.1
Japan	5.5	5.7	5.4
Jordan	31.6	34.7	28.7
Kenya	11.2	10.6	11.7
Korea	27.9	28.4	27.5
Kuwait	15.3	18.8	12.3
Lebanon	20.8	27.9	14.5
Liberia	6.5	4.3	8.5
Libya	20.3	18.3	22.0
Luxembourg	2.3	2.2	2.4
Madagascar	9.1	8.5	9.7
Malawi	6.5	6.0	6.9
Malaysia	19.5	20.5	18.6
Mali	16.8	25.9	8.7
Mauritania	24.0	20.0	31.8

Table 10. SIPRI Military Expenditures as Percent
of Central Government Expenditures, 1972-88
(concluded)

	1972-88	1972-79	1980-88
Mauritius	0.9	0.8	1.0
Mexico	2.8	3.5	2.2
Morocco	15.4	14.2	16.4
Mozambique	20.6	...	20.6
Mynamar	25.5	29.0	22.0
Nepal	7.7	7.5	7.8
Netherlands	6.0	6.5	5.5
New Zealand	4.5	4.4	4.6
Nicaragua	22.1	11.4	31.7
Niger	4.3	4.9	3.7
Nigeria	13.3	19.2	8.0
Norway	7.2	7.5	7.0
Oman	44.9	44.6	45.2
Pakistan	28.7	30.2	27.4
Panama	4.2	3.6	4.8
Paraguay	13.3	14.3	12.4
Peru	29.1	24.5	33.1
Philippines	15.1	18.8	11.8
Poland	7.4	7.5	7.3
Portugal	11.5	16.2	7.3
Romania	4.7	4.7	4.7
Rwanda	12.3	16.1	8.9
Saudi Arabia	29.0	23.1	34.1
Senegal	11.5	13.3	10.0
Sierra Leone	4.4	4.2	4.6
Singapore	21.1	24.3	18.2
Somalia	17.2	21.4	13.5
South Africa	12.7	12.7	12.7
Spain	7.7	8.3	7.2
Sri Lanka	6.1	4.6	7.5
Sudan	14.2	16.3	12.3
Swaziland	6.7	...	6.7
Sweden	7.5	9.0	6.2
Switzerland	9.8	10.9	8.9
Syrian AR	35.5	34.7	36.3
Taiwan Province of China	53.0	58.2	48.5
Tanzania	17.0	16.2	17.6
Thailand	23.6	22.7	24.4
Togo	7.0	6.2	7.8
Trinidad and Tobago	4.6	3.3	6.0
Tunisia	9.4	5.9	12.6
Turkey	19.8	20.3	19.2
Uganda	25.7	20.9	30.0
U.S.S.R	25.6	26.3	24.9
United Arab Emirates	34.6	25.1	43.1
United Kingdom	12.2	12.3	12.1
United States	26.2	26.9	25.7
Uruguay	11.0	10.4	11.6
Venezuela	8.5	7.5	9.4
Yemen, AR	35.2	40.9	30.1
Yemen, PDR	25.1	26.4	24.0
Yugoslavia	41.1	30.0	52.1
Zaire	8.4	11.5	5.7
Zambia	10.0	10.7	9.4
Zimbabwe	16.8	17.1	16.6

Sources: SIPRI, ACDA, Steinberg (1990), GFS, IFS.

Table 11. World Military Imports, 1972-88

	1972-88	1972-79	1980-88	1972-88	1972-79	1980-88
	-----Average -----			-----Average -----		
	(In percent of imports, cif)			(In percent of total world military imports)		
Industrial	0.4	0.4	0.4	15.0	15.5	14.6
Eastern Europe	3.2	2.7	3.6	13.0	15.7	10.6
Developing countries	6.7	5.9	7.4	71.9	68.8	74.8
Asian developing	2.6	2.6	2.7	9.3	8.1	10.4
Middle East	14.4	13.3	15.4	38.3	37.3	39.2
North Africa	13.4	12.6	14.2	10.7	11.3	10.2
Sub-Saharan Africa	5.4	3.7	6.9	6.6	6.1	7.1
Latin America and Caribbean	3.3	2.1	4.5	7.0	6.0	7.9
Total	1.9	1.7	2.1	100	100	100
Miscellaneous categories of developing countries:						
Heavily indebted	3.0	2.7	3.2	8.9	9.9	8.0
Small low-income economies	7.5	5.8	8.9	3.8	3.9	3.7

Sources: ACDA, IFS.

Table 12. Empirical Studies of the Effect of Military Expenditure on Growth

A. Aschauer (1989)

Dependent Variable: Capital productivity in the US, 1949-85

Explanatory Variables	coefficient	t-value
Constant	-2.29	-10.5
Time	0.008	4.6
Labor-capital ratio	0.38	4.7
Gov. capital ratio to GDP	0.39	15.3
Military capital ratio to GDP	-0.001	-0.72
Capacity utilization	0.42	11.4
R-squared	0.976	

B. Benoit (1978)

Dependent Variable: Average Growth of Civilian GDP, 1950-65
all variables are averages over the entire period, (44 countries)

Explanatory Variables	coefficient	t-value
Constant	not reported	
Defense spending as proportion of GDP	0.0176	1.34
Private investment as proportion of GDP	0.3059	5.57
Net economic assistance	0.0512	2.30
R-squared	0.6061	

C. Frederiksen and Looney (1982)

Dependent Variable: Average GNP per capita growth of a nation, 1960-78
(74 countries)

Explanatory Variables	coefficient	t-value
Constant	0.56	
Investment growth, 1960-70	0.171	4.82
Investment growth, 1971-78	0.061	2.33
Military expenditure to GDP (average of 1967, 1970, and 1975)	10.76	1.41
R-squared	0.48	

Table 12. Empirical Studies of the Effect of Military Expenditure on Growth (concluded)

D. Deger and Smith (1983)

Dependent Variable: Simultaneous equations, 1965-73
(50 countries, all LDCs)

Explanatory Variables	GDP growth		Savings ratio		Military Expenditure ratio to GDP	
	coef.	t-value	coef.	t-value	coef.	t-value
Constant	-8.93	(-2.4)	14.54	(3.8)	3.98	(4.5)
GDP growth	...		0.48	(1.92)	...	
Savings ratio to GDP	0.93	(3.8)	...		...
Military expenditure ratio to GDP	0.35	(2.8)	-0.43	(-3.2)	...	
Per capita income 1970 US\$	-0.26	(-2.4)	...		0.19	(2.6)
External capital ratio to GDP	0.59	(2.9)	-0.67	(-7.63)	...	
Population growth	-0.49	(-1.1)	-0.075	(-.03)	...	
Growth of agriculture	0.16	(1.2)	...		...
Interaction of GDP growth and per capita income	...		0.037	(4.6)	...	
Total population	...		...		0.02	(-4.3)
Gap bet. purchasing power parity GDP and nominal GDP	...		...		-0.3	(-2.1)
War dummy variable		4.67	(3.7)
OPEC dummy variable		11.31	(10.8)
R-squared	0.226		0.865		0.7808	

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