Appendix 5C. Sources and methods for military expenditure data

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I. Introduction

This appendix describes the sources and methods for the SIPRI military expenditure data provided in chapter 5 and appendices 5A and 5B, and on the SIPRI Military Expenditure Project website, <http://www.sipri.org/contents/milap/>.

The data in this edition of the SIPRI Yearbook should not be linked to the military expenditure data published in previous editions because the data series are continuously revised and updated. This is true in particular for the most recent years as figures for budget allocations are replaced by figures for actual expenditure. In some cases entire series are revised as new and better data become available. The SIPRI Military Expenditure Database includes consistent series dating back to 1988 for most countries.[1] Data for the years 1950–87—published in previous editions of the SIPRI Yearbook—cannot always be combined with the post-1987 data since SIPRI conducted a major review of the data for many countries for the period beginning in 1988. Changes in base years and method of currency conversion also hinder comparison between editions of the SIPRI Yearbook. In this edition, the base year for the constant dollar series (table 5A.3) is 2005. Conversion to constant US dollars has been made using market exchange rates (MERs) for all countries.

II. The purpose of the data

The main purpose of the data on military expenditure is to provide an easily identifiable measure of the scale of resources absorbed by the military. Military expenditure is an input measure, which is not directly related to the 'output' of military activities, such as military capability or military security. Long-term trends in military expenditure and sudden changes in trend may be signs of a change in military output, but interpretations of this type should be made with caution.

The purpose of the specific tables are as follows. Data in constant dollars for world military expenditure and military expenditure by region, organization and income group are provided (in table 5A.1) to enable assessments of trends in these aggregates. Country data on military expenditure in local currency at current prices (in table 5A.2) are the original data for all the other tables. These are provided to contribute to transparency and to enable comparison with data reported in government sources and elsewhere. Country data in constant dollars are provided (in table 5A.3) to allow for comparison over time for individual countries. In addition, data in current dollars for 2007 are provided for regions (in table 5A.1) and for countries (in table 5A.3). The current dollar figures give a better basis for international comparisons than the constant dollar data—although international comparisons of expend-

[1] The SIPRI Military Expenditure Database can be accessed at <http://www.sipri.org/contents/milap/milex/mex_database1.html>.

iture are conceptually problematic (see section IV below). The current dollar figures also facilitate comparison with other economic indicators, which are often expressed in current dollar terms. Data on military expenditure as a share of gross domestic product (GDP) are provided (in table 5A.4) as an indicator of the proportion of a country's resources used for military activities, that is, as an indicator of the economic burden of military expenditure, also called the defence burden or the military burden.

III. The coverage of the data

The military expenditure tables in appendix 5A cover 168 countries for the 10-year period 1998–2007. Total military expenditure figures are calculated for three types of country groupings—geographical region, international organization and country income group (categorized by gross national income per capita). The coverage of each of these groupings is provided in the notes to table 5A.1.

The definition of military expenditure

The guideline definition of military expenditure used by SIPRI includes expenditure on the following actors and activities: (*a*) the armed forces, including peacekeeping forces; (*b*) defence ministries and other government agencies engaged in defence projects; (*c*) paramilitary forces, when judged to be trained and equipped for military operations; and (*d*) military space activities. It includes all current and capital expenditure on: (*a*) military and civil personnel, including retirement pensions of military personnel and social services for personnel; (*b*) operations and maintenance; (*c*) procurement; (*d*) military research and development; and (*e*) military aid (in the military expenditure of the donor country). It does not include civil defence and current expenditure for past military activities, such as for veterans' benefits, demobilization, conversion and weapon destruction.

IV. The limitations of the data

A number of limitations are associated with the data on military expenditure. They are of three main types: reliability, validity and comparability.

The main problems of reliability are due to the less than comprehensive coverage of official military expenditure data, the lack of detailed information on military expenditure and the lack of data on actual, rather than budgeted, military expenditure. In many countries the official data cover only a part of total military expenditure. Important items can be hidden under non-military budget headings or can even be financed entirely outside the government budget. Many such off-budget mechanisms are employed in practice.[2] For a more comprehensive overview of the conceptual problems and sources of uncertainty involved in all sets of military expenditure data, the reader is referred to other sources.[3]

[2] For an overview of such mechanisms see Hendrickson, D. and Ball, N., 'Off-budget military expenditure and revenue: issues and policy perspectives for donors', Conflict, Security and Development Group (CSDG) Occasional Papers no. 1, CSDG, King's College London, Jan. 2002.

[3] Such overviews include Brzoska, M., 'World military expenditures', eds K. Hartley and T. Sandler, *Handbook of Defense Economics*, vol. 1 (Elsevier: Amsterdam, 1995); and Ball, N., 'Measuring third world security expenditure: a research note', *World Development*, vol. 12, no. 2 (Feb. 1984), pp. 157–64.

The validity of expenditure data depends on the purpose for which they are used. Since expenditure data are a measure of monetary input, their most valid use is as an indicator of the economic resources consumed for military purposes. For the same reason, their utility as an indicator of military strength or capability is limited. While military expenditure does have an impact on military capability, so do many other factors such as the balance between personnel and equipment, the technological level of military equipment, and the state of maintenance and repair, as well as the overall security environment in which the armed forces are to be employed.

The comparability of the data is limited by two different types of factor: the varying coverage (or definition) of the data and the method of currency conversion. The coverage of official data on military expenditure varies significantly between countries and over time for the same country. For the conversion into a common currency, as discussed below, the choice of exchange rate makes a great difference in cross-country comparisons. This is a general problem in international comparisons of economic data and is not specific to military expenditure. However, since international comparison of military expenditure is often a sensitive issue, it is important to bear in mind that the interpretation of cross-country comparisons of military expenditure is greatly influenced by the choice of exchange rate.

V. Methods

SIPRI data are based on open sources and reflect the official data reported by governments. In practice, it is impossible to apply the SIPRI definition of military expenditure to all countries, since this would require detailed information about what is included in military budgets and about off-budget military expenditure items, and an extensive process of recalculation. In many cases SIPRI is confined to using the official data provided by governments, regardless of definition. In these cases, SIPRI chooses the data series that corresponds most closely to the SIPRI definition of military expenditure. Priority is given to choosing a uniform time series for each country, in order to achieve consistency over time, rather than to adjusting the figures for individual years according to a common definition.

Estimation

Estimates of military expenditure are predominantly made either when the coverage of official data diverges significantly from the SIPRI definition or when no consistent time series is available. In the first case, estimates are made on the basis of an analysis of primarily official government budget and expenditure accounts. The most comprehensive estimates of this type—those for China and Russia—have been presented in detail in previous editions of the Yearbook.[4] In the second case, when only incomplete times series are available, the figures from the data series which corres-

For African countries see Omitoogun, W., *Military Expenditure Data in Africa: A Survey of Cameroon, Ethiopia, Ghana, Kenya, Nigeria and Uganda*, SIPRI Research Report no. 17 (Oxford University Press: Oxford, 2003).

[4] Cooper, J., 'The military expenditure of the USSR and the Russian Federation, 1987–97', *SIPRI Yearbook 1998: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 1998), pp. 243–59; and Wang, S., 'The military expenditure of China, 1989–98', *SIPRI Yearbook 1999: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 1999), pp. 334–49.

ponds most closely to the SIPRI definition are used for the years covered by that series. Figures for the missing years are then estimated by applying the percentage change between years in an alternative series to the data in the first series. These difficulties mean that the military expenditure data cannot be accurately compared between countries. They are more appropriately used for comparisons over time.

All estimates are based on official government data or other empirical evidence from open sources. This avoids the introduction of assumptions or extrapolations into the military expenditure statistics. Thus, no estimates are made for countries that do not release any official data, and no figures are displayed for these countries. SIPRI estimates are presented in square brackets in the tables. Round brackets are used when data are uncertain for other reasons, for example, when the data are based on a source of uncertain reliability and in cases when data expressed in constant dollars or as shares of GDP are uncertain due to a lack of reliable economic data.

Data for the most recent years include two types of estimate, which apply to all countries. First, figures for the most recent years are for adopted budget, budget estimates or revised estimates, the majority of which are revised in subsequent years. Second, in table 5A.3 the deflator used for the final year in the series is an estimate based on part of a year or as provided by the International Monetary Fund (IMF). Unless exceptional uncertainty is involved, these estimates are not bracketed.

The totals for the world, regions, organizations and income groups in table 5A.1 are estimates because data are not available for all countries in all years. These estimates are most often made on the assumption that the rate of change for an individual country for which data are missing is the same as the average for the region to which it belongs. When no estimate can be made, countries are excluded from all totals.

Calculations

With one exception, the SIPRI military expenditure figures are presented on a calendar-year basis on the assumption of an even rate of expenditure throughout the financial year. The exception is for the United States, for which SIPRI follows the reporting format of the source—a financial-year basis.

The original data are provided in local currency at current prices (table 5A.2). The only calculation made on these data is to convert to calendar year figures the figures for those countries that have a financial year that differs from the calendar year. These data are converted to US dollars at constant prices and exchange rates with 2005 as the base year (table 5A.3). Country data on military expenditure as a share of GDP (table 5A.4) are calculated in domestic currency at current prices and for calendar years.

The choice of base year for data expressed in constant dollars has an impact on cross-country expenditure comparisons because variations in prices and currencies differ between countries. For conversion from current to constant prices, SIPRI uses the national consumer prices indexes as the deflator. This means that the trend in the SIPRI military expenditure data in constant dollars reflects the real change in their equivalent purchasing power for civilian consumption.[5] Conversion to dollars is then made by use of the annual average market exchange rate of each country.

[5] A military-specific deflator is a more appropriate choice for the purpose of measuring purchasing power in terms of the amount of military personnel, goods and services that could be bought for the monetary allocations for military purposes. However, military-specific deflators are not available for most countries.

Purchasing power parity versus market exchange rates

An alternative to using market exchange rates for currency conversion is to use purchasing power parity (PPP) conversion factors (also called PPP exchange rates). The PPP dollar rate of a country's currency is defined by the World Bank as 'the number of units of a country's currency required to buy the same amount of goods and services in the domestic market as a U.S. dollar would buy in the United States'.[6]

The only PPP rates available for all countries are those estimated by the International Comparison Program (ICP), coordinated by the World Bank.[7] These PPP rates are designed to make it possible to determine and make international comparisons between the real value of a country's economic output (GDP) and the standard of living of its residents. Since MERs are determined by the supply and demand of currencies used in international transactions, they do not necessarily reflect differences in price levels between countries. However, the prices of many goods and services on domestic markets are determined in partial or complete isolation from the rest of the world. PPP rates are developed to control for such differences in price levels in order to provide a measure of the real purchasing power of the GDP of each country.

Using PPP rates instead of MERs results in much higher output and expenditure figures for many countries.[8] The difference is greatest for developing countries since they have relatively low prices for non-traded goods and services. This means that a unit of local currency has greater purchasing power within a developing country (which is better reflected by using PPP rates) than it has internationally (which is what is reflected by using MERs).[9]

PPP rates are statistical estimates, calculated on the basis of collected price data for a basket of goods and services for benchmark years. Between benchmark years, the PPP rates are extrapolated forward using ratios of prices indexes, either GDP deflators or consumer price indexes. Like all statistics, they are point estimates that fall within some margin of error of the unknown, true values. In February 2008 the ICP released the final results of a new round of PPP estimation for the benchmark year 2005.[10] These results date back to at least 1993 for most emerging markets and developing countries. The new PPP rates for 2005 are based on price surveys for more than 1000 goods and services conducted during 2005 and 2006. They include ICP estimates of PPP rates for 100 developing countries and PPP estimates for another 46 countries provided by the joint Eurostat–Organisation for Economic Co-operation and Development PPP programme.

The 2005 round of PPP estimates includes about 40 more countries than the previous, 1993 round. New methods have also been developed to overcome shortcomings in previous price data collection and estimation processes. The 2005 ICP round has resulted in a significant revision of the PPP for developing countries. The 2005 data

[6] World Bank, *World Development Indicators 2007* (World Bank: Washington, DC, 2007), p. 245.

[7] On the International Comparison Program see its website at <http://go.worldbank.org/X3R0INNH80>.

[8] See table 5.2 in chapter 5.

[9] On the issues involved in international comparison and currency conversion and the use of PPP rates see Ward, M., 'International comparisons of military expenditures: issues and challenges of using purchasing power parities', *SIPRI Yearbook 2006: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2006), pp. 369–86.

[10] International Comparison Program (ICP), *2005 International Comparison Program: Tables of Final Results* (World Bank: Washington, DC, Feb. 2008), <http://www.worldbank.org/data/icp/>.

involved a reduction in the PPP rates of developing countries (and thus a downward revision of their GDPs expressed in PPP dollars) and an upward revision in other countries, including those for all oil-exporting countries. The revision has been particularly large for some key emerging market countries, especially China, which participated in the 2005 ICP survey for the first time. The new PPP rate for China is around 40 per cent lower than the previous estimates, which were extrapolated from a bilateral comparison of 1986 prices between China and the USA, which proved to be an inaccurate guide.[11] As a result of these improvements, the new PPP data cannot be combined with the ICP's previous PPP rate estimates.[12]

For the conversion of military expenditure data into US dollars, the relevance of GDP-based PPP rates is limited. The PPP rates produced by the ICP are estimates based on statistical surveys of price data for a basket of goods and services that are major components of the gross domestic product, including both traded and non-traded items. The intention is that the PPP rates should reflect the prices of goods and services that are representative of consumption patterns in each country. This means that purchasing power is determined primarily for civilian goods and services. The interpretation of military expenditure data converted using GDP-based PPP rates therefore reflects the amount of civilian goods and services that could be bought for the amount of money devoted to the military sector. The extent to which these data reflect the amount of military goods and services that the military budget can buy is not known.

The ICP notes that PPP rates should not be used for all international comparisons and that MERs should be used to measure such things as international trade, capital flows and the value of foreign debt.[13] Military expenditure is used to purchase a number of goods and services which are not typical of national consumption patterns. For example, the price of conscripts can be assumed to be lower than the price of a typical basket of goods and services, while the prices of advanced weapon systems and of their maintenance and repair services can be assumed to be much higher. Due to these uncertainties, and despite the limitations of MERs, SIPRI uses market exchange rates to convert military expenditure data into US dollars.

VI. Sources

The sources for military expenditure data are, in order of priority: (*a*) primary sources, that is, official data provided by national governments, either in their official publications or in response to questionnaires; (*b*) secondary sources which quote primary data; and (*c*) other secondary sources.

The first category consists of national budget documents, defence White Papers and public finance statistics as well as responses to a SIPRI questionnaire which is sent out annually to the finance and defence ministries, central banks, and national statistical offices of the countries in the SIPRI Military Expenditure Database (see appendix 5D). It also includes government responses to questionnaires about military

[11] Elekdag, S. and Lall, S., 'Global growth estimates trimmed after PPP revisions', *IMF Survey Magazine*, 8 Jan. 2008.

[12] International Comparison Program (ICP), *2005 International Comparison Program: Preliminary Results* (World Bank: Washington, DC, Dec. 2007), pp. 11–13.

[13] International Comparison Program (note 12), p. 10.

expenditure sent out by the United Nations and, if made available by the countries themselves, the Organization for Security and Co-operation in Europe.

The second category includes international statistics, such as those of the North Atlantic Treaty Organization (NATO) and the IMF. Data for the 16 pre-1999 NATO member states have traditionally been taken from military expenditure statistics published in a number of NATO sources. The introduction by NATO of a new definition of military expenditure in 2005 has made it necessary to rely on other sources for some NATO countries for the most recent years. Data for many developing countries are taken from the IMF's *Government Finance Statistics Yearbook*, which provides a defence heading for most IMF member countries, and from country reports by IMF staff. This category also includes publications of other organizations that provide proper references to the primary sources used, such as the Country Reports of the Economist Intelligence Unit.

The third category of sources consists of specialist journals and newspapers.

The main sources for economic data are the publications of the IMF: *International Financial Statistics*, *World Economic Outlook* and country reports by IMF staff. The source for PPP rates in this volume is the preliminary results of the 2005 International Comparison Program.[14]

[14] International Comparison Program (note 12).