A note on the international comparison of military expenditure

Jacques Fontanel

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The economics of military expenditures .

Palgrave Macmillan,

London, 1987

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Summary : The comparison of military expenditures raises some technical, economic and political difficulties, concerning mainly the differing national monetary units, conceptual differences, secrecy of information, chronological comparisons and the difficulty of define armaments. Exchange rates have several limitations as a conversion factor in international comparisons and chronological data have a problem to solve with general price indices, improvement and innovation of armaments. Using general purchasing-power parity is costly and need a lot of hypothesis. Then, special analyses must be applied in order to improve the military expenditures comparisons.

Sommaire : La comparaison des dépenses militaires soulève certaines difficultés techniques, économiques et politiques, concernant principalement les différentes unités monétaires nationales, les différences conceptuelles, le secret des informations, les comparaisons chronologiques et la difficulté de définir les armements. Les taux de change ont plusieurs limites en tant que facteur de conversion dans les comparaisons internationales et les données chronologiques ont un problème à résoudre avec les indices généraux des prix, l'amélioration et l'innovation des armements. L'utilisation de la parité générale du pouvoir d'achat est coûteuse et nécessite de nombreuses hypothèses. Des analyses spéciales doivent alors être appliquées afin d'améliorer les comparaisons des dépenses militaires

Keywords : Military expenditures, international comparisons, chronological data, price indices

Dépenses militaires, comparaisons internationales, comparaisons inter temporelles, indice des prix

The comparison of military expenditures raises a number of technical, economic and political difficulties.[1] These are due to differing monetary units from one country to another, conceptual differences, secrecy, and the statistical difficulty of treating different kinds of armament on the same footing.

Comparative information about military expenditures is usually expressed in United States dollars, because of the widespread use of conversion ratios derived from exchange rates. SIPRI, NATO and USACDA base their estimates on the average annual exchange rates published by the International Monetary Fund, to eliminate short-term speculative fluctuations. Yet exchange rates have several limitations as a conversion factor in international comparisons which seriously undermine the credibility of the results obtained due to:

(1) The very large domestic sector that is not connected with international trade and is broadly independent of exchange rate trends,
(2) Changes in interest-rate differentials, and sudden capital movements attributable to international speculation,
(3) The fact that some exchange rates are set arbitrarily, mostly by countries with planned economies but also by other countries

that exercise a more or less strict control over foreign exchange,

(4) The poor credibility of official exchange rates to adjust prices in different currencies for purposes of international comparisons, because they do not reflect the currencies' internal purchasing power.

If SDRs are used the results are just as dubious, especially for non-IMF countries, because the arithmetic is still based on exchange rates.

There are other methods of analysis, of which the three most important appear to be the study of indicators, 'building blocks' and purchasing-power parities.

So far as *indicators* are concerned, it is sometimes recommended that military expenditure should be regressed on economic, financial or 'physical' variables (the latter being particularly awkward to select). But even when two groups of indicators are distinguished so as to establish an error range, the method has considerable shortcomings. Its results are dubious because the indicators evolve over time and space for no very clear or foreseeable reason, the sensitivity of the coefficients implies rigorous and accurate information, the explanatory variables must not be subject to manipulation by the public sector or by speculation, etc.

The *'building-block' method* used by the United States to ascertain and compare USSR and US military expenditures is designed to answer the question: what would it cost the United States exactly to duplicate the national security programme defined by the USSR? This comparison often leads to errors, substantially because quantities and prices are not independent of one another. To estimate the Soviet military effort in terms of US prices does not seem very realistic since if the USSR has a strong army based on men the main reason is the low cost of manpower, in contrast to manpower costs in the United States. Other problems such as military secrecy, the difficulty of 'sovietising' hardware, the technological gap and the differences in price formation make the building-block method a very awkward one to use.

The *Purchasing Power Parity method* (PPP) is especially interesting. The idea here is to express all outputs by value using a single pricing system. In principle this is no different from comparing a country's output over several different periods. The first OECD study directed by Gilbert and Kravis included 250 classes of products capable of international comparison, in 20 groups including military

expenditures. Unfortunately, these expenditures have since disappeared from studies using the PPP method. This method is recommended by the UN Group of Experts on the Reduction of Military Budgets, relying on recent studies of the economic comparison of the main aggregates in national accounts. USACDA would also like to use this method, but considers that the information currently available would hardly permit this.

The International Comparison Project (ICP) funded by the UN sets out to compare the purchasing power of currencies and real GDP per capita (together with some of its components) in different countries. The outstanding work by the Kravis team has enabled three phases to be completed but there are serious political and financial difficulties with the fourth phase now under way, which seeks to analyse purchasing power parities for 77 countries, since World Bank funding has been lost while China and the USSR are refusing to participate.

For an international comparison, all military production and expenditures have to be valued according to a single pricing system. In fact, whether the comparison is over time or over space, the methodological problems are the same, though international comparisons impose additional requirements. The principle is simple: products are selected as representative for all the countries concerned, their prices in the various countries are ascertained, a weighting is chosen to be representative of the structure of the country, inter-country prices ratios are then calculated (weighted by expenditures) and economic (or military) sectors are aggregated so as to determine purchasing power parities by sector or type of expenditure.

The method is described in several publications[2] and need not be discussed further here. However, three comments should be made:

(1) There are several studies comparable to those undertaken by Kravis. For example, the EUROSTAT project sets out to establish purchasing power parities for the EEC member states, while some similar estimates have been undertaken by the CMEA and the Latin American Free Trade Area.[3] The techniques used are slightly different from those in the Kravis project, but the results are not significantly different.[4]

(2) The currency conversion index should have several properties, of which the most important are probably circularity, additivity and the quality of the weightings chosen. While comparisons of countries two by two enable the perverse effects inherent in the

choice of weightings to be limited, they offer no solution in regard to circularity. Conversely, the multilateral method permits circularity, but makes the choice of the statistical structures more difficult.

(3) The published studies can disseminate findings only after a considerable delay. Phase II of the Kravis project gives findings only for 1973 and Phase III, still awaiting publication, will give details only for 1978. Another point is that the operation is a costly one.

Finally in the military sector, there are several characteristics which make purchasing power parities especially difficult to calculate: the rapidity of technological development, absence of markets for certain military equipment, the awkward problem of unique goods, the fact that there are transfers in kind under assistance programmes, the State's position as monopolist or monopsonist in respect of a particular product etc.

The Group of Experts on the Reduction of Military Budgets considers that the PPP procedure should be retained and that involves not just the solution of formidable technical problems but also, and most of all, political will, and agreement on the methods and products to be selected. Taking account of the findings currently available for 1970 and 1973, we have applied the conversion indices which Kravis obtained for civilian products to the military sector. Two points should be noted:

(1) This method is akin to an opportunity cost analysis. It is of particular interest in connection with the implications of disarmament for development, but it hardly permits precise comparison of expenditures. The findings show the direct cost of military expenditure in respect of consumption, production or investment. So these are interesting indicators, even though they lack the precision required for international negotiations on reducing military expenditure.

(2) In view of the time necessary to calculate and publish purchasing power parities, it seems necessary to consider studying the discrepancies between the new estimates and the USACDA and SIPRI estimates, and also to show the variations from one period to another, from significant comparisons of the methods actually used.

Table 2.1 represents military expenditures (in 1973 dollars) by the ICP sample countries for the year 1970 by, respectively, the SIPRI method (ME1) the GDP PPP conversion index (ME2), by the Gov-

ernment Expenditures index (ME3) and by the application of public sector salary and commodity indices to the structure of military expenditures (ME4).

Table 2.2 is a comparable study for 1973, adding the growth rate for military expenditures calculated as an index by SIPRI between 1970 and 1973, military expenditures in national currencies published by SIPRI for 1973, together with the military budgets index (base 1970) calculated from information published in the *UN Yearbook*.

Table 2.3 shows, from base year 1970, indices for wholesale prices, consumer prices, the real growth rate, the growth rate per capita, variations in the exchange rate and in GDP purchasing power (DPPP GDP), government expenditures (DPPP Govt Exp), salaries (DPPP Salaries) and commodities (DPPP Commodities). For the international comparison indicators, an increase in the index in fact means a reduction in the international dollar purchasing power of the local currency.

Table 2.4 shows the relationship between the PPP estimates and the SIPRI and USACDA estimates.

Table 2.5 shows the PPP value of the increase in military spending for the 16 sample countries.

Several points must be made:

(i) In all developing countries, military expenditures are constantly under-valued.

(ii) For the developed countries, depending on the PPP method used the broad results are similar or slightly upward, but there are also appreciable structural modifications. This is because while ME3 and ME4 lead generally to an over-estimate of SIPRI military expenditures, the same does not apply to ME2. Depending on the method used, either Germany or the United Kingdom rank first or second among the developed countries after the United States.

(iii) For countries such as India the results are highly divergent (a ratio of 1 to 9 between the smallest and the largest estimate).

(iv) Taking the seven leading developing countries in the tables and the other nine developed countries, the proportion of total expenditure they account for rises, depending on which method is applied, from 5.5 per cent 19.3 per cent.

Other findings could be discussed but it seems worthwhile to go further into the assumptions underlying the PPP calculations.

First, as regards using the purchasing-power parity of GDP, this

TABLE 2.1 *Principal methods for estimating military expenditures for 1970*

Country	*ME1 (SIPRI) $(1973)*	*ME2 (PPP/GDP) $(1973)*	*ME3 (PPP/Govt Exp) $(1973)*	*ME4 (PPP/Public Sector indices) $(1973)*	*National currency*
Kenya	21	37	70	69	126
India	1 949	4 818	10 131	9 950	10 840
Philippines	104	256	543	573	500
Korea	334	739	1 342	1 527	102
Colombia	121	258	406	412	1 885
Malaysia	243	392	440	461	510
Iran	959	1 716	1 569	1 352	54 120
Hungary	567	648	819	1 015	9 848
Italy	3 293	3 395	3 124	3 254	1 562
Japan	2 597	2 369	2 836	2 952	570
UK	7 673	8 149	8 952	8 783	2 444
Netherlands	1 788	1 489	1 354	1 242	3 968
Belgium	1 132	984	982	963	37 388
France	8 835	7 420	7 690	7 710	32 672
German FR	10 108	7 524	6 861	7 533	22 573
USA	89 065	77 854	77 854	77 854	77 854

TABLE 2.2 *Principal methods for estimating military expenditures (ME) for 1973*

Country	*Index Defence Budget UN 73/70*	*ME (SIPRI 1973) National Currency*	*Index (SIPRI 73/70)*	*ME1 (SIPRI) $1973*	*ME2 (PPP/GDP) $1973*	*ME3 (PPP/Govt Exp) $1973*	*ME4 (PPP/Pub Sector Indices) $1973*	*GDP (PPP)*
Kenya	205	262	215	37	77	156	155	4 731
India	138	16 737	143	2 165	6 600	18 000	17 550	227 626
Philippines	186	1 398	280	207	603	1 320	1 685	30 283
Korea	178	181	180	456	1 128	2 000	2 160	30 782
Colombia	189	2 479	131	104	261	393	333	24 892
Malaysia	134	681	133	280	520	582	587	13 351
Iran	222	253 950	470	3 691	7 323	7 470	7 175	56 883
Hungary	125	9 489	96	547	663	968	1 630	29 128
Italy	146	2 392	153	4 107	4 736	4 345	4 750	159 953
Japan	178	924	164	3 395	3 595	3 980	4 095	432 232
UK	139	3 512	144	8 614	10 300	11 480	11 700	210 103
Netherland	141	5 465	138	1 967	1 874	1 820	1 750	56 905
Belgium	136	48 941	131	1 259	1 294	1 320	1 180	45 416
France	132	42 284	132	9 513	9 234	10 100	10 800	245 491
German FR	136	31 908	141	12 027	10 326	9 465	10 900	296 940
USA	95	78 358	101	78 358	78 358	78 358	78 358	1 302 920
		Total		126 727	136 892	151 757	154 808	

TABLE 2.3 *Significant indices for the country sample 1973 compared with 1970*

Country	*Wholesale price index*	*Consumer price index*	*Real growth rate*	*Growth rate per capita*
Kenya	108	108	119	107
India	141	128	105	99
Philippines	159	128	121	111
Korea	132	131	137	130
Colombia	169	153	122	113
Malaysia	113	113	125	116
Iran	124	122	148	136
Hungary	107	108	121	120
Italy	126	123	112	109
Japan	116	124	129	124
UK	125	128	110	109
Netherlands	118	125	115	112
Belgium	116	118	117	116
France	122	120	117	114
German FR	114	119	112	110
USA	123	114	115	112

Country	*Exchange rate variation*	*DPPP GDP*	*DPPP govt exp.*	*DPPP salaries*	*DPPP commodities*
Kenya	98	101	93	94	96
India	103	112	87	85	104
Philippines	112	119	114	89	133
Korea	128	117	120	121	112
Colombia	130	130	137	150	85
Malaysia	79	100	101	100	107
Iran	91	110	99	96	111
Hungary	83	94	82	80	87
Italy	93	110	111	113	115
Japan	76	107	115	119	107
UK	98	113	112	119	108
Netherlands	78	109	112	113	108
Belgium	79	102	109	112	107
France	81	103	99	101	95
German FR	73	103	102	111	90
USA	100	100	100	100	100

TABLE 2.4 *Indicators of the difference between estimates by the PPP method and those published by SIPRI and USACDA 1973*

Country	SIPRI			ME4	
	ME2	ME3	ME4	ME (USACDA)	ME (USACDA)
Kenya	208	422	421	400	39
India	305	831	811	960	1 828
Philippines	291	638	814	822	205
Korea	247	439	474	334	647
Colombia	250	378	320	261	127
Malaysia	186	208	210	202	291
Iran	198	202	191	193	720
Hungary	121	177	298	123	1 321
Italy	115	106	116	121	3 934
Japan	106	111	114	104	3 857
UK	119	133	136	117	9 873
Netherlands	95	93	89	79	2 275
Belgium	103	105	94	79	1 485
France	97	106	114	111	9 687
German FR	85	79	91	83	13 079
USA	100	100	100	100	78 358
					130 726

clearly gives a somewhat oversimplified representation of opportunity costs; we should merely point out that military expenditures cost 'a little more' in international dollars than appears from the amount expressed in US dollars by the exchange rate system.

Secondly, government spending PPP is used because military expenditures are government expenditures. They can of course behave differently but since a number of procurement, allowance and salary rules are common to the military sector as well as the public sector, the results probably will not diverge unduly. This is an assumption which would be worth validating.

Lastly, the use of PPP for public spending categories applied to each country's own military spending structure enables us to estimate them still more closely.

However, these are assumptions requiring to be tested. But these results will very probably be better than those derived from exchange rates. With a view to reducing military spending, it would seem highly paradoxical and dangerous only to use the figures currently produced.

TABLE 2.5 *Trend in military expenditures from 1970 to 1973 according to estimates using the PPP method*

	IME2	*IME3*	*IME4*
Kenya	208	223	225
India	137	178	176
Philippines	236	243	294
Korea	153	149	141
Colombia	101	97	81
Malaysia	133	132	127
Iran	427	476	530
Hungary	102	118	161
Italy	139	139	146
Japan	152	140	139
UK	126	128	133
Netherlands	125	134	137
Belgium	131	134	122
France	124	131	140
German FR	137	139	145
USA	100	100	100

IME2 = Index for the trend of military expenditures based on GDP purchasing-power parity.
IME3 = Index for the trend of military expenditures based on government spending purchasing-power parity.
IME4 = Index for the trend of military expenditures based on purchasing-power parity for components of government spending.

A study of these findings shows:

(1) That the results are highly sensitive to the assumptions made. Since there can be a discrepancy of nearly 300 per cent according to the purchasing-power parity indices selected, it would be clearly undesirable to initiate a disarmament process without a technically and politically acceptable estimate of such parities in the military sector (which should preferably be defined beforehand, doubtless along the lines of the Group of Experts on the Reduction of Military Budgets).

(2) That these calculations produce substantial changes and reclassifications. Developing countries like India apparently have appreciably higher military expenditures than countries like France and Japan. With a view to creating a Disarmament Fund for Development, or when taking account of the most heavily militarily committed countries in international negotiations, these estimates could have substantial impact.

The purchasing-power parity method is costly, and produces findings only after a considerable delay. This means that it is very difficult to apply to the military sector. For the fundamental reason for wishing to compare countries' military spending can only be the express wish of the Governments to reduce such spending, though the economic analysis is in itself of considerable interest. In this case, the information appears far too late to permit straightforward negotiations. If the purpose of the comparison is to determine the military power of states, we must admit that it is not very appropriate, in view of the magnitude of non-market factors in the power relationships of countries – geographical situation, morale of the population, skills of manpower, natural riches, alliances etc.

In the circumstances it seems highly worthwhile, at least as a first approximation, to establish econometric relationships with which to obtain, over a relatively short period, a satisfactory estimate of military spending. Thus for a set date (e.g. every three years), a complete study could be undertaken in terms of purchasing-power parity for the military sector and estimates should then be made for the missing years, from a number of significant indicators or econometric equations for the military expenditure categories selected. With this in view, the inputs available for the present study are obviously very inadequate, because they are not sufficiently disaggregated and not directly applicable to the military sector. By way of a preliminary overall estimate, we have tried to determine the fundamental explanatory variables. However, since a period of three years (1970 to 1973) has been taken for calculating the indices, an estimate produced directly from the regressions calculated would produce results for 1976. Table 2.6 summarises the main econometric findings.

The regressions obtained are interesting for several reasons:

(1) They display the very limited role of exchange rates in calculating military expenditures in foreign currency (in this case the dollar). The exchange rate is never significant with a 0.05 degree of confidence.

(2) They stress the weakness of the impact of economic growth on military expenditures for the period expressed in international dollars.

(3) They indicate that the military spending index (SIPRI estimate) and the consumer price index (or the wholesale price index) off a statistically correct estimate of the military expenditures index expressed by the PPP method. We could therefore try to estimate

TABLE 2.6 *Principal econometric results*

(1) IME2 = − 0.03.ERV + 161
(0.03)

(2) IME2 = 0.13.ERV − 0.57.CPI + 215.6
(1.4) (2.4)

(3) IME2 = −0.68.ERV + 5.38.RGR − 0.19.CPI − 400.5
(1.07) (1.59) (1.79)

(4) IME2 = 0.88.IMES − 0.1.ERV + 0.04.RGR − 0.72.CPI + 101
(0.02) (0.1) (0.2) (0.16)

(5) IME2 = − 0.46.CPI + 214
(1.99)

(6) IME2 = 0.14.ERV − 0.58.CPI + 216
(1.4) (2.4)

(7) IME2 = 0.88.IMES − 0.094.ERV − 0.73.CPI + 105
(0.015) (0.09) (0.15)

(8) IME2 = 0.876.IMES + 7.6

with F = 879
D = 0.984
SR = 10.4
DW = 2.4

Value of the coefficients of the explanatory variables in this equation (*t* test)
ERV = 2.4
GRC = 0.09
RGR = 0.46
WPI = 5.7

(9) IME2 = 0.88.IMES − 0.81.CPI + 106.2
(57) (6.2)

with F = 1627
D = 0.996
SR = 5.44
DW = 2.4

Value of the coefficients of the explanatory variables in this equation (*t* test)
ERV = 1.06
GRC = 0.04
RGR = 0.07
WPI = 1.54

(10) IME3 = 0.89.IMES − 0.017.ERV − 0.49.WPI + 67.8
(51) (0.5) (4.1)

(11) IME3 = 0.98.IMES − 2.36
(17)

Table 2.6 continued

with D = 0.96
SR = 20.2

(12) IME3 = 0.998.IMES − 0.59.WPI + 68.4
(19) (2.1)
with F = 182
SR = 18
DW = 1.64
D = 0.96

(13) IME3 = 0.997.IMES − 0.14.ERV − 0.49.WPI + 70
(18.4) (0.4) (1.3)

(14) IME3 = 0.987.IMES − 1.08.CPI + 129.3
(20) (2.6)
with F = 208
SR = 17
DW = 2.35
D = 0.97
Value of the coefficients of the explanatory variables in this equation (*t* test)
ERV = 0.55
GRC = 1.2
RGR = 1.3
WPI = 0.04

(15) IME4 = 1.14.IMES − 1.66.CPI + 181.8
(17.1) (2.9)
with F = 149
SR = 23.5
DW = 2.2
D = 0.95
Value of the coefficients of the explanatory variables in this equation (*t* test)
ERV = 0.75
GRC = 0.9
RGR = 1.3
WPI = 1

Abbreviations
F = F test
DW = Durbin-Watson test
D = Coefficient of determination
SR = Standard deviation of the estimate.
Figures between brackets represent the standard deviation of the coefficients.

Table 2.6 continued

WPI = Wholesale Price Index
CPI = Consumer Price Index
RGR = Real Growth Rate
GRC = Growth Rate Per Capital
ERV = Exchange Rate Variation

IMES = Index for the increase in military expenditures from 1970 to 1973 (SIPRI)
IME2, IME3, IME4 = indices for the trend in military expenditures according to the conversion ratios used, respectively. PPP(GDP) Purchasing Power Parity for Gross Domestic Product, PPP(GE) Purchasing Power Parity for Government Expenditures, PPP(PSI) Purchasing Power Parity for Public Sector Indices.

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military expenditures in international dollars for the different countries by taking equations (9), (14) and (15). As our calculations were based on the SIPRI national currency estimates, the explanation of the explanatory value of this variable is evident. Conversely, it is interesting to note that the price indices have a negative influence on military expenditures expressed in international dollars. This appears doubly logical at the theoretical level, in regard to inflation being taken into account mainly by the consumer price index (closer to the concept of purchasing power than the wholesale price index) and also in regard to the negative sign expressing the depreciation of the national currency in relation to the reference currency.

The standard deviations for the regressions selected are comparatively small, bearing in mind that the time interval is three years. It is therefore enough to know, for each country, the SIPRI military expenditures estimate and the wholesale price index trend to obtain an estimate of military expenditures suitable for international comparison over a very short period.

Clearly, the sample of countries is not significant and the problem of price formation in Eastern countries has not yet been broached. But studies of this type would encourage a fuller understanding of the comparative military commitment of states in the economic sphere and most important of all, would reduce the technical alibis for politicians in the crucial issue of reducing military expenditures.

Bibliography

EUROSTAT (1975), Comparisons of Real Values of the Aggregates of ESA, Luxemburg,

Fontanel, J.(1980). Le concept de dépenses militaires. *Revue Défense Nationale*, (7)

Fontanel, J. (1982), Les comparaisons des dépenses militaires, Areès, Défense et Sécurité, novembre.

Fontanel, J. (1984), Economie des armes, La Découverte Paris

Fontanel, J., Smith, R. (1985) Analyse économique des dépenses militaires. *Stratégique*.

Fontanel, J., Smith, R. (1985), L'effort économique de Défense, Arès, Défense et Sécurité, n° Spécial.

Fontanel, J, Smith, R (1985). "La comparaison des dépenses militaires de la France et du Royaume-Uni." *Ares, Défense et Sécurité* Spécial (1985).

Ivanov, Y, Ryzhov (1978), A new stage in the activities of the Council for Mutual Economic Assistance in the Field of International comparisons of National Product, Income and Wealth, March.

Karvis I.B. ; Heston, A., Summers, R. (1978), International comparisons of Real Product and Purchansing power. John Hopkins University Press..

Kravis, I.B. ; Heston, A., Summers, R. (1982), The international comparisons. Phase Project III, World Product and Income, international comparisons of GDP. John Hopkins University Press..

Salazar-Carrillo, J. (1973), Priice, Purchasing Power and the Real product comparison in Latin America, Income and Wealth, March.

United Nationns (1982), Report for the Group of Experts on the Reduction of Military Budgets, Working Paper n°3. 11 March 1982.