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THE SOVIET MILITARY BURDEN: A CRITICAL ANALYSIS OF CURRENT RESEARCH*

LEV DUDKIN AND ANATOL VASILEVSKY

Currently there are many publications dealing with the problem of Soviet military expenditures (SME) and only a few dealing with the Soviet military burden (SMB). However, estimates of the SMB given in the various sources differ considerably. It is evident that the disparity among estimates of SME is unavoidable because of the pervasive Soviet secrecy. Nevertheless, it is important to compare and analyze different estimates to determine the probable range of estimates. Existing studies only compare some of the estimates or do not give comparisons at all. The most comprehensive data on SMB can be found in a recent publication by Becker (1985), but his survey of estimates is also incomplete and doesn't contain the latest estimates.

In this paper we attempt to provide a full comparison of different estimates of the SMB, a critical analysis of them, and accurate definitions and estimates.

I. *Soviet Military Expenditures (SME) in Ruble Estimates*

Estimates of SME are usually calculated with two main objectives in mind: to compare them with the size of the U.S. and other countries' military expenditures or to determine the military burden on the Soviet economy and society, commonly as a share of SME in the Soviet GNP (rarely as a share of SME in national material product (NMP) and in gross domestic product (GDP)).

The methods used for calculating these estimates differ. Dollar estimates are used for comparing Soviet and US military activities. Dollar estimates of SME show what Soviet weapons, forces and military activities would cost if developed, purchased and operated in the United States. Thus the CIA dollar estimates show that the cumulative dollar cost of Soviet military activities for the decade 1970–1979 exceed US outlays by 30% in CIA work *Soviet and US Defense Activities* (1980, p. 3). Dollar estimates of SME and SMB do not show the actual burden on the Soviet economy as some specific problems (such as the so-called "index number problem") arise. "It is only in terms of Soviet resource trade-off rates that a measure of Soviet 'burden' can have any meaning" [Becker (1981, p. 12)].

Therefore, the data of SME and Soviet GNP in dollars published by the periodicals *World Military Expenditures and Arms Transfers* have little real value in determining real SME and SMB. Since the topic of this paper is the military burden, rather than the military

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balance between the US and USSR, only ruble estimates are used to express both SME and the ratio of Soviet defense spending to GNP.[1]

The Soviets publish only one figure for aggregate defense spending concerning individual years in the Soviet statistical annuals *Narodnoye Khozyaystvo SSSR*. These data are given in column 1, Table 2. Official Soviet figures of annual SME have remained virtually unchanged since 1969. Western sources agree that these figures are not realistic and are merely reflecting what the Soviet government would like the world to think about their SME.

The SME can be estimated in two ways. The CIA uses a building-block (direct-costing) method [see Colby (1975), Welsh (1983) and Burton (1983)] which begins by identifying and listing thousands of distinct components of weapons and military activities which make up the Soviet military program for a given year. A lot of data are available directly (e.g., military personell) to US Intelligence in ruble costs. The remainder are estimates in dollars and used to reflect Soviet and US prices.[2] RDT & E military spending is calculated on the basis of Soviet data.

The other approach to calculating SME in ruble prices is a residual method used by most other estimators of SME. It is based on the use of Soviet official data and consists in calculating military expenditures as a difference between the values of totals and civilian branches in machine building and metalworking. In this way an aggregate estimate of SME is developed in Lee (1977a), Cohn (1978) and Bond (1980) with military R&D added to procurement.

In the mid-1970s the CIA revised its estimates considerably, increasing them approximately by a factor of two.

Prerevision CIA estimates (in billions of rubles) in 1970 constant prices are given in column 1, Table 1 (including military pensions, RDT & E and space expenditures). The figures are taken from Rosefielde (1982, pp. 186–187) who notes that this series is computed by reducing the CIA post-revision figures by half. Other sources give a slightly different and separate figures of the prerevision CIA estimates.

Post-revision CIA estimates (in 1970 constant prices) also differ, as documented in columns 2 and 3, taken from the works of CIA (1978, p. 1; 1982, p. 123) and Becker (1985, p. 4).

The comparison of the figures in columns 1 and 2 shows that prior to 1975 the CIA estimate of SME was in error by factor of 2. The CIA attributed some 90% of their increase to higher prices for Soviet weapons and 10% to larger military forces and maintenance, but numerous critics (Lee, Rosefielde and others) consider the errors to be of a more serious nature. They maintain that the US intelligence establishment misjudged long-range Soviet military-political objectives, incorrectly attributing to the Soviet Union the concepts of military parity with the US, "deterrence" and "mutual assured destruction" [see Lee (1977b)].

The prerevision estimate of SME annual growth for 1970–1975 was 3% and the revised figure was 4–5% [see Bush (1976, p. 22)].

In 1983 the CIA made a second (this time downward) revision of its estimates [Gates

[1] It must be noted that different authors use different composition of SME. When it is known we give corresponding information in this survey. Our opinion about the rational definitions of SME in rubles (and dollars) are given at the end of this paper.

[2] Available Soviet prices are used directly and also to determine the dollar/ruble ratio for a given component of military activity.

TABLE 1. THE TOTAL SOVIET MILITARY SPENDING
(in billions of constant 1970 rubles)

	1	2	3	4	5	6
	CIA 1	CIA 2	CIA 3	CIA 4	Rosefielde	Lee
1955			30.0			
1956			29.0			
1957			26.0			
1958			26.0			
1959			26.0			
1960	14.3		27.0		14.3	
1961	14.9		30.0		15.5	
1962	15.5		34.0		16.9	
1963	16.1		35.0		18.3	
1964	16.7		38.0		19.8	
1965	17.4		39.0		21.7	
1966	18.1		40.0		23.7	29.2
1967	18.8	37.5	43.0		26.0	33.0
1968	19.8	39.5	46.0		28.7	38.5
1969	20.8	41.5	48.0		31.6	42.2
1970	21.0	42.0	49.0		43.5	46.5
1971	21.8	43.5	50.0		46.7	52.0
1972	22.5	43.0	51.0		50.2	56.5
1973	23.8	47.5	53.0		55.0	63.5
1974	24.8	49.5	57.0		59.7	69.0
1975	27.0	51.5	59.0		64.7	77.0
1976		53.3	63.0		70.3	83.5
1977		54.5	63.0		75.4	89.0
1978			65.0	64.0	82.5	98.0
1979			67.0	66.0	91.0	107.0
1980			71.0	67.0		117.0
1981				68.0		
1982				70.0		
1983						154.0
1984						
1985						<170.0

(1985) and Kaufman (1985, b)]. While confirming that prior to 1976, SME annual growth averaged 4–5%, the CIA now stated that between 1976–1983 the growth rate fell to about 2%, and procurement practically stopped. The reasons given for the decline of 1977–1983 were a general slowdown of the Soviet economy, growing transportation difficulties, industrial bottlenecks, the weapons production cycles (in which overall production falls between full series production of a new system and the phasing out of an old one), and possible political decisions. This time the CIA did not give any explanations of the reasons why its previous estimates were not accurate again. The CIA didn't give revised figures of SME. (They gave only rates of growth).

The reconstruction of the CIA estimates after the second CIA revision was made by Becker (1985) and is presented in column 4, Table 1. He assumed a 2% annual growth rate in the late 1970s and early 1980s.

The DIA generally agreed with the CIA revision and the explanation of the SME slow-

TABLE 2. THE TOTAL SOVIET MILITARY SPENDING
(in billions of rubles, current prices)

	1	2	3	4	5	6	7	8	9	10	11	12
	USSR	DIA	Lee (1977)	Lee (1979)	Bond (1980)	China	Britain	France	SIPRI (1979)	SIPRI (1980)	Mochi-zuki 1	Mochi-zuki 2
1955	10.7		14.0							23.3		
1956	9.7		12.5									
1957	9.1		12.5									
1958	9.4		13.5		13.7				17.0			
1959	9.4		15.0		14.1				18.4			
1960	9.3		16.0		15.3				18.3	21.8	14.0	
1961	11.6		18.5		18.0				22.8		16.0	14.3
1962	12.6		21.0		20.3				24.9		18.4	16.7
1963	13.9		23.0		21.5				27.3		21.1	17.2
1964	13.3		24.5		22.3				26.1		23.1	20.6
1965	12.8		26.0		22.5				25.1	30.0	29.8	26.4
1966	13.4		28.0		23.2				26.3		27.3	25.3
1967	14.5		32.5		25.6				28.5		29.6	26.0
1968	16.7		38.5		30.0				32.4		32.3	30.9
1969	17.7		42.0		31.4				34.6		33.3	35.4
1970	17.9	50.0	46.0	49.0	33.8	49.0		34.0	35.2	42.0	35.2	33.8
1971	17.9	53.0	50.0	53.5	36.3				35.7	42.7	38.4	38.4
1972	17.9	56.0	54.5	58.5	38.0				36.6	43.3	40.1	32.3
1973	17.9	60.0	60.5	64.5	41.8				36.9	44.0		36.7
1974	17.6	64.0	65.0	69.5	42.1			42.3	37.4	44.7		38.6
1975	17.4	70.0	71.5	76.0	44.7				38.0	45.4		40.4
1976	17.4	74.0			47.1				38.5	46.0		
1977	17.2	79.0			46.4				39.1	46.7		
1978	17.2	85.0			51.6				39.7	47.4		
1979	17.2	90.0					76–81			48.0		
1980	17.1	96.0					61–89			48.7		
1981	17.1	100.0					84–92			49.5		
1982	17.1									5.2		
1983	17.1											

down, but stated that a new increase began in 1982 and continued into 1984 [Bissel (1985, p. 131–133)].

The DIA reported its estimates of SME for 1970 and 1981, but unlike the CIA it made estimates in current prices [DIA (1983) and Bissel (1984, p. 94)]. According to these sources the SME increased from 50 billion in 1970 to about 100 billion in 1981 with an annual growth rate of 6–7%. Becker (1985) reconstructed the DIA estimates for 1971–1980. (DIA estimates of SME are given in column 2, Table 2.).

Rosefielde (1982), a well-known critic of CIA SME estimates, charges the CIA with making a number of false assumptions, an absence of tests and a bias toward understanding the SME, because of disregarding higher prices brought about by technical advance. He attempts to demonstrate the inconsistency of the CIA's estimates, using both physical and expenditure data on Soviet procurement. Rosefielde's estimates of SME in billions of constant 1970 rubles are given in column 5, Table 1. The author's estimate of total SME is calculated by subtracting the CIA's prerevision unpublished ruble procurement series from its unpublished prerevision total SME for 1960–1969 and its postrevision procurement series 1970–1979, then adding the author's estimates of Soviet procurement 1960–1979. However in calculations of his estimates Rosefielde uses some coefficients, which are not calculated in his book and that's why can be admitted as very arbitrary. RDT & E and military pensions are included. A comparison of his SME estimates with those of the CIA shows that until 1970, his estimates were lower than the postrevision estimates of CIA, but since 1970 they surpassed them. In the 1970-s Rosefielde's SME estimates were in between those of the CIA and Lee, at the beginning of the 1970-s being closer to the former, and at the end of the 1970-s being closer to the latter.

Lee, another and one of the most outspoken critics of CIA SME figures argued that the CIA, even after the first revision, consistently understated SME, and demonstrates the discrepancy between the CIA estimates and the Soviet data. For example, according to the CIA the annual increase in military machinery output in 1971–1975 was approximately 4.6% versus a 9.3% increase in civilian machinery output. As in their prerevision estimates the CIA implied that the priority of weapons was lower and was declining relative to the priority of civilian goods. The Soviet data show that total machinery output increased more than 11% per annum during 1971–1975, while the output of civilian machinery increased at just over 9%. This means that military procurement grew in excess of 14% per annum in 1971–1975, not at 4.6 [see Lee (1977b)]. This can be an example of the use of the residuals method.

Lee's estimates of SME in constant 1970 rubles [Lee (1977a, 1977c, 1980)] are given in Table 1, column 6. The figure 1985 is a projection. According to Lee, SME in 1985 probably exceeded 170 billion rubles [Lee (1985 and 1986)]. Lee's sum-total of SME consists of his residual calculation of military hardware in constant 1970 rubles plus military R&D, estimates of which "are mostly in current prices because a satisfactory method of converting R&D outlays to constant prices is lacking" [Lee (1980)]. Lee's SME in current prices are given in Table 2, column 3 [Lee (1977a)] and column 4 [Lee (1979a)]. Lee's estimates do not include civil defense, military pensions and some other important items. Lee states that annual SME growth for the periods 1970–1976 and 1976–1983 was 10.7% and 7.6% respectively [Lee (1985)].

A comparison of Lee's estimates with those of the CIA shows that CIA figures after the first revision for 1970 are close to Lee's, being short of it by a few billion. But the CIA

figure for 1975 was a quater less, and for 1980 almost one-third less than Lee's.

Two other American scholars have made a contribution to estimating SME and SMB, using the residuals approach. Cohn's initial study (1978) was revised and updated by Bond (1980). The estimate of total SME was obtained by Bond "by combining the operations and R&D expenditures series with the mid-point values of the procurement estimates." These estimates in current prices are given in column 5, Table 2. The author gives the following figures of average annual growth rate of SME: 6.8% for 1958–1978; 8.0% for 1960–1965; 8.5% for 1965–1970; 5.7% for 1970–1975; and 4.16% for 1975–1978. A comparison of Cohn's and Bond's estimates with Lee's estimates in current prices available for 1970–1975 shows the following. While using the machinery residuals approach and employing the same Soviet statistical data, Lee's estimates considerably exceed those of Cohn and Bond.

Holzman, another critic, (1980, 1982) believes that analogs are used far more frequently than the CIA is willing to acknowledge and CIA's pricing is not good enough. He dwells particularly on the index number problem. Because ratios of prices for different goods and services vary for different countries, their measurements in terms of one country tend to overstate the activities of others. The CIA, according to Holzman, disregards the effects of this problem. Since the CIA doesn't have the ruble prices for many items, it values them in dollars and uses dollar-ruble ratios based on items available for their ruble estimates. The effects of the index number problem in Holzman's opinion are not eliminated: the range of the index number spread is reduced less than it should be.

As is explained below, the CIA's practice of using dollar-ruble ratios reduces the range of the index number spread to less than it should be. According to Holzman, the problem with the CIA ruble estimate is made by subaggregating most of the items in dollars first, and then using the dollar-ruble ratios available to translate them into rubles, then the ruble estimate turns out to be mostly a dollar estimate, and this puts an upward bias in the ruble estimate of SME [De Bartolo and Holzman (1985; 1982)]. Holzman is the best known American critic who considers that the CIA overstates SME. Sivard (1985) agrees with him, but she does not disclose her method of calculations.

Birman (1984) criticizes both the CIA and Holzman and states that Holzman disregards the arbitrary non-market nature of Soviet prices which affects the outcome of the "index number problem." Under these conditions military branches work under better conditions than others, but it is in no way reflected in the level of expenditures. Birman states that the CIA considers price ratios of SME practically equal to the price ratios of the economy as a whole, completely ignoring in their computations the advantages of military branches. Birman (1985) also contends that the CIA uses identical composition of SME for different tasks: comparing military efforts and calculating SMB though CIA always emphasizes that military expenditures are not equal to military power. According to Birman, for the estimation of SMB all direct and indirect military expenditures should be taken into account, while for comparing military efforts only those directly affecting the military strength of the country at a given period of time must be considered.

Criticism of the CIA estimates of SME was answered by the former chief of the CIA's Military Analysis Center, Donald Burton (1983), who defended the CIA estimates and criticized those of Rosefielde and Lee.

Most of this criticism was directed against Rosefielde. According to Burton, Rosefielde's

method of calculation is based on three false assumptions: ". . . the interpretation of CIA expenditure estimates as quality rather than value indices, the belief that the CIA's earlier estimate for 1960 can meaningfully be compared with its current estimate for 1970, and that machinery prices have been generally stable" [Burton (1983, p. 90)]. Burton rejects Rosefielde's assertion that CIA estimates fail to take into account the growth in complexity, capabilities and costs of new Soviet weapon's systems. He states that the estimates try to catch the costs of particular kinds of weapons and the particular generations of weapons.

But incorrect could be the CIA's costs, they tried to consider the changes in technology (after the first revision they were better at it). Rosefielde's adjustment factor is therefore used to account for CIA downward bias rather than for technological change. Calculating such a factor as a general coefficient rather than for specific arms for a given year or some period would be a very difficult task indeed. Rosefielde's use of the CIA prerevision series (which was later rejected by the CIA) also makes his position vulnerable. Burton's criticism therefore sounds rather convincing.

The same cannot be said about his criticism of Lee. He does not as much criticize Lee's estimates as the shortcomings of the method used to derive them. The residuals method, as Burton remarks, admits a large margin of error, and Soviet statistics are not reliable. Burton thinks that Lee ignores the fact that his figures contain inflation.

Referring to an unpublished CIA machinery residuals approach study, Burton states that Lee's estimate ranges should be larger, and that different results can be obtained by his method using the same data, although he gives no examples to prove his point. But Burton does not explain how Lee, using an incorrect method could make correct estimates of SME for 1970, while the CIA, using the correct method, made incorrect estimates before the first revision.

In explaining the CIA method of calculating the SME estimates, Burton touches on the first revision, saying that there were signs that the CIA's dollar-ruble rations were too low, but that it was only in 1974 that the CIA managed to obtain a great deal of new data which showed that its estimates should be doubled. It could be an explanation for a 10% revision, but not for a 100% revision. An error of such magnitude could be seen even without detailed calculations, and many critics both within and outside the intelligence community stated that the CIA estimates could not possible be correct. It seems, at least before 1975 the CIA should have admitted it had insufficient data and gave preliminary estimates.

Turning to Holzman, Burton responds to his criticism of CIA dollar estimates of SME and its ruble estimates of US military expenditures by stating that the subaggregation in dollars makes the ruble evaluation of the USSR relative to the US much too high. In this article Burton says that an attempt was made to take this into account by adjusting the ratio. He uses Holzman's criticism to say that one could feel "greater confidence in CIA's own estimates which fall mid-way between the two extremes." This is a strange argument indeed: why couldn't the CIA be mistaken along with one or the other side?

Burton speaks of a steady increase in SME, but does not so much as hint to the changes in estimates which came as a matter of course just some months after he published his article. Even if it were true, as Burton states, that none of the three main critics of CIA presented a convincing case, we feel quite justified in saying that he did not either.

Although Rosefielde and Lee published their response to Burton's criticism and he in turn rebutted their answer [see Correspondence (1985)], the discussion did not add much to what was said before. Rosefielde denied that his estimates were derived by adjusting CIA

estimates which had been rejected by the CIA, saying that he used "real weapon's output statistics," compatible with DIA data. But he does not explain his use of CIA prerevision data and their projection to other years.

Lee, for his part, says that he cannot explain the difference of results in the materials which had not been published. He states that he took into consideration the unreliability of Soviet statistics, e.g., Soviet data on R&D.

Burton in his answer could not avoid mentioning the second CIA revision. Following the CIA he explains the reason for the slowdown in rates of growth of SME but he doesn't explain why CIA made incorrect estimates of SME. It is difficult therefore to share his confidence in CIA estimates.

China, Britain and France published their estimates of SME for some years in current prices. The Chinese estimate (*Peking Review, 1975, 1976*) are similar to Lee's, being one of the highest JME estimates available, but there is no explanation as to how they were reached. They are given in column 6, Table 2. The SME growth rate in 1970–1975, according to the Chinese data, was 8.26.

On the contrary, France (Table 2, column 8) gives the lowest SME figures for 1970 and 1975, apart from Bond and Mochizuki whose figures are almost identical. Figures of France's estimates are taken from the IISS work The Military Balance, 1980–1981, 1982–1983.

Britain's SME's estimates, given in column 7, Table 2 (*Statement of Defense Estimate, 1983*) are somewhat higher than those of CIA (though based on them, but lower than Lee's Rosefielde's and DIA's estimates (column 2, Table 1), whose estimates of annual SME growth was 4%.

The Stockholm International Peace Research Institute (SIPRI) also reported ruble estimates of SME based on an analysis of Soviet official budget figures. Until 1979, SIPRI was the only Western organization using the official Soviet "defense" figures. In 1979, however, SIPRI reported a revised SME exceeding Soviet official data but still lower than most other Western estimates (*SIPRI 1979, 1980, 1981, 1982, 1983*). SIPRI's estimates of SME are given in columns 9 and 10, Table 2. SIPRI did not explain its method of calculation, or the reasons for the revision. The SIPRI estimates are rather low, close to France's estimates for 1970 and 1975, but they are higher than Cohn's and Bond's estimates.

Japanese researcher Kiichi Mochizuki (1983) developed a different method, based on the official Soviet statistical data to calculate SME. He analyzed statistics on national accounts including data on Material Product System of the USSR. His estimates are derived as the sums of (1) consumption by the service men$=0.6\times$(consumer material expenditures), (2) expenditures on science in the branches financed by the state (nekhozraschetnye), (3) non-productional capital expenditures in the branches financed by the state (nekhozraschetnye), (4) either "other expenditures" or "growth of state reserves." Estimates of Mochizuki are given in Table 2, columns 11 and 12. In column 11 the sum with "other expenditures" and in column 12 with "growth of state reserves" are presented. The values in column 11 are higher than those in column 12. The SME estimates of Mochizuki are close to those of Bond and SIPRI (1979), but lower than the values of SIPRI (1980–1983). The usage of Material Product system data and some new Soviet sources (for example, Sh. B. Sverdik's book (1981)) is an advantage of his approach. His method, however, should be further developed to get more accurate data. His experimental estimates of SME include

some nonmilitary expenditures, but at the same time they do not include some military expenditures, for example, the so-called "hozraschetniye" budgetary and also non-budgetary military expenditures). Mochizuki's approach could be best used in determining growth rates of SME, rather than absolute estimates of SME. It can be combined with other methods.

II. *The Soviet Gross National Product (GNP) in Ruble Estimates*

The problem of estimating the Soviet military burden (SMB) is compounded because the annual figures in rubles of Soviet GNP are unavailable. As already stated, regularly

TABLE 3. THE SOVIET GNP
(in billions of rubles)[3]

	1	2	3	4	5	6
	CIA 1	CIA 2	DIA	Rosefielde	Lee	Mochizuki (GDP)[4]
1955		174.5			122.1	
1956		189.1			131.6	
1957		196.2			143.7	
1958		211.2			157.9	
1959		233.4			172.6	
1960	182.7	232.3		170.0	179.4	168.4
1961		245.3			190.8	178.6
1962		254.5			205.9	192.2
1963		251.7			220.4	201.2
1964		279.4			241.2	216.9
1965		296.8		234.0	254.9	233.0
1966		311.9			280.9	249.2
1967		326.3			309.7	273.1
1968		346.0			337.0	296.4
1969		355.9			357.4	317.8
1970	383.2	383.3	387.0	340.0	387.8	350.1
1971		398.2			409.3	370.3
1972		405.7			437.2	384.4
1973		435.2			466.9	415.2
1974		452.2			494.9	437.5
1975		459.7		449.0	528.8	455.9
1976	530.8	481.6				483.6
1977		497.0		496.0		510.6
1978		514.1				539.0
1979		518.2				559.7
1980	635.8	525.4	625.0		666–698	583.9
1981		536.1				
1982		549.0				
1983		568.2				
1984		579.7				

[3] The CIA 1, DIA, Lee and Mochizuki—in current prices; the CIA 2 and Rosefielde—in constant 1970 prices.

[4] Mochizuki states that his estimates of GDP are 1.06 times lower than in the GNP conception published by the US Congress.

TABLE 4. THE SHARE OF THE SOVIET MILITARY SPENDING IN GNP

(percent)

	1	2	3	4	5	6	7	8	9	10	11
	USSR	CIA 1	CIA 2	CIA 3	CIA 4	DIA	Rose-fielde	Lee	Mochi-zuki[5] 1	Mochi-zuki[5] 2	China
1955	9.0		17.0					11.5			
1956	7.6		15.0					9.5			
1957	6.5		13.4					8.5			
1958	5.9		12.0					8.5			
1959	5.5		11.0					8.5			
1960	5.1	10.0	12.0				10.0	9.0	8.3		
1961	6.2		12.0					9.5	9.0	8.0	
1962	6.3		13.0					10.5	9.6	8.7	
1963	6.3		14.0					10.5	10.5	8.5	
1964	5.8		14.0					10.0	10.7	9.5	
1965	5.1	8.3	13.0	15.7	11–13		10.1	10.0	10.6	11.3	
1966	5.0	7–9	13.0		11–13			10.0	11.0	10.2	
1967	5.0		13.0		11–13			10.5	10.8	9.5	
1968	5.0		13.0		11–13			12.0	10.9	10.4	
1969	5.0		13.0		11–13			12.0	10.5	11.1	
1970	4.7	6.6	13.0	13.6	11–13	12–14	14.0	12.6	10.1	9.7	15.0
1971	4.0		12.0		11–13	12–14		13.1	10.4	10.4	15.0
1972	4.0		13.0		11–13	12–14		13.4	10.4	8.4	15.0
1973	4.0	6.8	12.0		11–13	12–14		13.8		8.8	15.0
1974	4.0		13.0		11–13	13–15		14.0		8.8	15.0
1975	4.0	6.0	13.0	12.4	11–13	13–15	15.3	14.4		8.9	15.0
1976	3.0		13.0		11–13	13–15					
1977	3.0		13.0	12.3	11–13	13–15	16.5				
1978	3.0		13.0		11–13	13–15					
1979	3.0		13.0		11–13	14–16					
1980	3.0		13–14		12–14	14–16		18.0			
1981	3.0		13–14		12–14	14–16					
1982	2.0		13–14		13–14						
1983	2.0				13–14						
1984					13–14	15–17					
1985					15–17	15–17		21.0			

[5] Mochizuki shows share of SME in GDP.

published figures of annual Soviet GNP in dollars cannot be used for measuring the military burden. Therefore those who estimate the Soviet military burden use their own ruble estimates of Soviet GNP. Data of the Soviet GNP estimates which one can see in some sources are given in Table 3. Some CIA data in established prices, taken from the paper of Directorate of Intelligence (1983) are given in column 1. The CIA data on GNP for 1955–1980 in 1970 factor-cost prices, taken from the paper of the CIA: *USSR; Measures of Economic Growth and Development* (1982) are given in column 2. The figures for 1981–1984 given in column 2 have not been yet published (the CIA recently began using 1982 prices [MacEachin and Schmitt (1986)]).

The CIA method of calculating Soviet GNP estimate is described in the CIA paper: *USSR Gross National Product Accounts, 1970* (1975).

The DIA's estimate of Soviet GNP for 1970 and 1980 (column 3) is taken from Bissell Testimony in *Allocation of Resources* (1984, p. 192).

Rosefielde's estimates (column 4) are calculated in 1970 prices from net material product data reported in the Soviet statistical annual *Narodnoe Khosyaystvo SSSR*. The NMP values are converted to GNP using the correspondence ratio 1,17, implied by Rush Greenslade (1976).

Lee's estimates of Soviet GNP (column 5) are taken from his own work (1979b, p. 41). Mochizuki's figures of GDP (column 6) are taken from Mochizuki (1983).

Table 3 shows that the difference among the Soviet GNP estimates of CIA, DIA and Lee is insignificant, but Rosefielde's and Mochizuki's estimates were consistently lower than the others. In 1970 the difference was 30–50 billions of rubles. Lee's projection tends to overstate GNP for 1980, evidently because he did not anticipate the slowdown in the Soviet economy at the end of the 1980s. Birman (1984, 1985) thinks that CIA and other Western sources overstate the Soviet GNP, as it doesn't take into account difference in quality of the Soviet and Western products and services. (Birman also mentions some other factors of overestimating which are discussable, however). Birman notes that the Soviet GNP calculated by the CIA proves to be larger than the GNP constructed on the Sovieto Kcial data.

III. *The Soviet Military Burden in Ruble Estimates*

Estimates of SMB presented as a share (percent) of SME in the GNP are given in Table 4.

The Soviets do not report the figures of their defense burden. Thus Western scholars calculate the "Soviet official" share of SME in GNP by using both official Soviet figures of JME and Western estimates of Soviet GNP. The figures of the "Soviet official" burden given in column 1, Table 3, are taken frrm Becker (1985), who uses sources containing indices of GNP and calculates them for years for which the indices are absent.

The figures show a steady decline in SMB from 9 percent in 1955 to 2 percent in 1982 and 1983.

The prepevision CIA estimates, taken from Rosefielde (1982) are given in column 2 (CIA 1), Table 4.

There are several CIA postrevision estimates. Some of them are given in columns 3, 4 and 5, Table 4. The figures of column 3 (CIA 2) are taken from Becker (1985, pp. 13,

14). The figures of column 4 (CIA 3) are calculated by the authors with the use of upper and lower bounds of a 90% confidence interval around CIA estimates of SME [Rowen (1982, p. 281)] and CIA calculations of GNP [CIA (1982, pp. 65–67)]. The column 5 (CIA 4) shows CIA SMB estimates officially announced by CIA sources.

The 11–13% range of SMB[5] for 1965–1973 is taken from CIA (1976, p. 1) and Turner (1981, p. 124). The estimates for other years are taken from the following sources: for 1980, 1981—from Turner (1981, p. 124) and Rowen (1982, p. 252): for 1982–1984—from Gates (1985, p. 8) and for 1985—from MacEachin (1986, p. 66).

But the values which Rosefielde gives without any references somewhat contradict the CIA 11–13% range, being in the 12–14% range. The estimate for 1980–81 (column 5) was given by Welsh (1983).

The DIA estimates of the SME share in GNP (column 6) for 1970–1973 was 12–14% i.e., 1% higher than the commonly cited 11–13% CIA estimate. The DIA estimate for 1980–1981 is 2% higher than that of the CIA and their 1983 estimate of SME share in GNP was 15–17% [DIA (1984, p. 12); Bissel (1984, p. 25; 1985, p. 135); Becker (1985, pp. 13, 14)].

It is interesting to note that the SMB ranges derived with the use of upper and lower bounds of CIA estimates column 4 (CIA 3), Table 4, show a pronounced downward bias in its officially announced estimates, (column 5 (CIA 4), Table 4). The former estimates are in between CIA official estimates and higher DIA estimates (column 6, Table 4) and in some cases even closer to them than to their own (column 4, Table 4).

Rosefielde's (1982) estimate of Soviet military burden (column 7) for 1960–1965 were 2% lower and for 1970–1977—2–4% higher than those of CIA.

Lee's (1977a) estimate (column 8) for 1970 was less than those of the CIA, DIA and Rosefielde, but his estimates for later years [Lee (1980)] exceed those of the CIA, although in 1975 his estimate coincides with DIA. But his 18% for 1980 supercedes even DIA's estimate and Lee's estimate for 1985 is 21% in constant prices and 17% in current prices [Lee (1985 and 1986)].

According to an experiment carried out on PlanEcon's new long-term simulation model of the Soviet economy, SMB for 1985 is 15% [see Vaňous and Roberts (1985)].

Sivard's (1985) current estimate of SMB is 11%. The method of its calculation is not explained.

Bond (1980) reports the SMB as a share of SME in NMP, not GNP, and hence is not given in Table 3, but his data suggest rather a stable level of burden: 10.5% for 1960, 11.6% for 1965, 11.7% for 1970, 12.3% for 1975, and 12.2% for 1978.

Mochizuki's (1983) estimates of SMB, given in column 9 and 10, are calculated as a share of SME in GDP. The values in column 9 are derived from SME calculations containing "other expenditures" and in column 10—containing "growth of state reserves." They are the lowest values of SMB given by non-Soviet sources, being lower even than the values of Bond, Sivard and Holzman. Mochizuki's current SMB estimate of 8% is too low as he doesn't take into account essential factors.

[5] Instead of the 11–13% range generally cited for 1965–1978 the CIA also gave narrower ranges of 11–12% and 12–13%. These figures were related to different definitions of defense expenditures: narrow definition and broad. The latter includes "civil defense" and some other items abscent in the US military budget [CIA, (1976 p. 1) and Turner (1980, p. 44)].

China [*Peking Review* (1975, 1976)] gives an estimate of 15% as the annual share of SME in GNP for 1970–1975 (column 11).

As we can see, estimates of Soviet military burden by DIA, Lee, Rosefielde and China for 1975 are close, and higher by approximately 2% than those of the CIA. This can be mainly explained by their higher estimates of SME.

CIA thinks that SME figures must be in constant 1970 rubles because recent SME figures are generally unavailable in sufficient numbers. Hence Soviet GNP figures for comparison purposes must also be constant 1970 rubles. For index number reasons, estimates of SME/GNP in 1970 rather than current rubles, will bias the ratio upward because nIw weapons priced in 1970 rubles will be more expensive, that is, the numerator of the ratio is much higher in 1970 prices, while GNP as a whole is not [Holzman (1983); see also Lee (1985)].

In Congressional hearings, Senator Proxmire tried to learn the reason for the difference between CIA and DIA estimates. The DIA representative replied that CIA estimates are calculated in constant 1970 rubles, while DIA's estimates are done in current prices, which they consider the best measure [Bissel (1985, p. 235)].

In the last published paper, CIA admitted that SMB in constant 1982 prices is 15–17% [MacEachin and Schmitt (1986)].

The opposite views on the Soviet military burden were expressed by Holzman and Birman. Holzman believes that the CIA's overestimates of SME could affect their estimates of the Soviet military burden and feels that the share of SME in GNP could be one or two percent below the CIA's 12–14 percent [Holzman (1982)].

Birman states that the CIA underestimates the military burden. First, the CIA's estimate of the GNP is too high (in 1975). Then even the main items of the budget make the share of SME amount to 11% to GNP. Many small budget items, such as education, health care, pensions, etc., should be added. Second, there are other additional sources of military expenditures, e.g., civil defense. Third, there are non-budgetary sources of SME, such as bank credits. Moreover, there is a budget deficit and conceivably the real size of the budget may be greater than the official sum, the unseen difference going to the military. According to Birman (1984) if all of the factors are taken into account, the real share of SME in GNP will be no less than 20%. In another paper Birman (1985) gives the following explanation of his figure:

> "Why do I disagree with the notion that the military share of the GNP is as low as 12–14 percent? Firstly, it follows from my comparisons of the total sizes of the Soviet and American GNPs. Secondly, it follows from what I have just stated—that the CIA calculation ignores the exceptionally good conditions for military industries. I see no way to quantify the factor precisely, but would dare to suggest that conditions in military industries are at least 50 percent better than in other industries. So, if the CIA estimates the military share at 12–14 per cent, I would assert that it is not less than 20 percent of the GNP."

Similar considerations were expressed by other researchers. Doe (1983, pp. 163, 164) gives 32 sources of Soviet Ministry of Defense revenues outside of the budget. Bisell (1985, p. 124) notes the preference given to military production and R&D over civilian counterparts, subsidies provided by the civilian sectors. He further states that if Soviet policies reflecting the primacy of the military were considered, the estimate would be larger and

more accurately reflect the "full cost of defense" to the Soviet Union.

Although he uses 17% as the top point of the estimate range of the share of SME in GNP, he admits that broader calculations would increase his estimates. Lee's estimates already have been mentioned.

Most of the sources which give figures for the 1980s estimate the share of SME in the range of 17–20%.

Conclusion

The present study shows that there has been a marked improvement in estimating SME and the Soviet military burden for the last 15 years. Various researchers have given a better idea of SME and their share in GNP. We can also better understand the difficulties in making the estimates and the range of possible errors. The polemics and mutual criticism showed weak points in the methods used to derive the estimates. The arguments have forced the authors to develop techniques of computation, and new factors are being evaluated, e.g., the role of weapons write-off and the price of Soviet arms sales [see Wiles and Efrat (1985)]. At a time when few reliable data are available, it would be fruitless to denounce some approach or method as utterly false and leave it out of consideration. The different methods and results can be used comparison and integration.

The most remarkable fact in this connection seems to be the similarity between estimates for 1970 SME derived by Lee and the CIA, using guite different methods, which demonstrates a potential approach for obtaining reliable future SME estimates, although both methods must be considerably developed to achieve this aim.

At the same time and despite the improvement in methods for estimating SME and the Soviet military burden, the results are still far from being satisfactory. The margin of error is too high and the results differ greatly.

The peculiarities of Soviet society, and the economy in particular, make it difficult to employ usual calculations in money terms. Beginning from 1975 the Soviets publish less detailed data on the Soviet national income. Apart from the US intelligence services, researchers in the field must work independently and with limited means. It is understandable that the CIA and DIA are reluctant to publish their initial information, since publications of this kind can reveal secret sources and the weak points in knowledge. However, it seems that some methodological questions concerning, e.g., the definition of military expenditures, methodology of determining costs and prices and possible methods of calculation of SME and SMB, could be openly discussed by analysts in the field.

In defining military expenditures, even such a basic question as the list of kinds of military expenses is not yet resolved. Some sources include military pensions in the volume of military expenditures. Others exclude them. What portions of RDT and E and, particularly, what elements of space research to include in military expenditures ought to be seriously discussed. In addition, the problem of including civil defense in the list of military expenditures should be addressed. These definition problems cannot be resolved without taking into consideration specific properties of different political systems.

It is difficult not to agree with Birman that SMB must be as inclusive as possible. These SME must include expenditures, relating to the present, the future (R&D) and the past

(pensions) military activities.

As for military pensions, it should be noted that the Soviet retired officers make up the single most numerous group of pensioners whose pensions essentially exceed the standard Soviet pensions maximum (120 rubles a month). These pensions are usually given to the people before the pension age established for ordinary people. Unlike most other pensioners they are allowed to receive pensions in addition to their civilian salary when they are retired from military service. Therefore there are special reasons for including military pensions into SME used for calculating SMB.

There is no doubt that civil defense should be included in SME for calculating SMB. Moreover it is diKcult to agree with Birman that it should be excluded from SME for comparing the military balance. The military strength of a country consists of both the capacity to attack and to defend, including the defense of the civil population and civilian and military objects. Military and civil defense are interconnected, e.g., building a perfect antimissile systIm would make civil defense unnecessary. This is why the exclusions of pensions and civil defense from SME (in most of the estimates of SMB) understates SMB. SME for SMB should include outlays caused by military planning in civilian sectors of industry and infrastructure, which are larger in the USSR than in Western countries.

Expenditures for KGB and MVD troops should be included into the SME calculations too. These troops take part in military operations (WWII, Afghanistan, etc.).

It seems logical to include exported weaponry into the volume of SME used for the calculation of SMB as well as into the volume of SME used for comparisons of military balances. Indeed, export of weaponry is used to enforce military and political influence and, consequently, military power. Then the productive equipment which produces exported weaponry (if we mean the export of new weaponry) can be used for rapid increase of the volume of domestic weaponry. In other words this volume of exported new weaponry shows a real existing potential of the military might. Correspondingly we must not exclude the exported production from SME.

The next substantial problem after the definition of SME is the price problem.

The significance of the price problem is clearly seen if we note the significant differences among various sources in estimation of the ratio between constant and current prices. Currently, both CIA and DIA believe that the change from the 1970 to 1982 price base leads a to higher estimate of SMB. As a result, CIA now states that SMB is 15–17%, although previously (in 1983) CIA's estimate of SMB was 13–14%. Both CIA and DIA (including Lee, who now works with DIA) agree that SMB in current prices (or close to current prices) is 15–17%. But while Lee believes that constant 1970 prices create an upward bias (21%), CIA and DIA feel that 1970 constant prices have a downward bias (12–14%). It is also interesting that while Lee and Holzman hold opposite views on SME and SMB, both agree that constant prices have an upward bias. The reason for this paradox is that in assessing the effect of constant prices, different trends are taken into consideration.

Holzman, as it was mentioned, considers the lower prices for goods which no longer are new, and the CIA and DIA consider inflation and state that price index for military production in 1982 increased 50% in comparison to 1970 (MacEachin and Schmitt, 1986,

p. 66).[6] Of course it is desirable that both trends should be considered, as well as the growth in the complexity and sophistication of weapons. However, we would like to note that increasingly rapid modernization of weaponry reduces the significance of the factor of decreasing prices on old products because of their short life (as we can see on the example of MIG fighter bombers). The nonmarket nature of the Soviet economy and shortages allow state organizations to fix arbitrary prices for new products without taking into account their quality. To hide underfulfillments of production or finance plans, the Soviet plants and planning boards of civilian industries often declare old products (sometimes even of worse quality) new ones and of better quality to get price increases. This is what affects significantly the indices of volumes of production both in current and constant prices. This is why the indices of the produced and utilized national product and the indices of GNP (and GDP) constructed on their basis are overstated and contain essential hidden inflation.

At the same time the reasons for the hidden inflation have less influence on the military industry because in it such indices as fulfillment of plans for creation and production of specific new weaponry by pre-arranged dates and not volume of production and profit are controlled first of all. Besides, better control of quality in this industry makes it difficult to change prices without real ground. This means that in the formula of SMB mostly the denominator (GNP) is overstated by the factor of the hidden inflation. As a result when one calculates SMB on the basis of the Soviet indices of production, he understimates SMB.

To understand this fact however is not the same as to calculate its influence on the figures of SMB. The fact is that nobody even in the USSR, knows exactly and moreover nobody can know the total influence of hidden inflation on the indices of the growth of the Soviet economy. The reason for this is that the people who overstate the volume of production hide their actions from their chiefs, and their chiefs are even interested to pretend that they do not know about the hidden inflation. This is why anyone trying to gather such facts in the USSR could be at once stopped or even accused of slander. In this situation it is doubtful that Western experts can determine the hidden inflation.[7] Of course higher Soviet authorities and Western experts can see that the growth of mass production in physical units (in tons, meters and so on) increases much more slowly than the declared increase of industrial production in money measurements.

There are also some specific instruments to compare real change of quality of "new" products with the growth of prices. We mean particularly the information about the changes of standards and patents on new products or alleged "new production". However such analysis for the whole or sufficient part of the nomenclature of the Soviet products could require creating special research organizations for each branch of the Soviet industry.

[6] In his remarks on this paper, Professor Holzman gave the following possible explanation of this paradox. If the CIA had truly valued weapons in constant 1970 prices, then there is no question but that these prices would have overvalued 1982 weapons relative to their value in 1982 prices for readily apparent reasons. What may have happened, however, is the following. When you try to value weapons in 1970 prices that couldn't have been produced in 1970, you are faced with the "infinite cost" problem. To avoid this, various devices are used. One of these is simply to value the new products at "factor cost," which means basically leaving out the new advanced technology that is the real diffdrence between the new and old products. In this event, the 1970 prices of new products won't be as high as they should be and, in fact, 1982 prices of these products might be higher because they will be real prices rather than just factor costs excluding technology. It is possible this is the reason for the bizarre results.

[7] The discussion of hidden inflation in the USSR (see: Steiner (1978), (1982), Rosefielde (1981), (1983)) and Leggett's paper (1981) also confirm the difficulty of estimating the size of the USSR inflation.

It is difficult to calculate not only hidden inflation, but also other factors determining SMB, such as the privileged status of the military sector (though some concrete methods for definite industries can be proposed and used).

Some estimaters of SMB (DIA, Lee) stated that if all factors had been considered the estimate of SMB would have been considerably higher. The top figure of the range of possible SMB values, however, has not been indicated. Using more than approximate approach of Birman we could get the top value of the SMB range (rather than the estimate of SMB as was the case with Birman). Taking 15–17% latest SMB estimate of CIA and DIA as the basis and assuming that the components of SMB not taken into account amount to the same 50% increase we shall get 24% as the top value of the SMB range. The weakness of calculation is that we do not know whether the effect of the mentioned factors is 50%, 25% or even less. However having in mind the analysis provided above the 11–24% range[8] could be reduced to more probable 17–22%, rather than 13–15% assumed by Becker (1985, p. 19). At the present state of our knowledge it is difficult to give more accurate figures of SMB.

What is the perspective of changes in SMB? The slowdown in the rates of growth of military procurement spending noted by SIA gave rise to speculations on trends of the SME. Some authors think that there has been a change in the Soviet attitude to the levelling of priorities in favor of the civilian industries [see Steinbrunner (1985)] or at least possible [see Kaufman (1985a), Holloway (1985)].

Our opinion is that the slowdown of rates of growth at SME can be only temporary and therefore reduction of SMB for a large period is unlikely. Rumer's (1986) notes on increase in machine building investment and on some specificities of Gorbachev's modernization program can only confirm such an opinion.

The current Gorbachev's liberalization can not change the Soviet military strategic objectives unless radical changes in the Soviet society take place. For this unfortunately there is only little hope.

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[8] We exclude experimental Mochizuki's estimate from this range as in his calculations of SME he doesn't take into account too essential factors (besides, Mochizuki reconsiders his estimate now).

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