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MEASURING THE PERFORMANCE OF A COMMUNIST COMMAND ECONOMY: AN ASSESSMENT OF THE CIA ESTIMATES FOR THE U.S.S.R.

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There are major methodological and practical problems in comparing the performance of capitalist and communist economies. They have been most carefully analysed for the former Soviet Union, for which there was a huge research input, mainly by the CIA. The CIA effort had considerable merit, particularly in assessing Soviet rates of growth. Unfortunately, it was terminated in 1991, partly because it suffered from unduly harsh criticism, partly because its political relevance waned. However, the CIA archives remain an important source for the study of comparative economic growth. It would be extremely useful if they were opened to scholars, a serious loss if they were destroyed.

INTRODUCTION

It has always been difficult to make reasonably valid comparisons of communist and capitalist economies. The official statistics on growth performance were unacceptable because their coverage was narrow, they overstated growth, and understated inflation. Reconstruction of the accounts on Western lines was and is a major research exercise. The CIA did this job rather successfully for the U.S.S.R. The result is that we have a reasonable picture of Soviet growth performance, available in such transparent detail that further refinements or modification can easily be made. Their seriousness of purpose can be readily demonstrated by brief consideration of the casual nature of their work on China.

THE NATURE OF THE COMPARABILITY PROBLEM

It is worth recalling some of the substantive and statistical difficulties in reconstructing the official accounts.

In communist economies, private property in means of production was virtually eliminated, and all major decisions on resource allocation were made by government command rather than by market forces. The party elite gave highest priority to investment in heavy industry and to military spending. Consumption shares were characteristically lower than in Western countries. Basic items were sold below cost and full employment was guaranteed. However, consumers had only limited access to commercial services, private automobiles and housing. There

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was no competitive pressure to meet consumer demand for quality goods, and queuing made heavy demands on consumer time. Price and tax structures and incentives were different from those in the West. Enterprise profits were simply mark-ups on labour and material inputs and did not reflect asset scarcity. Characteristically, these economies had high ratios of capital to output, and bigger inputs of energy and materials in relation to output. Managerial problems were increased by a preference for giant firms which produced diseconomies rather than economies of scale. In agriculture, in 1987, there were 500 persons employed on the average Soviet farm compared with little more than 1 in the U.S.A.; in industry, the average Soviet firm employed 814 people compared with 49 in the average U.S. manufacturing establishment. International trade was concentrated on other communist economies, with barter exchange or transactions at artificial prices.

The problem of comparison was exacerbated by differences in statistical practice. The communist economies relied on the material product system (MPS) which took a narrower view of the scope of economic activity than the standardized national accounts (SNA) used in the West. MPS ignored important non-material service activities which were considered "non-productive," i.e. passenger transport, housing, health, education, entertainment, banking, insurance, personal services, government, party administration and the military. For 1987, the CIA estimate of Soviet GDP was 22 percent higher than the measure of gross material product (GMP) in established prices. These "non-productive" items did not figure in the Soviet accounting aggregates or in the official input–output tables.

A second feature of Soviet official accounts was a preference for measures of gross output rather than value added. The material product estimates eliminated the double counting problem, but they were not always available in detail, which complicated comparison with Western measures.

The statistical reporting system drew mainly on information created to meet the needs of the governmental control system. Productive activity was reported regularly by virtually all enterprises in both current and "comparable" prices. Aggregate output was derived by aggregation of enterprise returns. Enterprises had an incentive to exaggerate the degree to which they were fulfilling plan objectives. When new or allegedly new products emerged, there was an opportunity for enterprises to exaggerate their quality or characteristics relative to older products. The statistical authorities made little use of sampling or crosschecks on the validity of enterprise reporting. There were no index numbers using physical quantities and value added weights as in the West. The meaning of Soviet volume indices was therefore quite fuzzy. The consequence was a universal tendency to understate inflation and exaggerate growth in the volume of output.

The Quality of CIA Work on the U.S.S.R.

Fortunately for comparativists, there was a massive research effort by the CIA, the U.S. Department of Agriculture, and the U.S. Bureau of the Census. They used Soviet physical indicators and input–output tables to produce GDP measures more or less comparable with Western concepts.

This research effort was initiated by Abram Bergson and his associates in the early 1950s, developed by government funded research in the Rand Corporation

and later by the CIA and other government agencies. Thus there were forty years of massive scholarly activity to produce comparable estimates of Soviet performance on a continuous, systematic, transparent and institutionalized basis. Apart from the military assessments, most of this work was fully documented and publicly available in about 30 volumes of hearings of the Joint Economic Committee of the U.S. Congress which appeared between 1955 and 1990. In the late 1980s as the Soviet economy began to disintegrate and in the early 1990s when it collapsed, there was harsh criticism of this research effort. Most of it was not well founded, but nevertheless it helped persuade the U.S. government to stop funding this research (and the similar work on East European economies) in 1991. As a result, the quality of the information we have on the performance of the former communist economies is now much worse than it used to be.

CIA Measures of GDP Growth by Industry of Origin for the U.S.S.R.

The CIA GNP estimates by industry of origin for the U.S.S.R. are described in greatest detail in JEC (1982). There is a general review of methodological problems by Laurie Kurtzweg (JEC, 1990) which also answers some of the critics of the CIA approach (such as Boretsky, 1987) who suggested that their figures had a downward bias, or (Khanin, 1991 and 1993), who leaned in the other direction. Becker (1994) and Schroeder (1995) summarize the main criticisms the CIA has had to face. CIA (1990), edited by John Pitzer, provides answers to most of the critics, and gives a balanced assessment of the strengths and weaknesses of the CIA work with some indication of research priorities. A favourable Russian assessment of the CIA work can be found in Kudrov (1998). Kudrov was a leading Soviet Americanologist, and his forthcoming book contains a detailed survey of past Soviet assessments of U.S.S.R./U.S.A. performance, with details of work which was previously suppressed.

(a) *Agriculture*

For agriculture, Severin, Hughes and Pitzer (JEC, 1982, pp. 247–316 and 88–91 respectively) describe CIA procedures for the U.S.S.R. Physical indicators were used for 28 crop items, 10 livestock products and four items of livestock inventory change using benchmark year producer prices (or surrogates) as weights. Feed, seed and wastage were deducted from output, as well as ten kinds of non-agricultural input to produce an aggregate index of value added. CIA (1991) provides a detailed update of these estimates to 1990 with 1982 weights. This approach was inaugurated by Johnson and Kahan (1959). It more or less replicated U.S. Department of Agriculture procedures, except that coverage was somewhat smaller.

The CIA measure for China was extremely crude by comparison. Aggregate tonnage of grain production was given a weight of 85 percent, and cotton output a weight of 15 percent. No price weights were used, no livestock products were included and no deduction was made for inputs, (see JEC, 1972, p. 42). This primitive procedure was never modified and the series was discontinued after 1982.

(b) *Industry*

The CIA measure of Soviet value added in industry was a development of earlier work by Nutter (1962) for the NBER and by Kaplan and Moorsteen for the Rand Corporation (see Moorsteen and Powell, 1966, pp. 619–41). It was similar to the approach used in the U.S. Federal Reserve Board industrial index for the U.S.A. Over time the procedures and coverage were improved and refined. Ray Converse (JEC, 1982, pp. 169–244) described in great detail the coverage and method as it had then emerged. The CIA measure contained physical indicators for 312 products. The physical indicators of gross output were weighted by benchmark year prices to estimate sector totals, which were then aggregated into branch and industry group measures, using value added weights at factor cost (derived as described below). This physical indicator approach was used for 58 of the 72 branches. For 11 branches value estimates were deflated with CIA deflators, and for 5 sectors use was made of Goskomstat gross output measures in "comparable" prices. The double deflation technique used for agriculture was not feasible in the case of industry, so the estimates were not adjusted for possible changes in non-industrial inputs over time. Output was broken down into eleven major industry groups using the Soviet rather than the standard international classification.

For China, the CIA had much less information than for the U.S.S.R. because of the collapse of the Chinese statistical system from 1960 to the mid-1970s. Their industrial index was first presented in 1967 with only 11 indicators. In 1975 the number of indicators more than doubled, but for 7 of the 11 sectors it contained, performance was measured by output of a single commodity (see detailed description by Field in JEC, 1975, pp. 160–74). The index was last presented in 1982, for the years 1949–80. By then its coverage had been widened, but it was based on indicators for only 45 commodities. The sector weights were wage bills, with gross output weights for handicrafts.

(c) *Rest of the Economy*

The CIA made separate estimates for 14 other Soviet sectors: construction, transportation, communications, trade, housing, utilities, repairs and personal care, recreation, education, health, science, credit and insurance, civil government administration, and military personnel (described in detail in JEC, 1982, pp. 83–168).

For China, the CIA offered no measures for these other sectors. Its surrogate GNP measure was simply an amalgam of its estimates for agriculture and industry, with agriculture given twice the weight of industry.

Conversion of Prevailing Soviet Prices To Value Added at Factor Cost

The CIA showed two sets of estimates for Soviet growth: at Soviet prices and at adjusted factor cost. The latter estimate is what they preferred. They followed Bergson's practice in converting data in Soviet purchaser prices into producer prices at factor cost in order to get a more realistic appreciation of the resource costs involved. Bergson's measures of Soviet output were usually in terms

of expenditure categories, whereas the CIA gave prime emphasis to estimates by industry of origin (though it also produced estimates by "end use" and by income originating which were roughly reconciled to the industry of origin approach).

Alternative calculation at factor cost and market prices is a normal feature of Western national accounts. In the Soviet case the move from purchasers' to producer prices involved removing indirect taxes, transport and distributive margins, and addition of subsidies just as it would in the West. In addition it involved an adjustment of Soviet profit margins. Reported Soviet profits were simply mark-ups on labour and material inputs, so they did not reflect the cost of capital assets. Therefore the CIA replaced reported Soviet profits by imputing a uniform 12 percent return on capital employed (using Soviet sources for the capital stock). The conversion exercise is described in JEC (1982), pp. 162–8, and in JEC (1990), p. 44. The CIA made no imputation for economic rents in natural resource sectors (agriculture and mining), see Liefert (1991).

Table 3 compares the CIA industry of origin estimates of GNP at factor cost and in "established" prices (i.e. prices prevailing in the U.S.S.R.). The factor cost adjustment brings some minor changes in the growth rates for industry and services, but the big changes are in the weights for the different sectors. The factor cost measure showed slower GNP growth for 1950–90 (3.5 percent per annum instead of 3.7) because the weight of industry was lowered substantially, and that of the slower growing sectors (farming and services) was increased. The reason for this is that indirect taxes were levied mainly on industrial products, some important services were heavily subsidized, and the adjustment for agriculture included a higher imputation for returns on capital employed, see JEC (1990), p. 23.

The construction of factor cost estimates for the U.S.S.R. was a very ambitious exercise involving a large CIA research input. The aim was to create a counterfactual estimate of what Soviet prices would have been if the economy were run on capitalist lines, removing the "distortions" created by the command economy, and getting a better picture of the real cost of production.

A major statistical weakness in this exercise is the poor quality of the official Soviet estimates of capital stock which were the basis for the CIA imputations. These estimates of the stock of fixed assets were based on an aggregation of individual enterprise returns of book values at historical cost. These wealth estimates give a much less reliable picture of real intersector asset distribution than the U.S. Department of Commerce estimates of the American capital stock using the perpetual inventory technique. There the deflators and age structure of assets are clearly specified.

A more fundamental problem is that the assumption of a uniform rate of return on assets in different sectors involves an idealized view of how capitalist economies work in a situation of long-term equilibrium.

Nevertheless, it is very useful to be able to compare the actual and counterfactual estimates which are summarized in Table 3 because they illuminate major idiosyncracies of the Soviet price structure. In fact I used the adjusted factor cost series for measuring Soviet GDP growth in Maddison (1995). The problem is different when making inter-country comparisons of *levels* of performance (such as those of Kouwenhoven 1996a and 1996b for industry and farming). Here it is

advisable to stick to actual prices. When such level comparisons are available for the whole economy, it will be possible to measure Soviet growth using U.S. prices, and U.S. growth using Soviet prices. This type of counterfactual better illuminates the issue because the U.S. price structure reflects capitalist reality which differs from that in a world of uniform intersector rates of return.

Weighting System

The CIA weighting practice was similar to that which used to prevail in constructing U.S. national accounts, i.e. the same weights were used for the whole period covered. Thus JEC (1982) presented estimates for 1950–80 in 1970 rubles, and JEC (1990) used 1982 rubles for 1950–87 (available for 1950–90 in CIA, 1991). As their main purpose was a binary comparison with the U.S.A., which followed the same practice (but changed the benchmark more frequently), there was nothing untoward in this procedure.

However, practice in most West European countries has moved towards construction of time series with changed weights every five years. Thereafter the five year segments may be linked over a longer period, expressed for convenience in *numeraire* prices of a single year (see Maddison, 1995, pp. 119–24).

In the U.S.A., the practice of the Department of Commerce changed in 1992 and three variants of the accounts became available, the old single benchmark approach; five year segments; and a chain index with weights changing every year. This was an enlightened and very illuminating innovation. Unfortunately, the Department of Commerce has changed its practice and now gives GDP growth estimates using only chain weights, which reduces comparability with most European measures (except that of the Netherlands).

It would be useful if one could apply sensitivity tests to the CIA estimates to see the impact of alternative weighting systems. The CIA did not systematically publish estimates of Soviet GNP in current rubles, but Pitzer (1983) provided some sensitivity tests, using current price and constant price CIA estimates for the four years 1960, 1970, 1976, and 1980. His GNP deflator for the U.S.S.R. rose by 2.1 percent a year for 1961–80 compared with the official Soviet deflator for net material product which showed a decline of 0.1 percent a year for the same period.

Summary of Growth Results by Industry of Origin

Table 1 presents a comparison of the official Soviet measures with the alternatives I used (which for 1928–90 were from Rand–CIA sources). The alternative estimates of output always show slower growth than the official measures. All measures show best performance in 1950–78, with a very distinct slowdown thereafter. It should be noted that for aggregate performance, the official measure refers to net material product. This approximates the notion of value added except that so-called "non-productive services" are not included as outputs or inputs. For industrial and farm performance, I could not find continuous official published estimates of net material product by sector, so in Table 1, I quote gross output

TABLE 1

CONFRONTATION OF OFFICIAL AND ALTERNATIVE MEASURES OF SOVIET GROWTH PERFORMANCE 1913–90

	Official Estimates of Performance			Alternative Estimates of Performance		
	Annual Average Compound Growth Rates					
	1913–50	1950–78	1978–90	1913–50	1950–78	1978–90
			Aggregate Performance			
NMP/GDP	6.1	7.7	2.4	2.1	4.4	1.2
Population	0.4	1.3	0.9	0.4	1.3	0.9
Per capita product	5.6	6.3	1.5	1.8	3.0	0.4
Employment	(0.5)	(1.6)	(0.3)	0.5	1.6	0.3
Labour productivity	5.6	6.0	2.1	1.7	2.7	1.0
			Farm Performance			
Gross output/value added	0.9	3.5	0.8	0.3	2.4	−0.1
Per capita GO/VA	0.5	2.1	−0.1	−0.1	1.0	−1.0
Employment	(−1.0)	(−0.7)	(−0.7)	−1.0	−0.7	−0.7
Labour productivity	1.9	4.2	1.5	1.3	3.1	0.6
			Industrial Performance			
Gross output/value added	7.2	9.2	3.1	3.7	6.5	1.5
Per capita GO/VA	6.8	7.8	2.2	3.3	5.0	0.6
Employment	(2.6)	(3.1)	(−0.2)	2.6	3.1	−0.2
Labour productivity	4.5	5.9	3.2	1.0	3.3	1.5
			Performance in Rest of Economy			
Value added					4.8	1.7
Per capita VA					3.4	0.9
Employment					2.6	1.0
Productivity					2.1	0.7

Source: Official figures for total net material product and gross output in farming and industry from Kudrov (1998). A continuous series for net material product for agriculture and industry was apparently not available though Becker (1972), p. 93, provides a partial coverage. Alternative estimates for 1913–50 GDP movement from Maddison (1995), farm value added from Davies (1990), p. 279 for 1913–28, Moorsteen and Powell (1966), p. 623–4 for 1928–50 adjusted for territorial change. Industrial value added 1913–28 from Nutter (1962), p. 169, 1928–50 from Moorsteen and Powell, p. 623–4 adjusted. Alternative CIA estimates for 1950–90 from Table 2. Population and employment from Table 3.

measures for sector output, from which no inputs are deducted. For the rest of the economy, I could not infer the official Soviet measure.

Table 2 presents my estimates of employment.

CIA ESTIMATES OF SOVIET EXPENDITURE CATEGORIES

The CIA expenditure estimates were closely related to those by industry of origin, and were, in significant degree, derived from them. The total GNP in terms of expenditure in fact replicated that by industry of origin.

The consumption estimates are described in detail in Schroeder and Denton in JEC (1982). As in ICP comparisons, they treat education and health as private consumption. In fact these items are provided by government, but this procedure facilitates international comparison. The estimates also cover so-called non-productive services which are omitted from the official Soviet accounts. They are presented in substantial detail and cannot be seriously challenged. However, the

TABLE 2

SOVIET EMPLOYMENT AND POPULATION 1913–90
(000s at midyear)

	1913	1950	1978	1990
Farming	51,450	35,726	29,740	27,239
Industry	5,900	15,317	36,014	35,286
Other	11,250	30,100	62,350	70,021
Total	68,600	81,143	128,104	132,546
Employment population	156,192	180,050	261,253	289,350

Source: 1913 total employment and employment in agriculture from Maddison (1976), industrial employment from Nutter (1962), p. 346. For 1950–90 the figures are mainly from Soviet sources. 1950 from *Narodnoe Khoziastvo 1965*, Moscow, 1966, pp. 435, 558–9, plus an additional 5,023 thousand working on private plots in farming (the allowance for private plots is the same proportionate addition—16.36 percent—to other workers in agriculture which this source indicates for 1965 (see p. 435). In addition I have included 4.6 million in the armed forces as indicated in Rapawy (1987), p. 194 and 3.5 million for penal labour as indicated by Bergson (1961), p. 443. For 1978, I followed the same procedure, adding an estimate of 4,182 thousand for labour on private plots, 4,088 thousand for the armed forces from Rapawy (1987) and assumed 1 million for penal labour. 1990 figures are from *Narodnoe Khoziastvo 1990*, p. 449 for agriculture, and pp. 100–1 for other sectors. In this case the official Soviet figure for agriculture includes workers on private plots. I added 3 million for armed forces, and 300,000 for penal labour. Rapawy (1987) and other statisticians from the Soviet branch of the U.S. Bureau of the Census have taken most of their estimates from Soviet sources. The main difference is that they estimate farm employment on private plots to be about twice as high as I do, e.g. 11,998 thousand in 1950 and 10,345 thousand in 1978. In Maddison (1969), p. 148 I rejected their estimates because they were "based on calculation of labour requirements in private plots assuming that output per man is similar to that in the public agricultural sector. This seems a questionable assumption and involves double counting of collective farmers and others who are already included in the labour force." Population figures from Maddison (1995). The figures refer to boundaries of the U.S.S.R. as they were from 1940–90. For 1987, see Table 8 below.

CIA estimates for investment and government consumption leave a good deal to be desired.

The estimates of levels of fixed investment are exaggerated for two reasons: (a) they include large repair costs, most of which would be treated in Western national accounts as intermediate inputs; (b) they include a significant account of military investment, which in Western national accounts would be treated as current defence expenditure. The reason for this unsatisfactory treatment is stated to be the statistical difficulty in distinguishing major structural repair from other repair activity, and in identifying output of military equipment, but there also seems to be a reluctance to present Soviet defence expenditure overtly.

For the benchmark year 1982, the CIA estimate of total fixed investment and repairs is over 200 billion rubles, or 28 percent of GNP (see Table 4). As a rough estimate I would suggest deducting one-third of the machinery and equipment investment and half of the allowance for repairs. This would bring down total fixed investment to 158 billion rubles or 22.1 percent of GDP. Their estimate for general government civilian administrative expenditure in 1982 is 19.1 billion rubles (2.7 percent of GNP). I have not checked in detail, but the estimate is rather low for a country where the normal administrative superstructure was

TABLE 3

A COMPARISON OF THE CIA (1991) INDUSTRY OF ORIGINAL ESTIMATES OF SOVIET GNP 1950–90 AT ADJUSTED FACTOR COST AND ESTABLISHED PRICES
(million 1982 rubles and percent of GDP)

	1950		1978		1990	
	Industry of Origin Estimates at Adjusted Factor Cost					
GNP	186,731	(100.0)	627,681	(100.0)	727,533	(100.0)
Industry	34,297	(18.4)	197,584	(31.5)	235,017	(32.3)
Farming	75,873	(40.6)	147,225	(23.5)	145,059	(19.9)
Other	76,561	(41.0)	282,872	(45.1)	347,457	(47.8)
	Industry of Origin Estimates at Soviet Prices					
GNP	182,426	(100.0)	687,772	(100.0)	793,830	(100.0)
Industry	62,818	(34.4)	340,453	(49.5)	400,083	(50.4)
Farming	62,179	(34.1)	120,653	(17.5)	118,878	(15.0)
Other	57,429	(31.5)	226,666	(33.0)	274,869	(34.6)

Source: CIA (1991).

reinforced by the oversight role of professional party cadres, security police and prison administration.

Research and Development expenditure (R&D) was about 2.8 percent of GDP. At least half of this was likely to have been military research.

The residual item (column 6 of Table 4) in the account is a mixed bag, which includes net exports, changes in inventories, statistical discrepancies and defence spending. The residual item in established prices, after deduction of net exports and inventory changes, was 56.5 billion rubles (column 4 of Table 6). Most of this was presumably defence expenditure. If one modifies the CIA estimates for investment as suggested above, and considers that half of the R&D item was for military purposes, the total for military spending appears to have been 87.1 billion rubles or 12.2 percent of GDP in 1982.

In view of the large amount of work on military spending in the CIA (Central Intelligence Agency) and DIA (Defence Intelligence Agency), it is a pity that the CIA national accounts do not present an explicit and consolidated estimate of defence expenditure. This probably happened because such estimates were a delicate security issue, or interagency rivalries may have been involved.

There is an interesting survey by Noren (1995) which analyses the development of CIA/DIA estimates of Soviet military spending for 1955–88 and reviews the points made by the critics. Some of these (like Rosefield, 1982) suggested that the CIA/DIA understated Soviet spending; others (like Holzman, 1980) suggested spending had been exaggerated. Noren, one of the authors of the CIA estimates, takes a more balanced view. He cites CIA estimates of Soviet defence spending in 1982 prices (seemingly these are at established prices) which are higher than those which appear in JEC (1990) and CIA (1991). Noren's figures were not constructed as a residual, but by a "building-block" technique which involved very detailed reconstruction and costing of the Soviet military accounts. Another source of military expenditure is the published CIA/DIA (1992) testimony to the national security subcommittee of the Joint Economic Committee of the U.S. Congress. These CIA/DIA estimates are shown in Table 6. They differ from Noren's figures. In the original source they were shown in graphic rather than

TABLE 4

CIA ESTIMATES OF CONSUMPTION, INVESTMENT AND GOVERNMENT SPENDING AT ESTABLISHED PRICES
(billion 1982 rubles)

	Consumption	New Fixed Investment	Capital Repairs	Administration	R&D	Residual	GNP	GMP
1950	90.9	22.2	5.2	13.3	2.4	48.4	182.4	143.5
1955	123.5	39.4	9.4	11.2	3.5	57.3	244.3	199.7
1960	163.6	61.5	15.2	9.9	6.1	68.3	324.6	273.2
1970	268.1	115.0	26.4	13.2	12.7	96.9	532.5	445.5
1975	326.3	138.1	35.7	15.9	17.0	95.5	628.5	544.6
1980	372.9	149.4	43.1	18.4	20.1	88.2	692.1	569.2
1982	380.9	156.6	43.8	19.1	20.2	93.1	713.7	586.1
1988	419.3	193.3	51.9	19.9	23.5	97.9	805.7	658.5
1990	441.6	182.2	50.2	18.3	24.8	76.7	793.8	644.8

Source: CIA (1991), pp. 36–45. Column 1 refers to private consumption items plus expenditure on education and health; col. 2 includes military and civilian machinery and equipment, residential and non-residential construction and net change in livestock herds; col. 3 includes major and minor repairs; col. 4 refers to civilian administration; col. 5 includes military and civilian R&D; col. 6 includes net exports, inventory changes, the statistical discrepancy and military spending not included elsewhere. It is calculated as a residual by deducting the total of the first 5 columns from the CIA estimate of total GNP by industry of origin; col. 7 is the CIA industry of origin estimate; col. 8 is total gross material product—the Soviet aggregate which excludes non-productive services.

tabular form, and are given as a range of possibilities. In Table 6, I used the middle estimates from the CIA/DIA graph. The problems in obtaining firm estimates of Soviet investment expenditure make it difficult to establish perpetual inventory estimates of capital stock and total factor productivity. Uncertainty about the exact level of military spending complicates analysis of how important this burden was in retarding Soviet development.

Table 5 shows the CIA estimates at adjusted factor cost. In this table, the movement of the residual item is erratic and different from Table 4.

TABLE 5

CIA ESTIMATES OF CONSUMPTION, INVESTMENT AND GOVERNMENT SPENDING AT ADJUSTED FACTOR COST
(billion 1982 rubles)

	Consumption	New Fixed Investment	Capital Repairs	Administration	R&D	Residual	GNP
1950	102.3	22.0	5.1	12.9	2.6	41.9	186.7
1955	128.7	39.3	9.3	10.9	3.7	45.4	237.2
1960	168.7	61.1	14.9	9.6	6.6	47.8	308.6
1970	261.1	114.4	25.9	12.9	13.7	66.7	494.7
1975	310.7	135.5	35.0	15.4	18.2	56.6	571.4
1980	348.7	146.5	42.2	17.8	21.6	48.7	625.5
1982	357.5	153.7	43.0	18.5	21.7	52.3	646.7
1988	410.9	189.2	50.9	19.3	25.2	39.1	734.6
1990	426.6	177.8	49.2	17.7	26.7	29.5	727.5

Source: CIA (1991), pp. 16–25. The composition of the first five columns is the same as in Table 4. GNP is the same as the CIA estimate by industry of origin. The movement and relative importance of the residual is substantially different from that in Table 4.

TABLE 6

A COMPARISON OF VARIOUS CIA/DIA ESTIMATES OF SOVIET MILITARY EXPENDITURES
(billion 1982 rubles)

	Noren (1995)	CIA/DIA (1992)	CIA (1991) Residual (incl. net exports and inventory change)	CIA (1991) Residual (excl. net exports and inventory change)	CIA (1991) Residual (incl. net exports and inventory change) at adjusted factor cost
1950	n.a.	n.a.	48.4	n.a.	41.9
1955	48.4	n.a.	57.3	n.a.	45.4
1960	49.2	n.a.	68.3	60.8	47.8
1970	66.3	84.0	96.9	67.8	66.7
1975	82.2	95.0	95.5	71.9	56.6
1980	97.3	110.0	88.2	58.0	48.7
1982	105.7	110.0	93.1	56.5	52.3
1988	124.8	120.0	97.9	87.6	39.1
1990	n.a.	102.0	76.7	n.a.	29.5

Source: The first four columns are at established prices. Col. 1 from Noren (1995), pp. 269–70; col. 2 from CIA/DIA (1992), p. 36, these are derived from a graphical presentation, and I show the midpoint of the range indicated; cols. 3 and 4 from CIA (1991), pp. 41–5; col. 5 at adjusted factor cost from CIA (1991), pp. 21–5, which does not provide figures excluding net exports and inventories. CIA (1982), p. 123, shows upper and lower bound estimates of Soviet military expenditures for 1951–80 in 1970 rubles, but these figures are a good deal higher than the defence content of the residual as shown on p. 137 of *JEC* (1982).

Apart from the questions concerning the relative level of Soviet investment and military spending, there are analysts who suggest that the CIA did not adequately deflate investment, and that its growth is therefore overstated. I have not been able to examine this question properly, but it is discussed in some detail in Kellogg (1990). If the CIA did exaggerate the growth of investment in real terms, this also implies some exaggeration in their estimate of the growth of industrial production.

For China, the CIA made no attempt to develop estimates by type of expenditure. In JEC (1972), pp. 40 and 45 there was a very rough guesstimate that 70 percent of GNP went to consumption, 18 percent to investment, 10 percent to defence and 2 percent to administration in an unspecified year. These guesses were not repeated in their later studies.

COMPARATIVE LEVELS OF U.S.S.R./U.S.A. OUTPUT AND PRODUCTIVITY

(a) *The Expenditure Approach*

The CIA did not devote as much effort to measuring comparative levels of Soviet performance as it did to evaluation of the growth record. The results of their various exercises are summarized in Becker (1994), p. 309. In retrospect it seems that their level estimates were too high. The last comprehensive CIA study was that of Edwards, Hughes and Noren (JEC, 1979). This was a bilateral comparison of major categories of U.S. and Soviet expenditure in dollars and rubles for 1976 on the same lines as the bilateral comparisons which OEEC carried out in the 1950s. The comparison was carried out at established purchaser prices. The

study showed quantity ratios and purchasing power parities in terms of U.S. and Soviet valuations as well as a geometric (Fisher) average. In terms of the Fisher measure Soviet 1976 per capita consumption was found to be 37.1 percent of U.S. levels, Soviet per capita investment about 4 percent above U.S. levels, and other items were 78 percent of U.S. levels. Soviet per capita GDP was 51.3 percent of the U.S. level on this basis. JEC (1981) by Schroeder and Edwards was a downward revision of the above for consumption.

The U.S.S.R./U.S. volume relatives are shown below in Table 7, adjusted to a per capita basis.

TABLE 7

CIA ESTIMATES OF PER CAPITA REAL EXPENDITURE: U.S.S.R./U.S.A. 1976 (U.S. = 100)

	At Ruble Valuation	At Dollar Valuation	Fisher Geometric Average
Consumption	29.9	46.1	37.1
Investment	91.4	119.1	104.4
Other	84.9	70.9	78.5
GNP	42.0	62.5	51.3

Source: JEC (1979), Vol. 1, p. 378, adjusted to a per capita basis. JEC (1980) is a revision of the above; its estimate of 1976 Soviet consumption relative to the U.S.A. was 27.6 percent in rubles, 42.8 percent in dollars, and 34.4 percent for the Fisher.

For China, the CIA made no serious effort to compare levels of performance with the U.S.A. In JEC (1972), pp. 42–3, they cited dollar estimates for China without attribution, which were drawn from crude estimates for 1955 by Hollister (1958), pp. 146–7. JEC (1975), p. 23, gives dollar estimates for Chinese GNP, with no indication of how they were made. JEC (1978), p. 208, also provided dollar estimates, and on p. 230 explained that they were an update of the 1955 benchmark. Their last effort in 1982 gave dollar estimates with no source indication.

Recently, the Soviet authorities participated for the first time in an international expenditure level comparison for 1990, which provides a rough cross-check on the CIA results. This exercise was carried out in the European Comparison Programme (ECP) of the Economic Commission for Europe (ECE). It involved a comparison of expenditure levels in the U.S.S.R. and six other East European countries, with Austria as the star country, on which the results were benchmarked. The first round involved bilateral comparisons with Austria. Then the results were made transitive and multilateral, using the EKS method. The U.S.S.R./Austria 1990 per capita GDP volume ratios were 31.1 in rubles, 50.4 in schillings, 39.6 for the Fisher geometric mean and 41.0 on an EKS basis.

The ECE converted this into a U.S.S.R./U.S.A. comparison, using the OECD's multilateral measure of the Austria/U.S.A. ratio as the link. This showed 1990 Soviet per capita GDP to be 31.6 percent of the U.S. level. This compares with a CIA estimate updated to 1990 of 42.5. Thus the CIA estimate was more than one third higher than the ECP estimate.

As the ECP exercise was more detailed and better documented than the CIA estimate, it seems clearly to be preferable. It is not possible to be precise on the reasons for the differences in results, but there are some identifiable differences. In the first place the CIA assumed more or less equal levels of productivity in the U.S.S.R. and U.S.A. in measurement-resistant services. In these cases their procedure amounted to using employment as a proxy output measure, whereas the ECP assumed relative productivity performance in such cases to be the same as in the commodity sector. Noren (1996) suggests that ECP also made substantial quality discounts for Soviet machinery and equipment which the CIA did not do. He also considers that the ECP estimates of government consumption (including military) in rubles are too low. Schroeder (1996) has no complaints about the ECP treatment of consumption.

Table 8 uses the ECP estimates to show U.S.S.R./U.S.A. aggregate performance together with estimates of GDP per capita and labour productivity. The estimates are backcast to 1987 to provide a cross-check on more recent attempts to measure U.S.S.R./U.S.A. levels of performance by industry of origin for 1987.

TABLE 8

AGGREGATE LEVELS OF OUTPUT AND PRODUCTIVITY U.S.A./U.S.S.R. 1987

	U.S.A.	U.S.S.R.	U.S.S.R./U.S.A.
	Aggregate Performance Levels		(U.S. = 100.0)
GDP (million 1990 $)	5,093,396	1,965,457	38.6
Population (000s)	243,942	283,100	116.1
GDP per capita ($)	20,880	6,943	33.3
Employment (thousands)	114,697	138,121	120.4
GDP per person engaged ($)	44,407	14,230	32.1
Annual hours per person engaged	1,608	1,700	105.7
GDP per man hour ($)	27.62	8.37	30.3

Source: Maddison (1995) for GDP (adjusted for purchasing power parity) and population. U.S. employment from OECD, *Labour Force Statistics*, Paris, 1994, Soviet employment from *Narodnoe Khoziastvo*, Goskomstat, Moscow, 1990, pp. 100 and 449; the Soviet employment breakdown in 1987 was 27,565 thousand in agriculture, forestry, and fisheries, 38,139 thousand in industry, and 68,417 thousand in services (including my imputation of 4 million in the armed forces and penal labour).

(b) *The ICOP Approach by Industry of Origin*

The alternative approach to measuring levels of performance is to do it by industry of origin, using census and input/output tables and other information on quantities produced and producer prices. The CIA did not use this method, but in the University of Groningen we produced seventy papers using this approach between 1983 and 1996. We made comparisons of value added, PPPs and productivity levels for nearly 30 countries for manufacturing, 13 for agriculture, with studies of performance in the service sectors in Japan/Korea/U.S.A. (Pilat, 1994) and Brazil/Mexico/U.S.A. (Mulder, forthcoming).

In the framework of the ICOP programme, Kouwenhoven (1996a and 1996b) carried out comparisons for Soviet farming and industry for the benchmark year 1987 and backcast them for several decades, drawing on the CIA time series and

the Moorsteen and Powell (1966) estimates for these sectors. 1987 was chosen as a benchmark year because detailed input–output tables were available for both the U.S.A. and the U.S.S.R. There is a U.S. industry census for 1987, and Kouwenhoven had access to detailed Soviet industry data for that year when he carried out research in Cisstat (former Soviet Goskomstat) in Moscow for several weeks in 1994. We were fortunate to have the co-operation of Cisstat in this work, and we also invited Russian and Ukrainian economists to carry out benchmark analyses for agriculture and manufacturing for 1987, working independently of Kouwenhoven, as a cross-check on his results. The outcomes of this work are shown in Table 9 for agriculture and Table 10 for manufacturing.

TABLE 9

CONFRONTATION OF KOUWENHOVEN WITH REVENKO ICOP ESTIMATES FOR U.S.S.R./U.S.A. FARMING 1987

	U.S.S.R./U.S.A. ratios				
	Kouwenhoven	Revenko		Kouwenhoven	Revenko
Gross output in farming			Employment (000s)		
rubles	76.2	80.3	U.S.A.	2,106	2,897
dollars	89.9	89.4	U.S.S.R.	34,619	25,800
Fisher	82.8	84.7			
Farm value added			Population (000s)		
rubles	93.2	n.a.	U.S.A.	243,942	
dollars	110.0	n.a.	U.S.S.R.	283,100	
Fisher	101.3	(103.6)[a]			
Output per head of population					
GO (Fisher)	71.3	72.9			
GVA (Fisher)	87.2	(89.2)[a]			
Output per person engaged (Fisher variant)					
GO	5.0	9.5			
GVA	6.2	(11.6)[a]			

Source: Kouwenhoven (1996), Revenko (1996). Population estimates from Maddison (1995).

[a] Applying Kouwenhoven's U.S.S.R./U.S.A. ratio of value added to gross output to Revenko's gross output relative.

(i) Results for Farming

The estimates of Kouwenhoven and Revenko (1996) are very similar for gross farm output, with a rather small dispersion between the Paasche and Laspeyres variants in dollars and rubles (see Table 9). Revenko did not make estimates of value added. Kouwenhoven shows that the Soviet advantage was greater in terms of gross value added, as the U.S. ratio of inputs to gross output was higher than in the U.S.S.R. His paper discusses some of the problems in measuring Soviet and U.S. inputs in a comparable fashion, given the fact that the Soviet input–output table was constructed on an MPS basis and excluded inputs of "non-productive" services. Kouwenhoven adjusted for these, assuming these non-covered inputs were proportionately the same in the U.S.S.R. as in China (whose 1987 input–output table shows both MPS and SNA concepts).

For U.S. farm employment, Kouwenhoven used the U.S. national accounts, whereas Revenko used the U.S. Department of Agriculture estimates. It is not

TABLE 10

CONFRONTATION OF KOUWENHOVEN WITH KUDROV AND PRAVDINA ICOP ESTIMATES FOR U.S.S.R./U.S.A. MANUFACTURING 1987

	U.S.S.R./U.S.A. ratios				
	Kouwenhoven	Kudrov and Pravdina		Kouwenhoven	Kudrov and Pravdina
Gross output in manufacturing				Employment (000s)	
rubles	48.6	50.4	U.S.A.	18,960	20,184
dollars	75.2	69.2	U.S.S.R.	32,414	33,006
Fisher	60.4	59.0			
Valued added in manufacturing				Population (000s)	
rubles	32.3	34.9	U.S.A.	243,942	
dollars	55.9	49.4	U.S.S.R.	283,100	
Fisher	42.5	41.5			
Output per head of population					
GO (Fisher)	52.0	50.8			
GVA (Fisher)	36.6	35.8			
Outper per person engaged (Fisher variant)					
GO	35.3	36.1			
GVA	24.8	25.4			

Source: Kouwenhoven (1996), Kudrov and Pravdina (1996). Population estimates from Maddison (1995).

altogether clear why there is a discrepancy of about 800 thousand people between the two sources, but the difference is mainly in the estimate of self-employed. The U.S. Department of Agriculture shows an average of 1,846 thousand farm operators and unpaid workers for 1987, compared with the national accounts estimate of 1,142 thousand self employed. The latter only includes people devoting most of their working time to farming. The former includes operators working more than one hour a week, and unpaid help working 15 hours or more in the survey week.

For the U.S.S.R., Kouwenhoven took his employment figures from the U.S. Bureau of the Census. These differ from those in the Soviet statistical yearbook (*Narodnoe Khoziastvo*), because the former source made a higher imputation for work on private plots. I think the U.S. Bureau of the Census exaggerates Soviet employment (as explained in the notes to Table 2). Revenko uses estimates from *Sel'skoe Khoziasto*, which are 9 million lower than those which Kouwenhoven uses, i.e. 25.8 million including 21.3 million in Soviet public sector agriculture and 4.5 million in private plots.

Thus there is some disagreement about farm employment. Revenko's figures for the U.S.S.R. may well be the most reasonable. He uses Soviet figures which exclude non-farm work, double counting of labour on private plots, and people whose actual labour input is rather small. Thus we are left with a range of estimates for the ratio of Soviet to U.S. farm labour productivity. Kouwenhoven's Fisher average shows Soviet value added productivity to be 6.2 percent of the U.S. level

in 1987, whereas Revenko's figure would be 11.6 percent if we adjust his gross output relatives by Kouwenhoven's ratio of value added to gross output. The difference in results stems almost entirely from the employment relatives.

(ii) Results for Manufacturing

Table 10 confronts the results of the 1987 manufacturing comparisons of Kouwenhoven with those of Kudrov and Pravdina (1996). Both sets of estimates are available in disaggregated form for 16 branches on the SITC classification. The estimates of total output and value added are rather similar even though there were differences in the product matching procedure. In manufacturing both studies recognize that the Soviet input ratio was a much bigger proportion of gross output than in the U.S.A., the reverse of the situation in agriculture.

The employment figures of Kudrov and Pravdina was somewhat higher than those of Kouwenhoven, for reasons which are not clear as they do not give precise sources. However, this does not have too big an effect on the productivity figures, which are virtually identical in the two studies.

Conclusions

The CIA estimates of Soviet growth performance were made in a transparent, scholarly fashion. They are the best documented and most reasonable estimates we have. It is therefore desirable that the whole CIA archives become publicly available, as they would be invaluable for researchers wanting to make further refinements for the Soviet period. Unfortunately most of the archives of CIA financed work on East European countries now seem to have been destroyed. It would be a pity to have the same thing happen with the archives on the former U.S.S.R. It remains important to refine CIA estimates of Soviet investment in order to get better estimates of capital stock and total factor productivity. It is also important to complete the Groningen U.S.S.R./U.S.A. comparisons of levels of output by industry of origin as a cross-check on previous expenditure estimates of the CIA and ECP.

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