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SOVIET ESTIMATES OF THE RATE OF INFLATION

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UNTIL recently Soviet economists discussed inflation in the United States and other industrialised countries with enthusiasm, but inflation did not figure among the problems of the Soviet economy. Yet it should not be thought that up to now this problem has not been discussed in the economic literature. Under conditions in which one could not speak openly of inflation or cast doubt on official statistics, it was necessary to resort to other means, to replace the word 'inflation' with various euphemisms. These include such circumlocutions as 'unjustified rise in the cost of capital construction' or 'blown-up prices' for machinery and equipment, 'the unjustified rise in prices', and the like. In certain publications one encounters, though in an extremely cautious form, criticism of the indices on investment that are based on unaltered prices of both equipment and construction.

The purpose of this paper is to analyse and interpret Soviet sources to reveal quantitative indicators of hidden inflation in capital investment.

SOURCES AND APPROACHES

Information that provides some idea of the quantitative dimensions of the inflation process in investment is to be found in many publications devoted to various aspects of investment. Taking the peculiarities of the investment process in the Soviet economy and the methods employed by Soviet researchers for their analysis and planning into account, we will apply the following approaches to assess the quantitative characteristics of the scale and rate of hidden inflation in investment:

- magnitude and causes of construction cost overruns (excess of costs over the initial estimate);
- investment per unit of new production capacity in real terms, for example, one ton of cement;
- unit cost of construction output, i.e. 1 sq.m. of floor space;
- price per unit of nameplate productivity of machines and equipment (e.g. per horsepower).

This paper deals mainly with the investment in the productive sphere, which in 1986 accounted for 72% of total investment in the national economy.[1] A few words should first be said about the reliability of the sources. *a. Estimates by experts*. The most reliable experts include Yakov Kvasha, Viktor Krasovsky and Delez Palterovich, all of whom have the reputation of being conscientious scholars of the highest calibre. Vladimir Fal'tsman has been the most prolific author on various aspects of the investment problem. Fal'tsman had considerable experience at Gosplan before moving to TsEMI. *b. Survey data.* Surveys of construction projects conducted by Stroibank contain data on construction cost overruns. In fact, one of the basic functions of Stroibank is to exercise control over the allocation and expenditure of investment. This organisation is characterised by a higher degree of objectivity than any other agency involved in the investment process. *c. Data based on the technical-economic studies of institutes.* An analysis conducted by an institute elicits greater confidence if that institute is not subordinate to a production branch ministry but is under either the Academy of Sciences or Gosplan (e.g. TsEMI; Scientific-Research Institute of Gosplan; Institute of Economics in the Academy of Sciences). The analysis conducted by institutes under the control of particular ministries can be exceedingly important, since these institutes have the opportunity to receive much richer information than do the academic institutions. However, it is also true that they are vulnerable to the pressures of narrow ministerial vested interests and hence have a tendency toward self-defence—to divert the main thrust of their findings from their home ministry and to focus the brunt of their negative findings on some outside ministry or institution.

Construction cost overruns

1. Data and their meaning.

The cost of construction relates to creation of fixed capital assets. A unit of capital here is a project. The actual cost of the project and the initial estimate relate to the same project. But revisions in estimate cost go hand in hand with revisions in the project's design: capacity, technology, product mix, etc. One and the same project may represent quite different amounts of fixed capital in the initial and final design.[2]

Our objective is to deduce the estimate of the rate of inflation that makes up a part of cost overruns. Such an estimate may be distorted by the biases in the original estimate of the project's costs. One would expect designers' estimates to be influenced by their interest:

a. designers are interested in exaggerating the estimate cost, because volume of design work is determined as a percentage of the estimate cost of the project.

b. presenting low initial estimates helps to get projects into the plan.

c. in their estimates designers use prices of non-standard equipment quoted by prospective producers. If equipment is scheduled for delivery at a future date, producers are likely to quote a price that exceeds current prices. (See the discussion of Malygin below.)

If a. and c. are the case, the original estimate itself will be inflated, and cost overruns relative to this estimate will not reflect the full extent of inflation; b. will counteract this bias.

Surveys of construction projects by Stroibank are the main source of data on cost overruns (see Table 1). The results of the surveys are submitted to the government, Gosplan and Gosstroi, the ministries and TsSU, with the goal of strengthening discipline in investment spending.

Stroibank classifies the causes of overruns into justified and unjustified (see Table 1). Justified causes include, in addition to those listed in the Table,

TABLE 1

DATA ON COST OVERRUNS AND THEIR CAUSES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Source	experts	experts	n.a.	Stroibank		Stroibank	
Year	1961–65	1961–65	1966	1966	1974	1979	1984
Number of projects	n.a.	n.a.	257	324	150	1844	n.a.
Overrun:							
billion rubles	n.a.	n.a.	n.a.	2·7	1·9	6·2	n.a.
%	10–12	3–5	n.a.	32·6	22	34	n.a.
Causes of overruns, % shares:							
— justified: more capacity, better quality of output, better working conditions, environment					50	50	44
— unjustified:			25				56
a. increases in prices of equipment, materials				20	38		
b. changes in conditions of construction and mistakes and miscalculations					12		

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1. Ya. Kvasha and V. Krasovsky, 'Kapital'noe stroitel'stvo i problema vozmeshcheniya', *Voprosy ekonomiki*, 1964, No. 11, p. 13.
2. Ya. B. Kvasha, 'O tendentsii fondootdachi', in: A. I. Notkin, ed. *Faktory ekonomicheskogo razvitiya SSSR*, (Moscow, 1970), p. 156.
3. E. A. Ivanov, *Vosproizvodstvo i ispol'zovanie osnovnykh fondov*, (Moscow, 1968), p. 81.
4. *Planirovanie i analiz narodnokhozyaistvennoi struktury kapital'nykh vlozhenii*, (Moscow, 1970), p. 229.
5. V. Il'in, 'Uskorenie stroitel'stva—vazhnaya narodnokhozyaistevnnaya zadacha, *Voprosy ekonomiki*, 1976, No. 1, p. 9.
6. V. I. Rybin and A. A. Khachaturyan, *Khozyaistvennyi mekhanizm v investitsionnoi sfere*, (Moscow, 1981), p. 110.
7. M. S. Zotov, 'Finansovye problemy upravleniya investitsionnym protsessom', in V. I. Rybin and L. M. Smyshlyaeva, eds. *Tendentsii i faktory povysheniya effektivnosti obshchestvennogo proizvodstva*, (Moscow, 1984), p. 200.

improvement in the mix of future output, and improvements in technology and organisation of production. Unjustified causes account for about half of the overruns in the 1970s. The author of reference 7, who gives a higher share of unjustified causes, is the chairman of the governing board of Stroibank. He does not refer to a specific date, but the book was published in 1984. There are no comparable data for the 1960s; reference 4 mentions only a 25% increase in cost adjusted for changes in capacity of the projects. A large element of unjustified cost overruns is due to increased prices of equipment and construction materials that 'did not correspond to an improvement in their consumption characteristics'.[3] This is mentioned as especially important in the 1979 survey.[4]

2. *Inflation in construction cost overruns: the 1970s*

The data in Table 1 will be used to deduce the rate of inflation in investment. Construction cost overruns contain three inflationary components: hidden inflation in the prices of equipment and materials that has been identified by Stroibank experts; hidden inflation that has not been uncovered; and inflation in construction proper.

The first component is called 'increases in prices of machines and materials in excess of improvement in their useful characteristics'. It was responsible for 20% of cost overruns in the 1966 survey and, judging by comments accompanying the survey results, played an even more important role in the cost overruns of the 1970s.

Hidden inflation proceeds under the guise of price increases reflecting higher quality, better working conditions, and improvements in technology and in the organisation of production—exactly the 'justified' causes of cost overruns. It is not easy (and sometimes impossible) for anyone but the consumer to verify the claimed improvements. The Stroibank experts cannot possibly 'find' all the inflationary price increases that producers have 'hidden'.

There is significant inflation going on in construction proper. It is most likely to be hidden in the 'errors and miscalculations' and 'changes in construction conditions' elements of cost overruns, but may also influence justified causes of cost increases.

Estimates of these components' contribution to cost overruns in excess of 20% are based on this writer's assessment. According to this assessment, inflation in construction proper contributed no less than 10% to cost overruns. This yields the minimum share of inflation in cost overruns of 30%. If we are to allow for greater importance of inflation in the 1970s compared with the 1960s, for hidden inflation that was not uncovered by Stroibank, and also for more than minimum contribution of inflation in construction proper, the total share of inflation in cost overruns rises to 40%; 30% and 40% will be considered as two alternative shares.

Combining these shares with percentage cost overruns given in references 5 and 6 in Table 1 yields inflation of 7%–9% over the life of the project in the early 1970s, and 10%–13% in the late 1970s, for projects surveyed by Stroibank.[5]

Stroibank surveys are not representative of all investment in the economy. They seem to concentrate on the larger projects. The average initial estimate cost of a project was 58m. rubles in the 1974 survey and 10m. in 1979.[6] (It may be that the higher rate of cost increases in the 1979 survey compared with 1974 reflects inclusion of smaller projects, rather than genuine acceleration.) The immense stratum of small investment projects is missed entirely in the data. In this writer's opinion, price inflation is higher for the smallest projects, where central control is the weakest. Therefore, extrapolating inflation estimates from Stroibank data to the total investment will yield downwardly biased estimates.

In order to obtain the average annual rate of inflation we need to know the average term of project completion. The Soviet economic literature contains references to extremely lengthy terms of project completion. Usually these are references to very large projects, such as the Krasnoyarsk Plant for Heavy Excavators, the giant Atommash plant producing equipment for nuclear power stations, the Oskol Electrometallurgical Plant, and others of comparable scale. However, most projects involve the construction or reconstruction of smaller plants and, although the terms of their completion exceed the norm, they do not last more than 3–4 years. This number is based on this writer's analysis of the literature. The Institute of Gosplan studied commissioning of fixed productive assets as a distributed-lag function of investment in 1961–80. They found the average lag to be 1.2 years, and increasing from 1.16 to 1.32 years over the period. Projects with zero and maximum (5-year) lags are said to make up the largest shares of total investment.[7] The methodological details are missing, but apparently TsSU annual data were used. This in itself lowers the accuracy of the results. Apparently, 5-year lags were the longest allowed in the model. In any case, this study underlines the great weight of the small projects, with supposedly higher inflation rates, in the total investment.

Since the data used here pertain to larger projects, the completion period is likely to be longer: 3–4 years. This yields average annual rates of inflation of 1.7–3% in 1971–75 and 2.4–4.2% in 1976–80.

There is an indirect corroboration of these estimates for the late 1970s–early 1980s. Based on the results of 1984 estimate price revision, V. Krasovsky proposed that Gosstroi should increase estimate prices 3% each year and to factor this increase automatically into the investment plans.[8] This would have allowed it to avoid the systematic gap between estimate and actual costs, and to ensure that estimate prices corresponded to the real volume of investment expenditure. But with the annual growth rate of investment below 2.5%–3%, such a proposal would have resulted in absorption of almost all the increase in investment by price increases. Gosstroi rejected this proposal.

3. *Inflation as a component of cost overruns in the 1960s*

No breakdown of cost overruns into 'justified' and 'unjustified' cost increases is available for the 1960s. The 30–40% share of inflation in construction cost overruns and the 3–4 years duration of the projects, derived for the 1970s in the preceding section, was extrapolated to the 1960s. This crude assumption results in estimates of average annual rates of inflation of 0.75%–1.6% or 0.9%–2% in 1961–65, depending on the cost overrun numbers one chooses.

Cost overruns in the projects surveyed by Stroibank in 1966 occurred mostly before this date, so that they also can be related to the early 1960s. Stroibank survey data yield substantially higher growth rates: 2.3%–4.1%. The discrepancy with the earlier estimates may reflect the heating up of inflation towards the middle of the 1960s. Ivanov's data, from another survey, already control for changes in

TABLE 2

ESTIMATES OF INFLATION DEDUCED FROM CONSTRUCTION COST OVERRUNS, AVERAGE ANNUAL GROWTH RATES (%)

	1961–65	*mid-1960s*	*1971–75*	*1976–80*	*1981–83*
Kvasha-Krasovsky—1964	0·8–1·6				
Kvasha—1970	0·9–2·0				
Stroibank—1966, Ivanov—1968		2·3–4·1			
Stroibank—1974			1·7–3·0		
Stroibank—1979				2·4–4·2	
Krasovsky—1986					3·0

capacity. If one assumes that this factor is responsible for 22% of the cost overrun, the estimated inflation rate is identical to that derived from Stroibank data. If the share of this factor is larger, the inflation rate estimate will be higher, too. Since there are indications that inflation in the prices of equipment was less important in the 1960s than in the 1970s, the upper end of the estimate interval is less reliable for this period. The results are summarised in Table 2.

Incremental capital–capacity ratio (ICCR).

Production capacity is a measure of capital stock in terms of output it can produce. By contrast with capital intensity/capital productivity, this is not actual output, but rather maximum output that can be produced with given capital stock when other inputs are available in necessary quantities.[9] Using potential output as a measure insulates it from all the numerous influences which make actual output a bad measure of capital stock. The change in the cost of a construction project has to be adjusted for changes in the capacity of the future plant. The cost of capacity is free from this problem. Capacity is measured in terms of physical quantities of a particular output, and may be easier to adjust for changes in the quantity of this output. It should be born in mind that ICCR data relate to investment in industry, whereas data on construction cost overruns relate to investment in the productive sphere in general. The growth of ICCR is characteristic of the development of the Soviet economy at least in the last 30 years. Vladimir Fal'tsman of TsEMI has conducted the most scrupulous studies of this phenomenon. His results are presented below.

1. Data on changes in ICCR

Fal'tsman compared commissioning of productive capacity with commissioning of fixed capital stock for 30 types of production capacities with homogeneous structure and quality of output (cement, steel, coal, electricity, etc.). He found that ICCR increased by at least 5%–6% a year in 1971–75 and by 5% in 1976–80.[10]

A later study used a much broader sample: the 130 most important products of the eight major industrial sectors (machine-building, ferrous metallurgy, chemicals, coal, construction materials, timber, light industry and foodprocessing).[11] The data were drawn from the balances of investment, capital stock and productive capacities. An attempt was made to adjust the dynamics of ICCR for changes in the quality of output. Capacity data were converted to monetary units and aggregated for each sector. This made it possible to express all three balances in comparable units. Capacity data were converted into both comparable and current prices. If changes in current prices reflect the quality improvements in output, the difference between indices of the commissioning of capacities in comparable and current prices shows the growth in capacities that is due to quality improvements in their output. Calculations using this method showed that between the 1971–75 and 1976–80 periods the increase in the commissioning of capacities adjusted for quality improvements was 10% higher than the commissioning of capacities in physical units, as cited in statistical sources.

The authors of the study cautiously stated that current prices reflected qualitative improvements 'at least partially', and that their method made it possible to obtain 'only an approximate estimate of the impact of the quality factor on the dynamics of production capacities'. However, even this belief appears to be optimistic. Changes in wholesale prices in general appear to overstate quality improvements in products. Yet the difference between current and comparable prices is unlikely to capture much of the quality improvement, for these two kinds of price coincide for new and custom made products. The divergence of the two types of prices may also represent other influences. Therefore, one should be sceptical regarding this quality adjustment. The ICCR ('quality adjusted') for the eight sectors of industry was found to grow at 5% per year in 1971–75 and 7.4% in 1976–80.

A study by Vladimir Kremyansky (of the Institute of Gosplan) states that ICCR in industry was growing at about 5% per year in the 1975–80 period.[12] This figure is two percentage points less than the TsEMI estimate. Kremyansky did not explain the method which he used in his calculations, nor did he indicate what his sample was.

According to Kvasha, in 1961–65 the ICCR was increasing at 1.2%–1.5% a year.[13]

2. *Causes of increase in ICCR*

Aleksandr Malygin (a specialist at the Research Institute of Gosplan), using the data of production ministries and Stroibank, identified ten 'objective, planned' sources of increased cost per unit of production capacity: (1) higher prices of equipment and construction materials; (2) increases in wages and salaries; (3) growth of expenditure for environmental protection; (4) improvements in working conditions; (5) higher construction costs because of relocation to the eastern regions of the country; (6) improvements in the quality of production; (7) deteriorating geological conditions for the extraction of raw materials and energy sources; (8) introduction of more advanced technologies and equipment; (9) improvements in the social infrastructure; (10) higher expenditures for the automation of production to replace labour and increase productivity.[14]

This is a collection of all possible factors that might have objectively justified the growth in capital-output ratios. It can be seen that some 'objective' sources of increasing ICCR coincide with 'justified' causes of construction cost overruns (e.g. 3, 4, 6, 8). Other sources differ (e.g. 5, 7), because ICCR relates to projects with a changing internal composition, whereas construction cost overruns were determined for a fixed sample of projects.

According to Malygin, the actual cost increases in the economy exceed the planned ones by a factor of two.[15] Furthermore, he characterises the actual cost increase as 'unobjective'. The 'unobjective' increases in ICCR apparently consist of inflation and errors and miscalculations, just like 'unjustified' construction cost overruns. But inflation is also hidden behind the 'objective' sources. Since planning organs are hard put to discriminate between real and fake improvements on the micro level, and end up validating the proposals of the enterprises, inflation is bound to seep into Malygin's 'objective, planned' sources (1) and (2), prices of equipment and construction materials, and wages in construction. The weight of these sources is considerable: the former is responsible for approximately one-third of the planned cost increases, and the latter for roughly one-tenth.[16]

The shift in extractive industry to the east (and especially to the north-east), the increased share of investment devoted to fuel industries in these regions, the increased costs associated with introducing industrial automation, and higher expenditure for ecological purposes are casually mentioned as the leading causes of the increase in capital intensity.

Although these factors certainly are at work, Soviet analysts have pointed out that their importance in explaining growth of capital intensiveness in the USSR should not be exaggerated. Thus, Siberia's share of industrial investment has increased over the last three five-year periods (1970–85). According to this writer's estimates, however, the territorial allocation for Siberia now comprises no more than one-fifth of all investment, compared with 16–17% at the outset of the 1970s. Thus the increase of Siberia's share of investment has only amounted to some 3 or 4 percentage points, hardly a dramatic shift. Moreover, as Krasovsky has observed, the relocation of extractive industries to the east is by no means equivalent to growth of ICCR. 'Exploitation of rich coal desposits through open-cast mining, and of uniquely concentrated oil and gas deposits, has begun, even if in regions not easily accessible. In the electric power industry, hydro-electric stations are being constructed on powerful rivers with rocky banks and more favourable conditions for obtaining cheap energy, etc.'.[17]

The head of the construction section of Gosplan, Sergei Bulgakov, and the senior Gosplan expert, Igor' Zaikin, have written: 'Numerous examples show that in Siberia and the Far East, despite the application of regional coefficients, the estimated costs for objects with a productive purpose are in many cases no higher than for analogous projects in the European part of the country'.[18] The direct evidence pointing along these lines can easily be multiplied.[19] Moreover, increase in the share of construction in inhospitable climates and new territories should have manifested itself in an increasing share of buildings and structures in the total investment. Yet the actual trend goes in the opposite direction. Shifts in the sectoral structure, which can also reflect some of these factors, were not found, in general, to increase the capital intensity of industry, at least not after 1965.[20]

The capital expenditures for ecological purposes have likewise been significantly exaggerated. 'State investment in measures for environmental protection and rational utilisation of resources' comprised 1.27% of the total investment in 1971–75, 1.46% in 1976–80, and 1.3% in 1981–82.[21] This apparently does not include ecologically-motivated changes in design or added features of machines and equipment. Still, according to Krasovsky: 'Notwithstanding the fact that in a number of instances the ecological expenditures have been large and their share in the general rise of costs sometimes goes as high as 30%, these have exerted an insignificant influence on the general growth of capital intensiveness (their share does not exceed 10–11%).[22]

The same is true for the substitution of automated production for human labour. A well-known Soviet economist, Abram Notkin, developed a theory which justified increases in capital intensiveness due to this factor.[23] According to Fal'tsman's calculations, the mechanisation and automation of production, or, in other words, replacement of manual labour with machinery, does not account 'even for one half' of the growth of capital intensiveness in industry in the 1970s. In his analysis, mechanisation of labour in heavy industry (ferrous metallurgy, machinebuilding, etc.) had a negligible impact on investment return.[24]

The situation is summarised by Zhuravlev of the Institute of Gosplan, who states that objective factors 'play an important, but not decisive role. One of the main causes of decline in the ICCR is the chaotic, weakly controlled price change, characteristic of the sectors of the investment complex'.[25] While this statement is vague, one may cautiously conclude from it that the inflationary component makes up at least 40–50% of the ICCR growth. Such an assumption is in agreement with Malygin's statement that 'unobjective' sources cause one half of the actual increase in ICCR, and 'objective', planned increases in prices and wages close to one quarter. Applying this correction to the reported rates of change in ICCR, one can deduce the estimates of inflation shown in Table 3.

Khanin's estimates

Unlike other authors whose estimates are reviewed here, G. Khanin carried out his research on real growth and inflation not as a planned project within a large institute, but entirely on his own. Despite, or, more likely, because of this, his work is the most innovative and comprehensive of the studies reviewed here. It is also the best documented, with two journal articles almost entirely devoted to a description of the methodology.[26] Alone among the authors trying to estimate real growth and inflation, Khanin popularised his work by publishing in newspapers and a literary magazine.[27] This has drawn an irate response from the official statisticians.[28]

The procedure used to deflate the official Soviet time series is based on a certain philosphy of economic growth. According to Khanin, certain relationships among the growth rates of real magnitudes in the economy as a whole and its sectors hold true for different economies and different periods of time. Underlying such invariance are broad characteristics of modern technology. Thus, the ratio of growth rates of machinebuilding output to growth of metal consumption by this sector, or the ratio of electric power consumption and industrial growth, fall into a certain 'benchmark' range, common for a variety of periods and economies. The

TABLE 3

ESTIMATED INFLATION IN ICCR, AVERAGE ANNUAL RATES OF GROWTH, (%)

	1961–65	*1971–75*	*1976–80*
Kvasha, 1970	0·5–0·8		
Fal'tsman, 1980, 30 products		2·0–3·0	2·0–2·5
Fal'tsman-Kornev, 1984, 130 products, quality adjusted		2·0–2·5	3·0–3·7
Kremyansky, 1981			2·0–2·5

'benchmark' range is operationalised as the range of values observed in the Soviet economy in the non-inflationary 1950s, or in the Western economies, with deflated data. As inflation distorts the official time series since the 1960s, ratios of magnitudes in rubles to those in physical units (such as the two mentioned above) start to deviate from their benchmark range.

In order to measure real growth, the largest possible number of proxy series is found for each official series. Proxies should be free from inflation, or subject to inflation to a smaller degree than the official series. Hence proxies in physical units are preferred, but those in rubles are also used. Growth rates of the proxy series for each particular official series are said to be closer to each other than to the official growth rates. This bolsters confidence in the method used.[29] The arithmetic average of the proxies is then used to represent the growth of the aggregate in real terms. The inflation rate is obtained by dividing the official series by the real growth series.

The implicit deflators for machinebuilding and construction, derived in this way, are combined with appropriate weights to derive a deflator for new additions to capital stock. One would expect the same deflator to be applied to productive investment. The key to the whole procedure is the derivation of the real growth series for machinebuilding and construction.[30]

The attempt to document and explain his methodology fully sets Khanin apart from most Soviet authors in economics. It is clear that he aspires to the highest standards of carefulness and replicability of results. Yet the conditions of pre-1985 censorship and, possibly, Soviet scientific publishing policy, which is oriented toward compressing published material at the expense of sometimes vital details, make even this comparatively abundant documentation less then fully clear. For the sake of publishability, Khanin describes not just his methodology, but the proposed methods for calculating alternative estimates at different levels of the economic hierarchy: enterprise, sector, economy. One and the same proxy is modified depending on the availability of data at each of these levels. Such a broad-ranging description creates ambiguity about the exact data used by the author himself. Although, to the best of our understanding, Khanin used almost exclusively publicly available data, a recent attempt by an expert on Soviet statistics and inflation to replicate some of Khanin's calculations was unsuccessful.[31] Successful replication apparently will require a systematic effort and, possibly further clarification by the author in future publications.

Much less is known about Khanin's actual estimates. Disparate items of data can be extracted from hints and qualitative statements. For our purposes, two estimates are important.

1. Inflationary ('unaccounted') growth of prices for the output of the machinebuilding sector in every five-year plan starting in 1966 (1966–70, 1971–75, 1976–80, 1981–85) fluctuated between 27% and 34%, which is equal to an average of 5%–6% per annum.[32]

2. The growth of real capital investment in production was 29% in 1961–65, 19% in 1966–70, 5% in 1971–75, 4% in 1976–80 and 0.95% in 1981–85.[33] This implies the following rates of inflation in investment (annual averages, %): 1961–65—2.1, 1966–70—3.9, 1971–75—7.0, 1976–80—2.7, 1981–85—2.9.

Price per unit of productivity of machinery and equipment.

Our original task was to collect and evaluate Soviet estimates of inflation in investment. This section deals with Soviet estimates of inflation in machinebuilding. Information on this process is contained in the ratios of machine prices to their productivity. The latter is measured in physical terms specific to the given machine as nameplate productivity indicated by the producer of the machine. Alternatively, the capacity of the motor of the machine (or electric apparatus) is taken as a proxy for its productivity. The justification for using such a proxy and an analysis of the problems it causes have been developed by Kvasha. This method has won recognition among Soviet experts and is increasingly being used by them. The latter method is less precise, for there are reasons for divergence between changes in the productivity of a machine and in the capacity of its motor; but it solves the problem of aggregating productivity data for different types of equipment. Nameplate productivity of a machine is related to plant capacity. In fact, plant capacity is calculated as nameplate productivity of main production machinery in the main production shop.[34] Plant capacity, defined in this way, takes into account productivity of a rather narrow group of equipment, and ignores the rest. Some investment in equipment is not included in construction cost estimates, and hence inflation in prices of this equipment is not reflected in construction cost overruns. Looking at price/productivity ratios directly, one is able to widen the circle of capital goods considered.

1. Data on price per unit of productivity

According to the calculations carried out by V. Falt'sman and M. Petropavlovskaya in TsEMI, domestic production of machinery and equipment in terms of capacity of motors was growing at 3% per annum in 1966–83 (just 1% per annum in 1976–82), whereas official statistics listed 7% growth (in comparable prices).[35] For the shorter period 1971–82, Fal'tsman's measure increased by the same 3%, versus an official rate of 8%.[36] These numbers yield a 3.9% growth rate of cost per unit of productivity (approximated by electric motor capacity of equipment) in 1966–82, 4.9% in 1971–82, and 6.5 in 1976–82.[37]

Delez Palterovich, of the Institute of Economics, Academy of Sciences, derived an estimate of the price/productivity ratio for equipment based on Gosstroi data for 140 industrial investment projects. His method is different from that of Fal'tsman; apparently, he used nameplate productivity of equipment. While all authors aim at that part of machinebuilding output which consists of producer durables delivered to domestic clients, Palterovich clearly states that this is what his data relate to. Growth of equipment productivity is adjusted for changes in other useful characteristics, apparently by expert methods.[38] The rate of growth in the cost per unit of productivity and other useful characteristics in 1979–84 was 3% per annum.[39]

The most comprehensive study of the dynamics of prices for domestic machinery measured in units of productivity was done by Fal'tsman and A. Kornev at TsEMI. It was based on 37 aggregated types of machinery and equipment that represent about 40% of the total volume of Soviet deliveries of investment machinery. Though it is not absolutely clear, it appears that nameplate productivity is used, and not its capacity proxy. Yet the conclusion is presented in an unintelligible form: cost per unit of productivity rose by 7% between 1966–70 and 1971–75, then by 15% between 1971–75 and 1976–1980.[40] This seems to imply a slower growth than the earlier data. Let us assume that average levels of price/productivity ratios for each five-year period coincide with the level in the third year of the period. This would mean that growth in 1968–73 was 1.4% per year, and 2.8% in 1974–77.

The clue to this discrepancy may be provided by yet another Fal'tsman result, covering 20% of domestic machinery output in 1976–80. Price per unit of productivity of domestic equipment increased by 15% in this period, while the combined increase for domestic and imported producer durables was 32%.[41]

2. *Inflationary component in price/productivity ratios*

In the general case, new machines may bring a number of different gains to the user, apart from greater productivity. Growing price/productivity ratios then can be interpreted as reflecting these additional gains. However, leading Soviet experts testify below that this has not been the case in the USSR. Thus Aleksandr Varshavsky (TsEMI) wrote in 1983:

> The primary direction of technical development in the 1960s and 1970s was to increase the unit capacity [productivity] of technological processes, machinery and equipment. This was accompanied by their increasing complexity. But surpassing the optimal level of equipment capacity led to a decline in the indicators of efficiency—in particular, to a growth in the average unit cost of capacity for the majority of basic machine categories.[42]

Or, to quote a statement in 1984 by Viktor Loginov, of the Institute of Economics, Soviet Academy of Sciences:

> The labour-saving form of technological progress is expressed in the growth of unit capacity and productivity of machinery and equipment . . . For a long time, the primary tendency in technological policy was to increase the capacity of machinery and equipment without proper attention to quality and efficiency parameters of the technol-

TABLE 4

INCREASE IN PRICE/PRODUCTIVITY RATIO OF PRODUCER DURABLES, AVERAGE ANNUAL RATES OF GROWTH (%)

	1966–70	*1971–75*	*1976–80*	*1976–82*	*1979–84*
Fal'tsman, 1985	1·5	2·7		6·5	
Fal'tsman-Kornev, 1984, 40% sample		1·4	2·8		
Fal'tsman, 1983 (domestic) 20%			2·8		
Fal'tsman, 1983 (domestic + imports)			5·7		
Palterovich, 1987, useful characteristics					3·0
Khanin	5·0–6·0	5·0–6·0	5·0–6·0		*5·0–6·0

*1981–85.

> ogy. As a result, we have fallen behind the most advanced foreign countries in those aspects of technological progress. . . . A technology should not be deemed to be 'new' if it differs from the basic form only in its greater capacity, but gives no advantage in its energy consumption or in weight of metal per unit of capacity, while its utilisation leads merely to a greater consumption of raw materials.[43]

In 1980 Fal'tsman quoted the study by TsSU stating that 'about 2/3 of the useful effect [of new machines] is reflected in savings of current cost—inputs of fuel, energy, raw materials. . . '.[44] But in 1987 he offered this assessment:

> Those specialists who still incline to disregard the mass phenomenon of rising costs on new machinery usually note that economic efficiency of new technology is not limited simply to the growth in its productivity, but includes savings on other forms of resources. . .. However, the high theoretical efficiency of each particular type of new machinery, which is adopted as the basis for setting its price, fails to manifest itself fully in the national economy for a variety of reasons. This permits one to suggest machinery cost is rising not only per unit of productivity, but also relative to the total gain to the user. This can only be demonstrated for a number of case studies, since actual gains from new technology are not planned or accounted for.[45]

The words in the latter quotation about high theoretical efficiency of new machines that fails to manifest itself fully reflect the recognition that calculations of useful effect are notoriously exaggerated both by the designers and producers and by the users, and cannot be trusted. On the other hand, productivity of equipment is an 'objective', measurable parameter that is monitored and checked by the authorities.

The case of tractors offers an instructive example. The official statistics measure production of tractors in terms of their total engine capacity in horsepower. This is also the basic indicator for qualitative growth. Thus, at the very time that agriculture and industry need tractors with medium or small capacity, the tractor manufacturers increase the output of still larger, heavier tractors. The capacity of the Belarus tractor (from the Minsk Tractor Plant) has steadily risen from 37 to 150 horsepower, at the very time that demand for smaller tractors (for loading, agriculture, and construction) increased. But the plant terminated production of the smaller tractors. Engine capacity is taken as the indicator of the user's gain (which justifies a price increase on the tractors), even though this indicator has long since ceased to correspond to real demand. Moreover, so far as other indicators of user gain are concerned (e.g. reduced energy consumption, higher labour productivity, smaller metal consumption per horsepower), no improvements whatsoever are to be observed.[46]

The key to understanding the statements quoted above is that productivity of machines is forced from above on designers and producers as the basic indicator.[47] (Productivity of equipment is so important because the volume of output is the main indicator for plants and sectors.) The rule in the command economy is that the basic indicator is improved while others are neglected.

All this leads to the conclusion that the growth of productivity (capacity), to a rather high degree, represents the total user's gain from machinery and equipment that was produced in the 1970s and early 1980s. The gains in other aspects were of little consequence. Hence, growth in the price/productivity ratio of machines largely reflects price inflation.

Increases in cost of construction

The predominant part of costs of construction projects falls on equipment and its installation, but we shall now examine changes in the cost of construction proper. The very fact of increasing construction costs is universally recognised. Some economists (for example, Dmitrii Chernikov, Deputy Director of the Institute of Gosplan) think that it is the first among factors responsible for growing costs of production capacity.[48] However, quantitative estimates of the increase in the cost of construction are very scarce.

1. Data on cost increases in construction

A series of calculations carried out at TsEMI compared data from the inventory of the square footage of buildings housing industrial production with data from the inventory of fixed capital. Both inventories were compiled in the course of the fixed capital revaluations of 1960 and 1972. These calculations showed that during the period 1960–72 the actual cost of 1 sq. metre of industrial building grew by an average of 5%–6% a year.[49]

Another study conducted by this institute established that between 1976 and 1980 the cost of 1 sq. metre of industrial building grew by 23%, which is an average of 4.2% a year.[50] An analysis of growing costs in housing construction conducted by the Institute of Gosplan showed that between 1971 and 1979 the cost of 1 sq. metre grew by 34.8% or an average of 3.4% a year.[51]

2. Evidence of inflation in construction

We shall not dwell on the non-inflationary causes of the higher costs in industrial construction. They certainly did have a role in causing the cost rise. Among these factors one can point to the predominance of framework buildings in industrial construction, the cost of which per square metre is substantially higher than that for non-framework structures (brick, large block and panels). Another factor was the shift of construction in agriculture from the use of locally available materials to structures made of reinforced concrete. Other factors of this kind could also be adduced. But whatever the technological and organisational causes may have been of this higher cost of construction, it is known that the revolution in the Soviet construction industry (in the second half of the 1950s and first half of the 1960s) was followed by a far slower tempo of development in construction technology and application of new materials and designs.[52] The geographic shift in construction and greater ecological considerations do not give a full explanation. Inflation, or 'the rise in the price of each unit of consumption value in the construction product',[53] appears to be the main component in the rising costs.

In contrast to machinebuilding, inflation in the construction sector has not been studied either in the West or in the USSR. There is no literature on its mechanism and manifestations. And they cannot be provided here—they must be the subject of a special study. However, the discussion below strengthens, in this writer's opinion, the case for the inflationary nature of the large part of cost increases in construction.

a. In 1975–85 the volume of design work per million rubles of capital investment was cut back—in striking contrast to preceding years, when this investment had systematically increased.[54] The relocation of investment activity to the eastern regions of the country, the increasingly complex conditions of construction and technological systems, the start-up of new production capacity, the emphasis on investment for the reconstruction of existing capacity (which, in effect, substantially complicates and raises the costs over those required for entirely new capacity)—all this, in theory, must mandate an increase in the expenditure on design per million rubles of construction. But no other explanation for the reduction seems plausible except: (i) the mounting irregularities in the investment process and, practically speaking, its ungovernability, which in turn cause construction increasingly to be undertaken without proper design preparations; and, (ii) of each million rubles spent on construction an ever growing share consists of non-existent construction, i.e. sheer inflation. The second circumstance is, to a significant degree, linked to the first.[55]

b. In the 1970s and 1980s the expenditure for construction materials (per million rubles of construction investment) declined. (By contrast, in the 1960s it increased.) In real terms, the quantity of cement, glass, wall and roofing materials used for construction—when measured against each million rubles of investment in construction—declined substantially in the period 1970–85.[56] The complaints about waste in the use of materials, as well as those about the high (and rising) rate of loss, have formed a recurrent theme in many periodical articles during these years.

c. The number of construction workers (per million rubles invested in construction work) similarly fell during the period 1970–85: from 99 workers in 1970 to 65 in 1980, and then to 57 in 1985 (per million investment rubles).[57] One might assume that, parallel to this labour reduction, the number of machines had been increased to replace the manpower. But that has not been the case: between 1975 and 1985 the number of excavators, earth-moving machines and bulldozers (per million investment rubles) declined. Only for mobile cranes was a slight increase recorded (12% over a ten-year period).[58] While unit capacity of construction machinery increased, this could not account for levelling off in their numbers per ruble of investment. The available machines do not match the mix of tasks to be performed, and are poorly utilised. Small, low capacity machines are especially lacking.[59]

Thus, in addition to the reduced ratio of design expenditures per million rubles of capital investment, there have also been analogous cutbacks in construction materials, the labour force and major equipment. This and other available information on the construction sector strongly suggest that inflation plays an important role in cost increases.

Conclusion

Table 5 summarises quantitative assessments of inflation distilled from Soviet sources. Given the crudeness of the assumptions made in estimation, one should not ascribe great accuracy to these numbers: tenths of a percent should be ignored. Estimates relate to five different aggregates, cover different periods, and were

TABLE 5

SOVIET ESTIMATES OF THE RATE OF INFLATION IN INVESTMENT, AVERAGE ANNUAL GROWTH RATES (%)

	1961–65	*mid-1960s*	*1966–70*	*1971–75*	*1976–80*	*1981–83*
A. Productive investment						
a. Construction cost overruns						
Kvasha and Krasovsky—1964	0·8–1·6					
Kvasha—1970	0·9–2.0					
Stroibank–1966 and Ivanov—68		2·3–4·1				
Stroibank—1974				1·7–3·0		
Stroibank—1979					2·4–4·2	
Krasovskii—1986						3·0
b. Khanin	2·1		3·9	7·0	2·7	2·9
B. Industrial investment— changes in ICCR						
Kvasha—1970	0·5–0·8					
Fal'tsman—1980, 30 products				2·0–3·0	2·0–2·5	
Fal'tsman and Kornev—1984, 130 products quality adjusted				2·0–2·5	3·0–3·7	
Kremyansky—1981					2·0–2·5	
C. Producer durables						
a. Cost per unit of equipment productivity						
Fal'tsman—1985		1·5	2·7		6·5&	
Fal'tsman and Kornev—1984, 40%				1·4**	2·8***	
Fal'tsman—1983 (domestic) 20%					2·8	
Fal'tsman—1983 (total)					5·7	
Palterovich—1987, useful char.						3·0*
b. Khanin			5·0–6·0	5·0–6.0	5·0–6·0	5·6–6·0*
D. Construction						
a. Cost of 1 sq. metre of building						
—Industrial						
Fal'tsman—1980, inventory		5·0–6·0				
Fal'tsman—1985					4·2	
b. Cost of 1 sq. metre of building						
—Residential						
Kremyansky—1980					3·4	

Notes:
& – 1976–82.
* – 1981–85.
** – 1971–75/1966–70.
*** – 1976–80/1971–75.

obtained by different methods from different data sets. Yet there is a surprising consistency among most of the estimates in Table 5, originating with different sources.

Stroibank cost overrun estimates and Fal'tsman's ICCR and Kremyansky's estimates of inflation in investment give the range of 1.7%–3.0% for 1971–75. Khanin joins these sources in the 2.0%–4.2% range for 1976–80. Fal'tsman's data on inflation in producer durables in this period also fall into these ranges (with two exceptions, to be discussed later). For the 1980s, Krasovsky's rule-of-thumb 3% estimate coincides with that of Khanin. For 1961–65, Khanin's estimate is in the same range as Kvasha in 1970. Palterovich's estimate of inflation in producer durables is consistent with Gostroi's estimate of inflation in investment. Consistency in the estimates of one author or group of authors is less surprising, but still nice to have: the Kvasha ICCR estimate and the Kvasha and Kvasha and Krasovsky estimates based on cost overruns, as well as Falt'sman's ICCR estimates and some of his estimates for producer durables, all display such consistency.

Khanin's estimates for machinebuilding are much higher than other estimates for 1966–75. Some of Fal'tsman's estimates for 1976–82 are as high as those of Khanin. However, in the former case inflation in imported machinery is what makes the estimates so high, whereas in the latter case only domestic output appears to be counted. Khanin's estimates for investment are within the consensus in 1961–65, 1976–80 and 1981–85. His estimate for 1966–70 is compatible with that of Stroibank for the mid-1960s, and with the cost of industrial construction in 1961–72, though much above Fal'tsman's producer durables inflation for that period. It is only in 1971–75 that Khanin's estimate for inflation in investment is a clear outlier.

Different estimates are sufficiently close to point out a consensus range, outlined in Table 6. The variation of estimates is too large in the late 1960s to make any generalisations. There is also a significant variation of the estimates for the early 1960s. The highest estimate is four times larger than the lowest, but the level of estimated inflation is low, and the width of the range of estimates is small.

The outliers, all of them on the high side, are Khanin for investment in 1971–75, and for machinebuilding in 1966–85; Fal'tsman 1985 and Fal'tsman 1983 (total) for producer durables in the late 1970s, and Fal'tsman's 1980 on construction cost in 1961–72. The outliers are not necessarily wrong, but the persuasive power of the consensus range is great. Cautious interpretation of voluminous evidence, both quantitative and qualitative, partly laid out on these pages, resulted in a convergence of a wide variety of estimates. It follows from this author's compilation of Soviet estimates of inflation in investment that most authors hold it

TABLE 6

CONSENSUS RANGE OF SOVIET ESTIMATES OF THE RATE OF INVLATION IN INVESTMENT, AVERAGE ANNUAL GROWTH RATES (%)

	1961–65	*1966–70*	*1971–75*	*1976–80*	*19-81–85*
Range of estimates	0·5–2·0	no consensus	1·7–3·0	2·0–4·2	3·0–3·8

to grow at 2–3% in 1971–75, and 2–4% in 1976–85. Dissent from these numbers indicates even higher rates of inflation.

One can also infer a trend of inflation over time: acceleration from the 1960s to 1970s (except for Stroibank data), and further acceleration over the 1970s (except Khanin and Fal'tsman 1980, ICCR). This twenty-year trend to higher rates of inflation apparently did not continue in the early 1980s.[60]

The numbers in Table 6 represent a summary of the research of some of the best Soviet economists. Indeed, given the organisation of research in the USSR, these are also the results of the work of the leading economics research institutes: TsEMI, the Institute of Gosplan, and the Institute of Economics of the Academy of Sciences of the USSR. In interpreting these results, information from a variety of other Soviet sources was used. This author's interpretation involved making a number of assumptions, especially in the estimates in parts A. and B. of Table 5. In making these assumptions, with their inevitable element of arbitrariness, every effort was made to stay on the low side. The 'true' rate of inflation may be closer to the high end of the range indicated in Table 6, on account of the modesty of the assumptions made by this writer.

At this point it would be appropriate to address the discussion of hidden inflation in Soviet investment which has taken place in the journal *Soviet Studies* in the 1980s. Participants in this debate were using the same Soviet sources as did this author. For example, the latest entry in this discussion, by A. Bergson, carefuly examines writings by V. Fal'tsman and especially his joint study with A. Kornev.[61] Yet Bergson has come to the conclusion that although the existence of hidden inflation is possible, it does not constitute an established fact. He believes that even if there is inflation, its rate is insignificant—less than one percentage point in 1971–75 and approximately one percentage point a year on average in 1976–80.

Existence of hidden inflation is hardly debatable now that Soviet scholars and officials discuss it forthrightly. Thus, the Deputy Chairman of the State Committee for Prices, Anatolii Komin, stated unambiguously in the pages of *Kommunist* in 1987 that inflation in the fuel and raw materials, transport and construction sector had been ignored.[62]

As far as the rate of inflation is concerned, this study benefited from collecting, analysing, and comparing the largest possible number of Soviet estimates, rather than a few at a time. I have also utilised significant portions of qualitative information. Materials examined here suggest to me, at least, that inflation in the investment sector of the economy is higher than the numbers offered by Bergson. Inflation, its origins, scale and rate, represents one of the principal problems in research on the Soviet economy. I hope that discussion of this problem will continue.

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[1] *Narodnoe khozyaistvo SSSR v 1986 godu*, (Moscow, 1987), p. 327.

[2] Construction costs in this article include both the cost of machinery and equipment and the cost of construction proper. Inflation in the latter, as a separate element of investment, is considered below.

[3] Rybin and Khachaturyan, *Khozyaistvennyi mekhanizm. . .*, p. 110.

[4] Another element of unjustified cost increases, changes in the conditions of construction,

apparently refers to correction of mistakes or imprecise estimates made early in the design stage.

[5] Arithmetic: 0.3 x 22% = 6.6%; 0.4 x 22% = 8.8%. Similarly for the 34% cost overrun.

[6] Sample sizes were 150 and 1844 projects, respectively.

[7] D. Chernikov, 'Nauchno-tekhnicheskii progress i strukturnye sdvigi', *Ekonomika i matematicheskie metody*, 1984 no. 4, p. 596.

[8] V. P. Krasovsky, 'Sovremennye problemy proektirovaniya', *Voprosy ekonomiki*, 1986 no. 4, p. 45.

[9] For a definition and discussion of capacity, see: Ya. B. Kvasha, 'Prognozirovanie fondoemkosti', in L. M. Gatovsky and S. A. Kheinman, eds. *Metodologiya prognozirovaniya ekonomicheskogo razvitiya v SSSR*, (Moscow, 1971); Gosplan SSSR, *Metodicheskie ukazaniya k razrabotke gosudarstvennykh planov razvitiya narodnogo khozyaistva SSSR*, (Moscow, 1974), pp. 69–70.

[10] V. Fal'tsman, 'Moshchnostnoi ekvivalent osnovnykh fondov', *Voprosy ekonomiki*, 1980 no. 8, p. 121. The author does not specify whether fixed capital is in current or in estimate prices.

[11] V. Fal'tsman, A. Kornev, 'Rezervy snizheniya kapitaloemkosti moshchnostei promyshlennosti', *Voprosy ekonomiki*, 1984 no. 6, pp. 37, 38.

[12] V. Kremyansky, 'Izmenenie stoimosti stroitel'stva', *Voprosy ekonomiki*, 1981 no. 10, p. 53.

[13] Ya. Kvasha, "O tendentsii fondootdachi", in A. Notkin ed. *Factory ekonomiches Kogo razvitiya SSSR*, (Moscow, 1970).

[14] A. Malygin, *Planirovanie vosproizvodstva osnovnykh fondov*, (Moscow, 1985), p. 48.

[15] Malygin uses a confusing phrase, 'increasing cost of increments of output', though the context strongly suggests that he speaks about ICCR.

[16] *Ibid.* p. 47.

[17] V. Krasovsky, 'Ekonomicheskie problemy fondootdachi', *Planovoe Khozyaistvo*, 1980 no. 1, p. 108.

[18] S. Bulgakov, I. Zaikin, 'Kapital'noe stroitel'stvo v investitsionnom komplekse', *EKO*, 1982 no. 3, p. 56.

[19] See: V. Dan-Chin-Yu, 'Vliyanie struktury investitsii na fondoemkost' kapital'nogo stroitel'stva',*Voprosy ekonomiki*, 1979 no. 12; Ya. Mazover and T. Makarova, 'Effektivnost' toplivnykh baz Sibiri', *Planovoe khozyaistvo*, 1981 no. 4, pp. 61–65.

[20] See Ya. B. Kvasha, 'Kapitaloemkost'', in V. G. Venzher, Ya. B. Kvasha, A. I. Notkin, S. P. Pervushin, S. A. Kheinman, *Proizvodstvo, potreblenie, nakoplenie*, (Moscow, 1965), p. 158; E. A. Ivanov, *Vosproizvodstvo i ispol'zovanie osnovnykh fondov*, (Moscow, 1969), p. 77; L. M. Smyshlyaeva, 'Fondoemkost' produktsii i puti ego snizheniya', in V. Krasovsky, ed. *Intensifikatsiya i rezervy ekonomiki*, (Moscow, 1970), p. 32; Stanley H. Cohn, 'A Comment on Alec Nove, "A Note on Growth, Investment and Price Indexes", *Soviet Studies*, XXXIII no. 2, (April 1981), p. 177; F. Klotsvog, G. Abdykulova, N. Granovskaya, L. Chernova, 'O nekotorykh tendentsiyakh razvitiya ekonomicheskikh proportsii', *Planovoe khozyaistvo*, 1983 no. 11, p. 36; V. V. Kossov, 'O tempakh v razvitom sotsialisticheskom obshchestve', *Ekonomika i matematicheskie metody*, 1980 no. 1, p. 90.

[21] *Narodnoe khozyaistvo* 1982, pp. 339, 361.

[22] V. V. Krasovsky, L. Fridman, 'Fondootdacha. Faktory rosta', *Ekonomicheskaya gazeta*, 1984 no. 38 (September), p. 11; V. V. Krasovsky 'Ekonomicheskie problemy fondootdachi', p. 108.

[23] See A. Notkin, *Problemy sotsialisticheskogo vosproizvodstva*, (Moscow, 1984), pp. 255–60.

[24] V. Fal'tsman, 'Moshchnostnoi ekvivalent osnovnykh fondov',p. 128.

[25] S. Zhuravlev, 'Novoe kachestvo ekonomicheskogo rosta', *Ekonomicheskaya gazeta*, 1986 no. 24.

[26] G. I. Khanin, 'Al'ternativnye otsenki rezul'tatov khozyaistvennoi deyatel'nosti proizvodstvennykh yacheek promyshlennosti', *Izvestiya AN SSSR. Seriya ekonomicheskaya*, 1981 no. 6; 'Puti sovershenstvovaniya informatsionnogo obespecheniya svodnykh planovykh narodnokhozyaistvennykh raschetov', *Izvestiya AN SSSR. Seriya ekonomicheskaya*, 1984 no. 3.

[27] G. I. Khanin, 'Sochtem fondy', *Sotsialisticheskaya industriya*, 27 August 1986; V. Selyunin, and G. Khanin, 'Pyl' v glaza', *Pravda*, 30 December 1985; G. Khanin and V. Selyunin, 'Lukavaya tsifra', *Novyi mir*, 1987 no. 2.

[28] V. Adamov, 'Chto stoit za indeksami', *Ekonomicheskaya gazeta*, 1987 no. 29; M. Korolev, 'Zadachi perestoiki statistiki', *Vestnik statistiki*, 1987 no. 4, p. 6.

[29] Khanin, 'Al'ternativnye otsenki. . . ', p. 84.

[30] *Ibid.*

[31] Fyodor Kushnirskii, 'New Challenges to Soviet Official Statistics: a Methodological Survey', in *The Impact of Gorbachev's Policies on Soviet Economic Statistics*, US Central Intelligence Agency, July 1988.

[32] Khanin and Selyunin, 'Lukavaya. . . ', p. 187.

[33] Khanin's seminar at TsEMI, 24 April 1987. Notes of this presentation were kindly made available by Professor Richard Ericson. TsSU data in the notes, supplied for comparison, are different

from those in *Narodnoe khozyaistvo SSSR v 1985g.*, p. 365. The latter are used here to derive implicit rates of inflation.

[34] See Gosplan SSSR, *Metodicheskie. . .* , pp. 69–70.

[35] V. Fal'tsman, M. Petropavlovskaya, 'Metody prognozirovaniya metalloemkosti produktsii mashinostroeniya', *Izvestiya Akademii Nauk SSSR*, Seriya ekonomicheskaya, 1985 no. 3, p. 79.

[36] V. Fal'tsman, 'Povyshenie otdachi osnovnykh fondov', *Voprosy ekonomiki*, 1985 no. 3, p. 53.

[37] Fal'tsman mentions his earlier studies which resulted in a 3% annual growth of the price/productivity ratio but does not indicate the relevant time period.

[38] The size of this adjustment is not given.

[39] D. Palterovich, 'Problemy ispol'zovaniya strategicheskikh i takticheskikh rezervov mashinostroeniya', *Ekonomika i matematicheskie metody*, 1987 no. 4, p. 590. The author states that his results (3% annual growth of equipment adjusted for productivity in 1979–84) are similar to those of Fal'tsman. Yet for an overlapping period (1976–82), Fal'tsman's estimate was much lower: 1%.

[40] Fal'tsman and Kornev, 'Rezervy. . . , p. 40.

[41] Fal'tsman, 1983, p. 16.

[42] A. Varshavsky, 'Problemy razvitiya nauchno-tekhnicheskogo potentsiala',*Izvestiya Akademii Nauk SSSR*, Seriya ekonomicheskaya, 1983 no. 6, p. 43.

[43] V. Loginov, 'Uskorenie nauchno-tekhnicheskogo progressa—vazhneishii faktor intensifikatsii ekonomiki', *Ekonomika i matematicheskie metody*, 1984 no. 4, p. 585.

[44] Fal'tsman, 'Moshchnostnoi ekvivalent. . . ', p. 130.

[45] V. Fal'tsman, 'Metodologicheskie problemy planirovaniya i prognozirovaniya uskoreniya razvitiya mashinostroeniya', *Ekonomika i matematicheskie metody*, 1987 no. 4, p. 581.

[46] V. Yatskevich, 'V pogone za loshadinymi silami', *Sotsialisticheskaya industriya*, Jan–Feb, 1987.

[47] This is the term used by the State price committee, which calls all other useful parameters 'less important'. A. Koshuta and L. Rozenova, 'Funktsii tsen v usloviyakh nauchno-tekhnicheskogo progressa', *Voprosy ekonomiki*, 1977 no. 3, p. 26.

[48] D. Chernikov, 'Nauchno-tekhnicheskii progress i strukturnye sdvigi v obshchestvennom proizvodstve', *Ekonomika i matematicheskie metody*, 1984 no. 4, p. 597.

[49] Fal'tsman, 'Moshchnostnoi ekvivalent. . . ', p. 124.

[50] Fal'tsman, 'Povyshenie. . . ', p. 54.

[51] Kremyansky, 'Izmenenie. . . ', p. 53.

[52] Boris Rumer, *Investment and reindustrialization in the Soviet Economy*, (Boulder, Co. Westview Press, 1984), p. 126.

[53] Kremyansky, 'Izmenenie . . . ', p. 54.

[54] *Narodnoe khozyaistvo SSSR v 1985 godu*, p. 376.

[55] We know of no changes in definitions that would account for the observed phenomenon.

[56] *Narodnoe khozyaistvo SSSR v 1985 godu*, pp. 152, 153, 154.

[57] *Narodnoe khozyaistvo SSSR v 1985 godu*, pp. 383, 373.

[58] *Narodnoe khozyaistvo SSSR v 1985 godu*, pp. 373, 376; D. Palterovich and V. Filimonov, 'Intensivnyi put' razvitiya osnovnykh fondov stroitel'stva', *Planovoe khozyaistvo*, 1982 no. 9.

[59] Palterovich and Filimonov, 'Intensivnyi. . . '.

[60] Possibly because of the slowdown of inflation in imported equipment in this period.

[61] *Soviet Studies*, XXXIX no. 3 (July 1987), pp. 406–24.

[62] A. Komin, 'Finansy i tseny', *Kommunist*, 1987 no. 8, p. 61.