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Comparing Planned and Actual Growth of Industrial Output in Centrally Planned Economies

A Research Paper

ER 80-10461
August 1980

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Comparing Planned and Actual Growth of Industrial Output in Centrally Planned Economies

Overview

Understanding the planned growth of industrial production is an important ingredient in the study of centrally planned economies. Comparison of the planned rate of growth of total industrial production with what the statistical authorities eventually claim creates the mistaken impression that plans are generally fulfilled. Yet, when the achieved output levels of individual products are compared with plan figures in physical terms, it becomes apparent that the overall plans could not possibly have been achieved.

The official rate of growth reported by the statistical authorities is biased upward for two reasons. With the gross output indexes used, an increase in double counting causes an overstatement of reported achieved growth. More importantly, the official data allow disguised inflation to enter the indexes under the guise of new-product pricing, so this inflation is counted as real growth. This is a particularly severe problem in the machinery industry, where products are complex and heterogeneous.

One way to circumvent the problems in the official data is to construct synthetic indexes based on a sample of commodities in physical terms and then to aggregate them with fixed prices and value-added weights. In this manner the impact of the biases resulting from double-counting and disguised inflation can be controlled. These synthetic indexes show a growth rate substantially lower than the official measures and suggest that overall plan targets are seldom achieved.

Comparing Planned and Actual Growth of Industrial Output in Centrally Planned Economies

Introduction

Periodically the Soviet Union and other centrally planned economies publish annual and five-year plans. An important feature of these plans is the expected growth of industrial production. One method of assessing the performance of these economies is to compare the actual growth of industrial production with the planned growth. This paper demonstrates that it is inappropriate to use the officially published data on aggregate industrial production for such a comparison because they systematically overstate the real growth of industrial production, create the erroneous impression that the plans are generally fulfilled, and cloud the picture of the relative performance of the branches of industry.

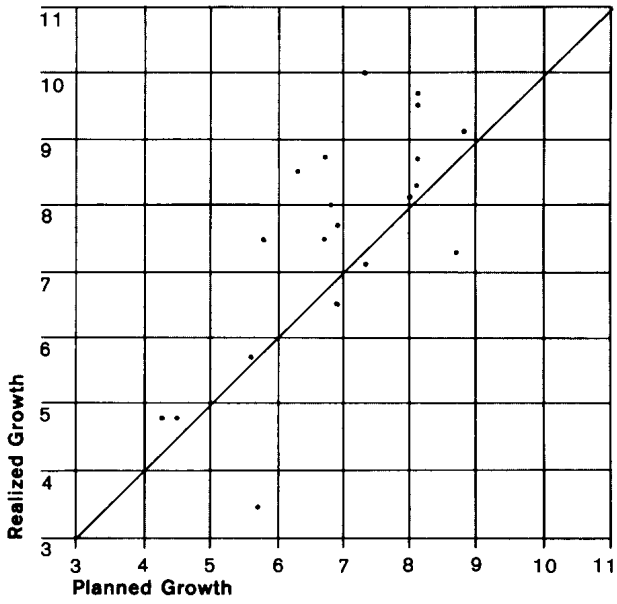
The fact that the officially reported growth rate of industrial production overstates the true growth rate can be demonstrated easily. Figure 1 plots the planned growth rate of Soviet industrial production versus the officially reported rate for 1960-79. A point above the 45-degree line means that the plan has been overfulfilled and a point below, underfulfilled. In only four of the 20 years did industry fail to meet its plan. Yet each year, especially recently, Soviet leaders carped about a long list of key commodities for which output fell below plan. To show the reason for their complaints, planned and actual production data for a sample of nine key industrial products were collected for the same 1960-79 period. The plan was underachieved more than 46 percent of the time.[1]

In 1977, a year for which unusually detailed plan and performance data are available, the reported value of industrial output grew 5.7 percent, slightly in excess of the planned rate of 5.6 percent. Moreover, every industrial ministry except the Ministry of Ferrous Metallurgy and the Ministry of the Meat and Dairy Industry fulfilled their plans. Yet the production of more than two-thirds of the individual commodities whose production was reported fell short of the planned

[1] Ray Converse and Robert E. Ramsson, "The Linkage from Plan to Performance in Soviet Industry: A Statistical Analysis," paper presented at the annual meeting of the American Association for the Advancement of Slavic Studies, New Haven, October 1979.

Figure 1

USSR Industrial Production: Plan and Performance, 1960-79



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level.[2] The true picture may have been even worse, because the Soviet Union often omits the publication of unfavorable production data. Thus the aggregate data create the impression that 1977 was a successful year, while the detailed commodity data give the opposite impression.

First, this paper describes the institutional and statistical sources of the bias in the official measures. Second, it presents several statistical tests that were conducted to verify the existence of the bias. Finally, it discusses some reasons why the bias is allowed to continue.[3]

[2] Ibid.

[3] Although most of the evidence presented here relates specifically to the Soviet Union, Thad Alton has shown this is also the case for several East European countries. For example, see Thad P. Alton, Elizabeth M. Bass, Laszlo Czirjak, Gregor Lazarcik, *Statistics on East European Economic Structure and Growth*, OP-48, (New York, L. W. International Financial Research Inc., 1975).

Sources of Bias

We believe that the inconsistency between plan and actual growth rates arises because they are constructed according to different approaches. The Council of Ministers and the State Planning Committee (Gosplan) formulate the plans with some feedback from the ministries and enterprises. The plan (*ex ante*) data are created mainly in physical units and are believed to provide relatively unbiased growth rates. The output (*ex post*) data are compiled by the the Central Statistical Administration (CSA) based on the accounting reports of the enterprises and ministries. The managerial incentive system and the methods of reporting production data both bias the results. The principal cause is the inclusion of disguised inflation. A secondary cause is the use of gross output rather than value-added as a measure of growth. Because the *ex post* data are exaggerated, unlike the plan data, comparing planned and actual growth rates is, therefore, akin to judging the size of grapefruits by the normal size of apples and concluding the grapefruit is a good apple.

This section summarizes the method of plan construction used by the Soviet Union and why we think it results in a relatively unbiased estimate of planned growth. Then it summarizes the method used to compute the measure of industrial growth and why it overstates the real growth.

Plan construction. To understand why the plan measures are relatively unbiased, we must examine the key stages in the planning process.[4] The party leadership makes the first step in formulating the annual plans by establishing general guidelines for the upcoming plan. These guidelines may include output targets for a few key commodities. Gosplan uses these guidelines to develop control figures for output in physical terms for a set of commodities which constitute about 80 percent of the value of industrial production. Then Gosplan splits these targets among the various ministries and republics, and they in turn allocate the targets to individual enterprises. At this point there ensues a protracted period of negotiations over the production expected from each organization and the inputs needed for that production. Once this phase is completed, Gosplan checks the plan for consistency by using material balances. This involves keeping a tally for each commodity, usually in physical terms, of the amount planned to be produced and that quantity required by other segments of the economy to achieve their targets. When planned demand exceeds the planned supply, the plan must be rectified by boosting production, cutting demand, expanding imports, or increasing the efficiency of material use. When a change is made in one material balance, it causes imbalances in other material balances, which cause further imbalances. In the end, changes are required in all of the balances to restore equilibrium. In reality, probably only the initial effects are considered by Gosplan.

Once the commodity targets are established, the planned growth in total industrial production is computed, probably as a weighted average of the planned growth rates of all of the commodities for which material balances are kept. Each ministry's planned growth is probably computed in the same way. The key point is that, until the commodity targets are aggregated, the planning occurs primarily in physical units.

Support for the proposition that Soviet plans are constructed primarily in physical units and, therefore, provide an accurate expected rate of growth can be obtained from plan data. We can use enterprise wholesale prices to aggregate the commodities for which plan growth is expressed in physical units in order to estimate the planned growth rate of total industrial production. If this estimate approximates the officially published planned growth rate, then we may claim that the planned growth rate is relatively unbiased. This assumes that the growth rates of the commodities for which plans are not published are well correlated with those that are published. Considering that the published commodity plans usually include the main products on which most industrial activity relies, this is fairly realistic.

[4] For a more detailed exposition of how the annual plans are drafted, see Paul R. Gregory and Robert C. Stuart, *Soviet Economic Structure and Performance* (New York: Harper & Row, 1974), ch. 5; Howard J. Sherman, *The Soviet Economy;* Igor Birman, "From the Achieved Level," *Soviet Studies* 30 (April 1978) pp. 153-172; David Dyker, *The Soviet Economy* (New York: St. Martin's Press, 1976), ch. 2; Alec Nove, *The Soviet Economic System* (London: George Allen & Unwin, 1977), chs. 2-3; and Gertrude E. Schroeder, "The Soviet Economy on a Treadmill of 'Reforms,' " in US, Congress, Joint Economic Committee, *Soviet Economy in a Time of Change* (Washington, D. C.: Government Printing Office, 1979), vol. 1, pp. 312-340.

Noren and Whitehouse performed this exercise for several key branches of industry for the Ninth Five-Year Plan (1971-75), a plan for which unusually detailed commodity data were published, and obtained growth rates which were very close to the published values.[5] The following tabulation compares the average annual rates of growth estimated by Noren and Whitehouse with the published rates (in percent):

Industrial Branch	Estimated Growth Rate Based on Commodity Plans	Officially Published Planned Growth Rate
Electricity	7.5	7.9
Coal	2.2	3.0
Oil extraction	7.3	7.5
Gas extraction	10.1	13.5
Ferrous metals	4.9	5.1
Paper and paperboard	7.9	8.5
Construction materials	6.5	7.1
Machinery	12.1	11.4
Light industry	5.7	6.6

Moreover, if these branch estimates are aggregated with gross output weights (the gross output for each branch in 1970, as reported by the CSA) to derive a total industry estimate based on commodity plans where available, the resulting figure of 7.9 percent per year is quite close to the official growth of 8.0 percent.[6] The same task has been done on a more limited scale for the 10th Five-Year Plan (1976-80). In this case the estimated average annual planned growth of industry works out to 6.5 percent compared with the officially published 6.4 percent.

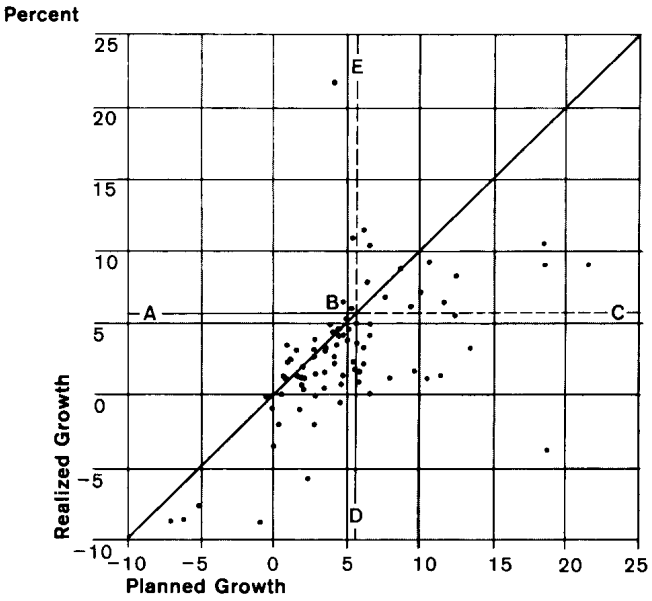
Figure 2 uses commodity data from the 1977 plan to illustrate the validity of the planned growth rate

[5] James H. Noren and F. Douglas Whitehouse, "Soviet Industry in the 1971-75 Plan," in US, Congress, Joint Economic Committee, *Soviet Economic Prospects for the Seventies* (Washington, D.C.: Government Printing Office, 1973), pp. 206-245.

[6] For completeness of coverage, it is necessary to use officially published planned growth instead of a rate based on commodity plans for some branches such as processed food and chemicals.

Figure 2

USSR: Plan and Performance for a Cross-Section of Products, 1977



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annual plan. The planned rate of growth of each product is plotted against its realized rate. The line segment DBE represents the planned growth rate of total industrial production for 1977 and ABC denotes the realized rate as computed by the Central Statistical Administration. By comparing the distribution of points along the horizontal axis, one gains a notion of how the planned growth of total industry compares with that for individual commodities. It is readily apparent that the planned growth for total industrial production falls near the midpoint of the sample. Although a majority of products were targeted to grow more slowly than the plan for total industry, they are clustered near the total industrial rate. The growth rates of those products that were slated to grow more rapidly than total industry are somewhat more dispersed, which probably compensates for the slightly more numerous cases of planned slow growth. The 1977 planned growth rate for total industry, therefore, was probably an unbiased average of the growth rates of the separate commodities.

In light of the preceding discussion, the plan goals do not appear subject to any large bias. Noren and Whitehouse concluded, "the plan goals . . . appear to be based firmly on a broad range of commodity goals and can thus be used in further analysis."[7]

Accounting for Actual Production. The *ex post* value of industrial production computed by the Central Statistical Administration overstates real growth mainly because the overriding goal of each enterprise manager is to meet his production goal. The methodology used to compute *ex post* levels of industrial production permits the manipulations necessary to ensure that the enterprise and national plan is fulfilled in value terms, if not in physical terms.[8] This section describes the various measures of output and shows how the Soviet use of one of them distorts a sector's contribution to industrial output, both in a given period and over time.

The correct method of calculating the real contribution of any enterprise to industrial output and total GNP by sector of origin is to count only the net contribution or value-added of each enterprise in constant prices. To do this one should deduct the cost of materials and services purchased from other enterprises because these intermediate items already are included in the output of the enterprise producing them. What remains after this deduction is the value-added by the producing sector—more specifically the total of profits, wages, depreciation, and payments to the other factors of production.

Since continuous time series of value-added are seldom available, a technique known as double deflation has been developed to estimate value-added. This entails deriving constant price indexes for the amount of gross output and also for purchases of intermediate materials by each producing sector. In many cases complete data are unavailable so the indexes must be derived based on samples of output and the consumption of intermediate product. These indexes are combined into a value-added estimate by deriving weights for a base year when a plethora of data on industrial structure are available; this could be the year of an industrial census or of an input-output table. These value-added weights of the base year are then applied to the indexes to subtract material purchases from gross output and arrive at value-added.

In contrast to this procedure most of the centrally planned economies use a gross output method to aggregate national output. In general this entails totaling the value of output of individual enterprises in a ministry, branch, or all industry to determine the respective total output figure. This has the effect of placing too high a weight on enterprises producing for final consumption, because it includes the value of intermediate products that are also counted elsewhere. As a result the importance of enterprises producing raw materials is understated, because their output estimates include few intermediate products. Figure 3 is instructive, showing the different impressions of industrial structure that are implied by the 1972 input-output table depending on whether value-added or gross output weights are used. Processed food, for example, has twice as large a share when measured by gross output instead of value-added, and the importance of light industry is also overstated. In contrast the contribution of the basic branches of industry, such as fuels, electricity, ferrous metals, and construction materials, are understated by use of gross output weights.

Enterprises usually use one of two methods for reporting their production.[9] The first is known as gross turnover of output (*valovoy oborot*). It includes intraplant consumption of a plant's own product, so enterprise output is calculated by adding together the output of individual workshops within the plant, even if

[7] Nolen and Whitehouse, p. 212.

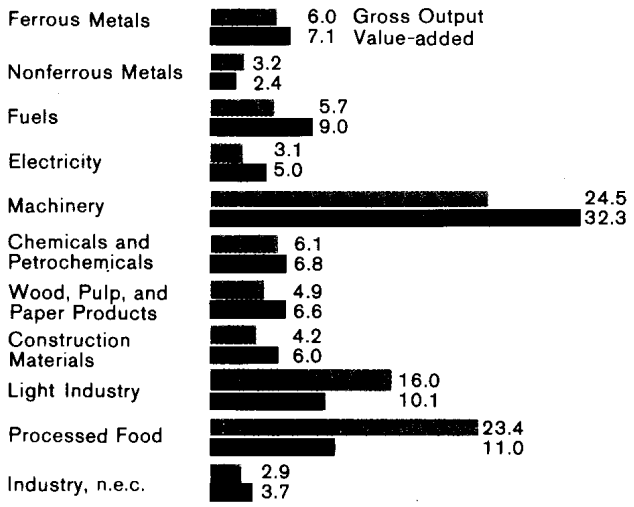
[8] The writings of the late Rush V. Greenslade in particular are prolific in discussing the problems with the Soviet industrial production indexes. For a more detailed treatment of this topic, see Rush V. Greenslade, "Industrial Production Statistics in the USSR," in Vladimir G. Treml and John P. Hardt, eds., *Soviet Economic Statistics* (Durham, Duke University Press, 1972), pp. 155-194; Rush V. Greenslade and Wade R. Robertson, "Industrial Production in the USSR," *Soviet Economic Prospects for the Seventies*, pp. 270-282; and Rush V. Greenslade, "The Real Gross National Product of the USSR, 1950-75," in US, Congress, Joint Economic Committee, *Soviet Economy in a New Perspective* (Washington, D.C., Government Printing Office, 1976), pp. 269-300.

[9] For a discussion of the two types of gross output measures, see M. R. Eydel'man, *Mezhotraslevoy Balans Obshchestvennogo Produkta* (Moscow: Statistika, 1966), pp. 200-03; A. I. Yezhov, *Statistika Promyshlennosti* (Moscow: Statistika, 1977), pp. 57-61; and Vladimir G. Treml et al., *The Structure of the Soviet Economy: Analysis and Reconstruction of the 1966 Input-Output Table* (New York: Praeger Publishers, 1972), pp. 45-46.

Figure 3

USSR: Share of Industry Output by Different Branches and Measures, 1972

Percent



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that output is consumed within the plant. Many of the Soviet production statistics recorded on this basis include but are not confined to consumer products. The second method is known as gross product (*valovaya produktsiya*). It excludes the intraplant turnover and, therefore, represents shipments from the enterprise adjusted by inventory changes. In general, production reported in value terms is computed on this basis.

The branch and total value of gross industrial output is calculated as the sum of the gross output of all of the industrial enterprises within a branch, ministry, or the entire nation. The values of enterprise output are allocated among branches according to their primary product. No adjustment is made for secondary products that normally would be allocated to a different branch. That the branch indexes are computed on an establishment basis as opposed to a commodity basis means that individual branches receive either too high or low a weight depending on the structure of production.[10] Ferrous metals and machinery are two prime candidates. Many machinery plants fabricate their own steel, and the value of the steel would be counted as part of machinery output. Similarly, most enterprises fabricate some of the metal parts they use; this metalworking production would be counted in the respective branch rather than machinery. While this type of commodity-establishment problem could bias the measures of branch output, it should not present any inherent problem for the total industry index.

The Soviet measures of gross output include items in addition to what are normally considered to be finished production.[11] Increases in inventories of semiprocessed goods are treated as output, although in recent years this has been limited to items with production cycles exceeding two months. In addition, some repair expenditures are treated as industrial production. Finally, many machinery enterprises are permitted to count expenditures for the development of new products as gross output.

Regardless of how measured, gross value of output is a misleading indicator because it includes intermediate products already counted elsewhere. For example, the value of coking coal used in manufacturing steel is counted in the output of the coal industry and, implicitly, in that of the steel industry. If the steel is used elsewhere in industry, the coking coal will be counted again.

If the amount of double-counting of production is constant and the industrial structure is stable, then the bias in the computed growth rate is minimal since the growth rate of value-added and gross output of each enterprise will be nearly identical. A small bias arises from the fact that the output of the separate enterprises will be combined by gross output weights rather than value-added weights.

The principal bias from double-counting arises, however, from increasing vertical specialization in the production of a given commodity. This causes the gross output of an enterprise to rise faster than value-added. The bias caused by this type of double-counting is particularly severe over time, where the economic structure is rapidly changing. By any standard, Soviet industry has grown rapidly over the last three decades and the degree of specialization has increased somewhat.

[10] Greenslade, "Industrial Production Statistics," pp. 172-174.

[11] Greenslade, "Industrial Production Statistics," pp. 171-186.

Soviet industry is notorious for its autarkic nature. Because of the vagaries of its distribution system, enterprise and ministry managers want to control as much as possible the production and distribution of the material inputs needed by their enterprises. Enterprises and ministries frequently produce goods which clearly lie outside their area of responsibility. Soviet planners and academics have long realized that this excessive vertical integration hampers efficiency and there have been numerous campaigns over the years to encourage specialization. To the extent these campaigns have been efficacious, this would increase double-counting and the upward bias of gross output as a measure of the growth of industrial production.

The construction materials industry is a prime example of how a changing industrial structure causes double-counting to increase. At one time, most cement was shipped directly to the construction industry. Soviet leaders decided, however, to "industrialize construction" by fabricating as many construction elements, such as walls, bathroom units, and railroad tracks, as possible in a plant instead of on site by the construction industry. This means that much of the cement is now converted into precast concrete products by other plants within the construction materials industry and a larger share of cement output is now double-counted.

Finally, industries with a high ratio of material inputs to gross output are more susceptible to biases imposed by double-counting. This means we would expect a greater danger of significant bias in the measurement of machinery, chemicals, and construction materials output and a smaller bias in the remaining branches.

But the most significant source of bias in the official production data seems to be the disguised inflation that creeps into the data under the guise of new product pricing and the deterioration of quality. While most of the value series published by the Soviets are ostensibly reported in constant rubles, we believe that these series reflect prices that become inflated over time owing to Soviet pricing procedures.

The task of the Central Statistical Administration is to report on what occurred in the previous year. Therefore, it is interested in the value of production rather than an average of physical units. To compute the real rate of growth, industrial production must be valued in constant prices of some base year. This is easy when the same product was produced in the current and base years. When a new product is produced, it is difficult, but necessary, to impute a price to it that corresponds to the prices of the base year. The primary flaw of the Soviet procedure is that excessively high prices are imputed to these new products. In addition, it is believed that existing products are frequently altered in insignificant aspects so that they may be classified as new products and be given higher prices.

Many enterprise managers find it advantageous to boost prices to meet their gross output plan. Although prices of existing products are strictly controlled by the government, an enterprise or ministry may have considerable influence over the price of a new product.[12] In theory a new product is given a price sufficiently high to recover research, development, and introductory production costs. After these initial costs are recovered, the new-product price is lowered and a permanent price is established.

In practice two things commonly occur, both of which overstate the growth of industrial production. First, Soviet managers will slightly alter the specifications of old products, and charge substantially higher prices for the new products, which in reality are virtually unchanged from the old ones. At the same time, the enterprise frequently halts production of the cheaper "old" item. Purchasers have little choice but to accept the more expensive "new" item and inflation.

Second, when a genuinely new product is introduced, the temporary price often becomes an unjustifiably high permanent price. In effect, this practice introduces current prices of a later year into a constant price series and biases the growth index upwards. As the proportion of new products increases, the bias due to using current prices increases.

[12] The new-product pricing phenomenon has been widely discussed. In particular, see Abraham S. Becker, *Ruble Price Levels and Ratios of Soviet Machinery in the 1960s*, Report R-1063-DDRE (Santa Monica, California, The RAND Corporation, 1973); Joseph S. Berliner, *The Innovation Decision in Soviet Industry* (Cambridge, The MIT Press, 1976); Padma Desai, "On Reconstructing Price, Output and Value-Added Indexes in Postwar Soviet Industry and its Branches," *Oxford Bulletin of Economics and Statistics* (February 1978): pp. 55-77; and Central Intelligence Agency, *An Analysis of the Behavior of Soviet Machinery Prices, 1960-73*, ER 79-10631 (December 1979).

It is not difficult to identify two characteristics that would greatly increase the likelihood that new-product pricing would be a serious problem in a given branch. First, this phenomenon would prevail in industries with a heterogeneous assortment of products. Not only are value measures the only meaningful quantification of output, but the presence of unique products provides many opportunities for price increases. Second, it would occur in technically dynamic industries where many opportunities for innovation exist and product complexities make it difficult to distinguish between real and cosmetic improvements. These features are most characteristic of the machinery and chemicals branches. It has been estimated that unique products comprise one-half of the output of the machinery branch. Moreover, the rapid rate of change in the mix of machinery products is confirmed by the estimates of Soviet scholars that from 10 to 17 percent of all machinery products are renewed annually.[13] This is also the branch whose growth is believed to be the most overstated.

Statistical Evidence of Bias

Soviet literature provides abundant evidence of the existence of the biases in the officially published growth rate discussed above. The use of Western reconstructions of Soviet data provides additional support for this proposition and gives some estimates of the size of the bias. This section presents the statistical evidence of a bias by comparing our index of Soviet industrial production with the officially published data. Some limited comparisons are made with East European data.

There can be little doubt that the *ex post* measures of performance in value terms are upwards biased. Gregory Grossman found this the case in his analysis of the Eighth Five-Year Plan (1966-70).[14] Although the Central Statistical Administration claimed that the overall plan had achieved its targeted 50-percent increase in industrial production, Grossman found the targets for only four of 37 key industrial commodities were achieved, and two of those four were expressed in rubles. The median level of plan achievement for the products in his sample was only 83 percent of the respective targets. Even allowing for the limited sample, an enormous and unlikely overfulfillment by commodities whose planned and actual production levels were unpublished would have been required to bring the overall growth rate up to the claimed level of performance.

Interpretation of the Ninth Five-Year Plan results leads to similar conclusions. The official measure of industrial production increased only 43 percent, short of the planned 47 percent. Analysis of the commodity data shows an even larger shortfall. More than two-thirds of the products in a sample of 58 products grew less than 40 percent, and nearly half grew less than 30 percent. The performance of the machinery branch is an apt example. That branch supposedly fulfilled its goals for the five-year plan, yet only two of 20 machinery items in the sample achieved their plan. Output of both items is measured in rubles rather than physical units.

Another way of demonstrating the upward bias of the official measure is to compare the official indexes with our synthetic index of Soviet industrial production (SPIOER). This synthetic index is based on the official data on commodity output, usually in physical terms. These data are aggregated into sectors with constant price weights and into total industry with value-added weights.[15] Figure 4 summarizes this procedure. The resulting indexes are believed to avoid most of the problems of the Soviet official measures discussed above.

Figure 5 plots the planned growth rate, the Soviet officially published rate, and our synthetic SPIOER estimate for the period 1960-79. It shows that, despite Soviet claims, the plan was fulfilled only in 1967, 1970, and 1973.

Table 1 compares the claimed growth and our estimates by branch of industry. It shows that the official measure is higher than the synthetic measure for total industry by one to two percentage points per year. Among the branches, the largest differences are in the same branches where we would expect to encounter the

[13] Abraham S. Becker, *Ruble Price Levels and Dollar-Ruble Ratios of Soviet Machinery in the 1960s*, pp. 8-9.

[14] Gregory Grossman, "From the Eighth to the Ninth Five-Year Plan," *Analysis of the USSR's 24th Party Congress and Ninth Five-Year Plan* (Mechanicsville: Cremona Foundation, 1971), pp. 54-66.

[15] A detailed exposition of the indexes and the methodology behind them will be published later this year.

Figure 4

USSR: A Capsule View of How the Index is Constructed

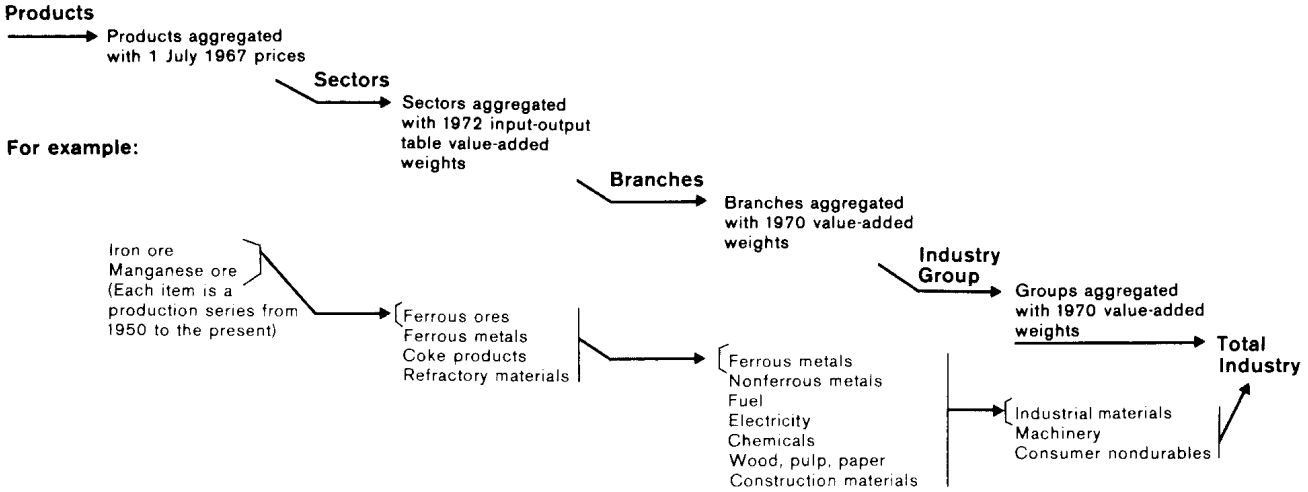

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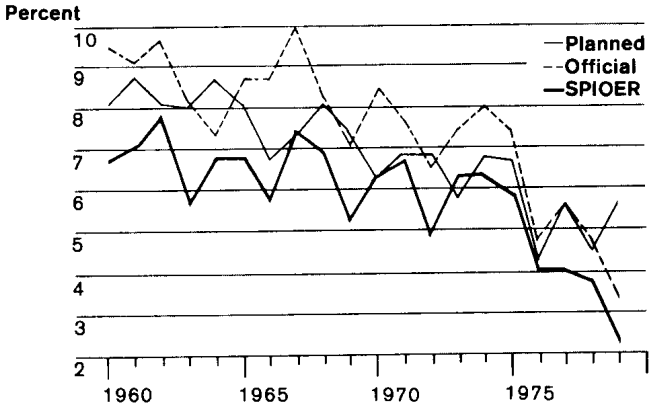
Figure 5

USSR: Growth Rates of Total Industry According to the Plan, Official Indexes, and SPIOER Indexes



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most bias (machinery, chemicals, and construction materials).

Because the bias in the officially published measure is greater in some branches than others, one obtains a distorted view of structural change in Soviet industry. For example, machinery production grew twice as rapidly as ferrous metals in 1966-70—11.7 percent per year compared with 5.7 percent—according to the official data. According to our synthetic measure, machinery production grew more rapidly than ferrous metals, but by the narrow margin—7.0 percent per year to 5.0 percent.

Comparison of similar synthetic indexes derived by Thad Alton's group with the respective gross output measures for several East European countries leads to similar results. The upward biases of the official indexes are demonstrated in table 2. Except for Bulgaria and Hungary in the 1961-65 period, the official indexes are always growing faster than the

Table 1
Average Annual Growth Rates of the Officially Published and SPIOER Indexes for Total Industry and Selected Branches of Industry

Percent

	1951-55	1956-60	1961-65	1966-70	1971-75	1976-78
Total industry						
SPIOER	10.9	9.6	6.8	6.4	6.0	4.0
Official	13.1	10.4	8.6	8.4	7.5	5.0
Ferrous metals						
SPIOER	11.1	7.6	7.2	5.0	4.0	2.2
Official	12.1	8.8	8.0	5.7	5.1	3.0
Fuels						
SPIOER	9.4	8.9	6.3	5.0	5.0	3.7
Official	10.1	8.5	6.5	5.7	5.9	3.8
Electricity						
SPIOER	13.1	11.4	11.5	7.9	7.0	5.0
Official	14.4	13.1	12.3	9.0	7.1	5.4
Chemicals and petrochemicals						
SPIOER	11.6	10.5	12.0	8.9	8.6	4.5
Official	17.3	12.0	14.4	12.2	10.6	6.6
Wood, pulp, and paper						
SPIOER	7.4	5.8	2.6	2.9	2.6	0.1
Official	8.3	7.8	5.0	5.5	5.2	2.3
Construction materials						
SPIOER	15.7	14.7	5.4	5.7	5.4	1.9
Official	17.6	17.6	9.1	8.6	7.5	3.7
Machinery						
SPIOER	12.2	12.4	8.2	7.0	8.2	6.2
Official	16.7	14.2	12.4	11.7	11.6	9.0
Light industry						
SPIOER	10.4	6.4	2.6	7.2	2.7	2.8
Official	12.3	6.9	2.6	8.6	4.6	3.8
Processed food						
SPIOER	10.2	8.4	6.8	5.9	3.9	1.6
Official	10.0	7.9	7.2	5.9	5.4	1.5

Table 2 Percent

Eastern Europe: Average Annual Growth of Industrial Production

	1961-65	1966-70	1971-75	1976-78
Bulgaria				
Official	12.0	10.8	9.0	6.7
Adjusted	14.2	8.7	5.7	4.6
Czechoslovakia				
Official	5.5	6.8	6.7	5.5
Adjusted	4.8	4.3	3.9	3.5
East Germany				
Official	5.8	6.5	6.5	5.5
Adjusted	5.0	3.8	3.4	3.5
Hungary				
Official	7.3	6.2	6.3	5.6
Adjusted	8.4	3.5	2.7	3.1
Poland				
Official	8.3	8.3	10.4	6.8
Adjusted	7.7	6.2	7.6	4.2
Romania				
Official	11.2	14.4	13.0	11.1
Adjusted	10.6	11.5	9.2	8.7

synthetic ones by appreciable amounts. Typically, the spread in growth rates is at least 2 percentage points per year and at times approaches 4 points.

Unfortunately, the data are such that it is impossible to decompose the differences between the growth rates into that caused by changes in double-counting, disguised inflation, or other reasons. T. P. Hill, however, used OECD data to estimate the possible impact of using a gross output index rather than value added.[16] He found that the use of gross output measures increased the growth rate for several OECD countries by an average of 0.1 percentage point per year for total industry. While this suggests that the net bias is not large, he found considerable variance in individual sectors. In about one-fifth of the industries surveyed, the gross output measure would increase growth rates by 2 percentage points or more and in about one-tenth, the gross output measure would decrease growth rates by 2 percentage points or more. In analyzing his sample, Hill found the difference between gross output and value-added growth rates was apt to be the largest under two conditions. First, the difference between the two measures tends to be high in those industries with a high ratio of material purchases to total output. Second, the difference is more likely to be large for sectors with high growth rates. The fact that Soviet industry is more material intensive than its Western counterparts and has sustained a rapid rate of growth in the postwar period suggests that the extent of bias arising from using gross output measures may be larger than the 0.1-percentage-point difference computed by Hill.

The data used to construct the SPIOER indexes indicate that disguised inflation exists in the official indexes. Commodity data are either unavailable or meaningless for some branches of our synthetic index, however. To ensure a comprehensive sample for our indexes it is necessary to rely on official data expressed in value terms for parts of the wood, pulp, and paper; chemicals; light industry; consumer durables; and producer durables branches. The inclusion of these value series may bias the synthetic indexes upwards but not to the same extent as the official measures. By dividing the samples for these sectors into physical and value categories and computing the relative growth rates, we can obtain a notion of the possible extent of the pricing bias. Table 3 shows that in virtually every case the value series grow more rapidly than the quantity series. The most serious case seems to be producer durables, where the value series are an important share of the sample and the growth differential is largest—averaging 4 percentage points per year.

These results only suggest the possible extent of the distortions that enter the Soviet value of output series. The actual bias in growth rates may be somewhat smaller for two reasons. First, there is some evidence that the value series represent sectors of the economy that probably are growing more rapidly than sectors represented by quantity series. For example, transport machinery is a quantity series and a sector that traditionally grows slowly once a nation's transportation infrastructure is in place. On the other hand, instruments and computers is a value series that would be expected to grow rapidly at this stage of develop-

[16] T. P. Hill, *The Measurement of Real Product* (Paris: Organization for Economic Co-operation and Development, 1971), pp. 97-106.

Table 3 Percent

Average Annual Output Growth of Selected Branches by Product Sample Components

	1951-55	1956-60	1961-65	1966-70	1971-77
Wood, pulp, and paper					
Quantity series	7.0	5.0	1.8	1.4	0.5
Official value series	18.1	17.8	10.4	9.1	8.0
Chemicals and petrochemicals					
Quantity series	11.4	10.2	11.8	8.9	7.5
Official value series	20.8	19.4	16.1	8.7	10.6
Light industry					
Quantity series	9.3	5.9	3.2	4.9	2.3
Official value series	13.4	7.6	1.2	12.1	3.9
Consumer durables					
Quantity series	18.2	11.8	9.4	4.9	12.5
Official value series	17.5	10.0	10.0	13.3	9.3
Producer durables					
Quantity series	11.1	12.7	7.3	3.6	4.5
Official value series	13.1	12.6	10.9	9.9	10.5

ment. Second, the quantity series may somewhat understate growth by failing to catch quality improvements—especially those for machinery items—that may have occurred over the years.

The Bias Will Continue

Why have these biases in the official Soviet measures been allowed to persist? The system works in a way that profits everyone. Since plans are taut and difficult to fulfill in real terms, enterprise managers find it easier to meet their production targets and to receive their bonuses by encouraging double-counting and disguised inflation. Because labor productivity growth is measured as the change in output divided by the change in average employment, the goals for labor productivity are also easier to achieve. Moreover, the availability of incentive funds that can be used to increase wages and fringe benefits to workers, and thereby reduce labor turnover, and to increase investment are dependent on plan fulfillment. The production ministries do not complain because their performance is evaluated on the same terms as the enterprises. Finally the Council of Ministers and the Central Statistical Administration may complain about specific shortfalls, but still the optimistic aggregate statistics present impressive propaganda to demonstrate the benefits of a centrally planned economy.

Which statistics should be used in analyzing Soviet economic performance? The measures of the actual gross value of output should be strictly avoided. As Rush Greenslade wrote:

> *I cannot think of any proper use for aggregated gross value of establishments unless all other measures are missing. Gross value of output of an enterprise . . . has utility for management analysis and control. Conceivably gross value might be used for questions of optimum scale of plant or optimum location. However, more detailed breakdown for products within plants would be even more useful for careful analysis of these questions. The establishment classification, and the gross weighting, of the GVO's would distort almost any economic analysis or projection.*[17]

[17] Greenslade, "Industrial Production Statistics," p. 187.

A better picture of industrial performance can be obtained by constructing a synthetic index that uses constant prices and value-added weights.

Since the planned growth measures apparently avoid the biases of disguised inflation and double-counting, they may reasonably be compared with the synthetic *ex post* growth measures. Also, the planned growth in one year may be compared with planned growth of another year to discern the shifting priorities of economic growth. Finally, the planned growth for some segment of industry in a given year may be compared with the national average or some other component to distinguish the relative priorities placed on them by Gosplan. But never should the planned growths of gross output be compared with the official gross output measures.