

# Soviet Industrial Growth

Estimates of it face difficulties, but the "best"  
Western guess finds Soviet claims much exaggerated.

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In applying Lord Kelvin's famous dictum to the workaday habits of many economists, one of my revered teachers, Frank H. Knight, used to say: "If you can't measure, measure anyhow." The student of the Soviet economy cannot avoid getting caught on the barb of this remark. Knowing the formidable difficulties of measuring, in a simple and direct way, such a complex and elusive thing as Soviet economic growth, he might refuse the job. But the public will not be denied: the question is too pressing to be left unanswered. The student is thus forced to act on a second principle also often enunciated by Knight, one that he attributes in turn to a revered teacher of his own: no question can be called unanswerable if it has to be answered, and some answers are better than others—or, at least, some are worse.

The question before us is how fast Soviet industry has been growing. It has been answered many times, and there is no doubt that some answers are worse than others. Within the brief compass of this article, I will try to explain why this is so and to give my own answers, without presuming that they are best.

## The Worst Answer

The worst answer, almost all Western scholars agree, comes in the form of the official Soviet index of industrial production. According to that index, industrial output has multiplied 36 times since 1913 in the Soviet Union, or 7 times more than in the United States, where it has multiplied around 5 times. The myth is easily dispelled: since Russian industry produced about a seventh as much as American industry in 1913, its output would now exceed the American level if the official Soviet index were correct. Not even the Soviet leaders claim this. In a recent speech, Khrush-

chev stated that Soviet industrial output had reached half the American level, a figure that is also probably too high. This would seem to imply a contradiction in Soviet arithmetic, a rare occurrence. The contradiction is avoided by an official statement that Russian output in 1913 was only 7 percent of the American level, a fancifully low estimate.

Unfortunately, the defects in the Soviet index cannot be fully analyzed and corrected because the underlying details have not been published. We do know that the index is not constructed in accord with generally accepted Western practices and that some of the methods used are bound to exaggerate growth. For example, until recent years output was evaluated in so-called "1926/27 prices," but new products were added to the index whenever they first came into production. They were supposed to be evaluated in the prices they would have had in 1926/27, had they been produced then. But this is a bit difficult to do in the case of television sets, jet airplanes, rockets, and the like. The expedient actually followed was to price each new product at its initial cost of production, which was inflated on two counts. First, initial costs are abnormally high, since they include developmental expenses, apply to a pilot rate of production, and do not allow for normally rapid reductions in cost, attributable to learning. Second, there was a steady and sharp inflation in the general price level over this period. Hence new products, which tend to grow faster in output than older ones, were entered into the index periodically at heavily inflated weights.

Other practices have a similar effect in exaggerating growth. Soviet statisticians seem to be aware of the more serious defects in the official index, and improvements have been made in the postwar years. Nevertheless, the index

continues to exaggerate growth, though not as heavily as before. Meanwhile, the index for earlier years, having become firmly established in official dogma, stands little chance of being revised.

## The Thorny Path to Better Answers

The only alternative open to the Western scholar is to start from scratch and construct his own production index. Enormous problems are immediately raised. In the first place, the basic data on physical output of individual industries also come from official sources; and, though they are not as unreliable as broader index numbers, they have many shortcomings. In the second place, the turbulent and uneven nature of Soviet industrial growth creates measurement troubles that could not be eliminated even if the basic data were ideal.

Social scientists accustomed to doing empirical work may find it hard to believe that Soviet statistics are "really" worse than others, because every empirical researcher in no matter what field of the social sciences quickly becomes convinced, for rather good reasons, that no data could be as bad as those he is forced to work with. Why call the kettle black when it is probably no grayer than the pot?

Let us acknowledge at once that all statistics contain faults and errors. Let us also acknowledge that no government or other agency is free from the temptation to stretch figures to its own account, if it feels it can get away with it. Representative government, competitive scholarship, and free public discourse are the Western institutions that have counteracted error and misrepresentation in statistics, imperfectly to be sure, but at least to some degree.

The peculiar difficulties with Soviet statistics stem, in the first instance, from the system of authoritarian, centralized planning—from what has been called a "command economy." Published statistics come from only one source, the state. There are no independent sources to restrain each other or to be used as checks against each other, except to the extent that related figures published by different state agencies might be uncoordinated before publication. On the other side, the suppliers of data to the central authorities—the economic enterprises and other administrative units—have a stake in the figures they report,

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since their performance is judged on the basis of them. The Soviet statistical authorities do not hide their concern over the misreporting that results from this feature of the economic system.

A second set of difficulties stems from the crusading nature of Soviet communism. Statistics are grist for the propaganda mill. Knowing the ideological views of Soviet leaders, one cannot expect them to dispense facts in a passive and detached manner.

For both broad reasons, Soviet statistics are selective and of varying reliability and ambiguity. The policy of selectivity has two rather opposing results as far as statistics on physical output are concerned. On the one hand, some areas of poor performance are shielded from view, being underrepresented in published data. On the other hand, some of the more rapidly expanding economic activities associated with the military sector are also not reported on. It is impossible to determine the net bias of the sample of published data: whether there is, on this count, a net over- or understatement of growth (1).

A few broad generalizations can be made about the reliability of the published statistics. In the first place, absolute output is probably overstated in the case of most industries, particularly for the years within the Plan period, though the degree of overstatement cannot be determined. In the second place, growth in output is also probably overstated relative to a prerevolutionary base, but not necessarily over other parts of the Soviet period. Over some of the latter years, growth may be overstated, over others understated, and over still others more or less accurately reported. This will vary from industry to industry and from one situation to another.

Let us now turn briefly to some of the more technical problems involved in constructing production indexes for Soviet industry. A production index is a synthetic measure that translates diverse growth rates for many different products into the single hypothetical rate that presumably would have obtained if, in fact, all products had grown at the same rate. The translation is accomplished by, in effect, transforming the many different products into a common generalized product—by weighting each product by its relative cost of production in a particular year. Thus, swords are “beaten” into plowshares by expressing both in terms of their productive value: the output of each is multiplied

Table 1. Average annual growth rates of Soviet industrial production according to different production indexes (percentages).

Index	Unadjusted		Adjusted*	
	1913–1955	1928–1955	1913–1955	1928–1955
Calculated indexes				
All indexes	3.0–4.7	5.1–7.3	2.7–4.4	4.7–6.9
“Best” index	4.2	6.5	3.9	6.1
Official Soviet index	8.2	11.9	7.9	11.5

\* Adjusted to exclude gains from territorial expansion during World War II.

(weighted) by its unit cost of production, and the resulting values are added together to get aggregate production. The aggregate can be thought of as the hypothetical quantity of plowshares (or swords) that could be produced if they were the only things produced. Growth between one year and another is measured by the ratio of aggregate production in the later to the earlier year, outputs of swords and plowshares being weighted in both years by the costs in a single specified year.

Even under conditions in which the basic data needed to compute index numbers are close to ideal, the numbers can be fickle. Their vagaries have made necessary the development of a specialized theory of index numbers, whose mysteries cannot be explored here. We must be satisfied to note that the numerical value of a production index will depend on such things as the weighting formula used, the year chosen for the weights, the structure of production, the path of growth followed, and so on. The divergence between indexes constructed in alternative ways tends to be greatest when an economy is undergoing swift and radical changes in its structure and when growth rates for different industries are widely dispersed.

Soviet industry has undergone just such swift and radical changes, particularly during the late 1920's and early 1930's. Growth rates have also diverged widely from one sector of industry to another, being much higher in “heavy” industry than in consumer goods industries. Growth has been interrupted at critical points by major disturbances. Quantitative growth has not been accompanied by the general improvement in quality that has characterized industrial development in most Western countries. These difficulties of measurement are compounded by the fact that there are few reliable data on costs of production: as is now acknowledged by Soviet economists, the Soviet price system does not accurately reflect relative costs of production. These factors, coupled with

the questionable reliability of statistics on physical output, makes the calculation of production indexes for Soviet industry unusually treacherous.

### Some Better Answers

In the face of these many problems, the only satisfactory approach is to measure Soviet industrial growth in a number of ways and examine the converging lines of evidence. In the work I have been associated with at the National Bureau of Economic Research (2), we have constructed a variety of production indexes, measuring productive activity at three different stages of fabrication, using Soviet weights for three different years (1913, 1928, and 1955) and American weights for four others (1914, 1929, 1939, and 1954), and varying in extensiveness of product coverage. These indexes have been supplemented by studies of the performance of individual industries, summarized by various techniques, including liberal comparisons with performance of counterpart industries over relevant periods of American industrial history. Since the study has not been completed, the figures presented here should be viewed as tentative and subject to revision.

Let us look first at the production indexes, concentrating our attention on the growth they show over two periods, 1913–1955 and 1928–1955. The first encompasses the whole Soviet era, except for the last few years; the second, the period under comprehensive centralized planning.

Over the longer Soviet period, these indexes show industrial production as multiplying between 3.5 and 6.8 times; over the Plan period, between 3.8 and 6.6 times. If we choose from among these indexes a single one that conforms most closely in its construction to the kind of production index preferred in the West and treat that index as the “best” estimate of Soviet industrial

Table 2. Comparisons of average annual growth rate for industry in the United States and Soviet Union (percentages).

Period	Soviet Union*	United States
1913-1955	3.9	3.7
1885-1927		4.8
1877-1919		5.0
1928-1955	6.1	3.7
1885-1912		5.3
1877-1904		5.6

\* Adjusted to exclude gains from territorial expansion during World War II.

growth, we find that Soviet industrial output multiplied 5.6 times over the entire Soviet period and 5.5 times over the Plan period. From these indexes, we note the failure of Soviet industry to show any net growth between 1913 and 1928. According to the official Soviet index, the corresponding multiples are 27 times for 1913-1955 and 21 times for 1928-1955. Hence, if the "best" estimate is accepted as correct, the official Soviet index contains a four- to fivefold exaggeration of growth over the periods under consideration.

For comparative purposes, it is advisable to translate these multiples of growth into average annual rates (see Table 1). The "best" estimate of growth is shown to be 4.2 percent a year, on the average, over the entire Soviet period and 6.5 percent a year over the Plan period, rates that are somewhat less than half those shown by the official Soviet index (3). Some of this growth is attributable to the acquisition of territory during and after World War II: the Baltic States, about half of Poland, a part of Rumania, and other lesser territories. These regions have added about 10 percent to Soviet industrial production, and eliminating this gain reduces the average annual growth rate to 3.9 percent for the entire Soviet period and to 6.1 percent for the Plan period.

These general results may be checked in two broad ways. First, study of about 50 individual industries indicates that Russian output in 1913 (within the pre-1939 Soviet territory) and 1955 was, on the average, roughly the same as U.S. output in 1885 and 1920, respectively. This would mean that Soviet industrial production grew approximately as much between 1913 and 1955 as American production grew between 1885 and 1920. Over the latter period, American industrial production multiplied 5.4 times, almost the same figure as found by the "best" index for Soviet industry for 1913-1955.

Second, a similar comparison can be

made for aggregate production. If the output of Soviet industrial products is evaluated in American prices, we find—after making allowance for the degree of coverage represented by the products for which this evaluation can be made—that the net production of Soviet industry was about 15 percent as large as net production of American industry in 1913, and about 22 percent as large in 1955 (4). The estimate for 1955 is probably less reliable than the one for 1913, and may be in error by as much as 10 percent in either direction. Looking back into American industrial history, we find that in 1877 production was about 15 percent of the level in 1913, and in 1913 it was about 22 percent of the level in 1955. Hence, through this indirect path, we would suppose that Soviet industrial output in 1913 and 1955 corresponded roughly with American industrial output in 1877 and 1913, respectively. Between 1877 and 1913, American industrial output multiplied 6.7 times, which is roughly the multiple shown for Soviet industry for 1913-1955 by the fastest-growing index constructed in our work at the National Bureau of Economic Research.

### The Answers Put into Perspective

The estimates of Soviet industrial growth presented here will take on more meaning if they are compared with the pace of industrial growth in this country. We note that Soviet growth has been slightly faster than American growth for 1913-1955, and much faster for 1928-1955 (see Table 2). It would be prudent to suppose that the differential will continue in favor of the Soviet Union over the near future.

These comparisons are important for many purposes, but they do not indicate the relative growth-generating capacities of the Soviet and American economic systems, even as far as industry alone is concerned. The industrial potentials of the two economies are similar: they are both large and richly endowed with natural resources. Given the state of the industrial arts, the rate of industrial growth tends to depend on the level of productive activity relative to the industrial potential. The lower that level, the faster the growth rate tends to be. It is therefore useful to compare Soviet with American growth over periods in which industrial production started at roughly the same level. In this respect, the American periods 1885-1920 or 1877-1919 are more or less comparable with the Soviet

period 1913-1955, and 1885-1912 or 1877-1904 with 1928-1955.

Over the longer "comparable" periods, the American growth rate exceeded the Soviet one; over the shorter ones, the reverse is true (see Table 2). The growth-generating superiority of one industrial system over the other—as far as it is revealed by these rather mechanical comparisons—remains in doubt, to be resolved only by the future course of history. It should be noted, however, that this set of comparisons involves a substantial advantage in favor of the Soviet Union, since it has had 20th-century technology at its disposal in working out its course of industrialization.

### Warnings about Conclusions

Since the aims of this brief survey of a particular measurement problem have been modest, it would be a mistake to conclude too much from it. Our attention has been focused on the broad aggregate of industrial production, not on the segments of industry receiving highest priority from Soviet leaders. Those are the segments that promote state power, in particular military power. It is wrong to infer military power from general industrial strength, and vice versa.

One must also be careful not to make simple mechanical comparisons between industrial growth rates in the Soviet Union and the West. The character of industrial growth and the context within which it has taken place differ so materially in the two parts of the world that comparisons of highly generalized measures of industrial growth carry a very limited meaning. In the Soviet Union enhancement of state power has been the primary objective of economic policy, the consumer being treated as a residual claimant. Heavy industry and ordnance have been supported at the expense of consumer goods; and other important sectors of the economy—agriculture, construction, and consumer services—have been neglected in favor of industrial growth. Leisure has grown very slowly, and human losses that stagger the imagination have been a part of the cost of growth. These matters are not brought up to place the actual quantitative achievements in a shadow; those achievements are real enough. But a full appraisal of industrial performance and its significance requires that it be viewed against the broader background of economic and social achievements as a whole.

#### References and Notes

1. These brief comments apply to the condition of economic statistics since 1956. Between 1938 and 1956, statistics on the physical output of individual industries were not published at all in the Soviet Union, with a few minor exceptions.
2. The National Bureau of Economic Research is a nonprofit organization engaged in economic

research, with its main offices in New York. Arthur F. Burns of Columbia University is president, and Solomon Fabricant of New York University is director of research.

3. The phenomenon of compounding makes the average annual growth rates diverge less percentage-wise than the multiples of growth for the longer spans.
4. The general opinion of American specialists in

Soviet studies seems to be that Soviet industrial production was about a third of the American level in 1955, which is considerably higher than the estimate given here [see, for example, *Soviet Economic Growth: A Comparison with the United States* (Joint Economic Committee, Washington, D.C., 1957), p. 11]. I can only say that I have not been able to reproduce the conventional estimate by direct calculations.

## Walter D. Bonner, Scholar, Chemist, Gifted Teacher

Walter Daniel Bonner, late professor and head of chemistry at the University of Utah at Salt Lake City, was born on 27 October 1878 in the town of Osceola, Nebraska. He was the oldest of eight children of a father of Scottish-American descent (via Pennsylvania and Ohio) who had been educated for the Presbyterian ministry. The father, wearied by a three-year diet of Greek and Latin, turned instead to cabinet-making and carpentry, at which he was adept. Bonner's mother was of New England ancestry and was relatively unschooled but could play the piano and sing with real ability. When young Walter was nine years old, his parents moved permanently to a farm, a step which never proved financially rewarding. From the age of nine until he reached his majority, Walter worked on this farm or hired out as a farm hand, and during the winter months he attended small country schools. It may be said that he was influenced on the side of scholarly pursuits and manual skills, mainly by his father, and in his love for and ability in music by his mother. The Bonner ancestry is liberally sprinkled with competent millers and engineers.

Because of the economic necessity for doing farm work, Walter was unable to begin high school until he was 21, when he entered Nebraska Wesleyan University and its associated preparatory school. Being compelled to support himself at Wesleyan, he did janitor work, at night, and carpentering, at which he excelled, during the summer vacations. His food during school terms often consisted of cooked oatmeal only. Stimulation to take up chemistry came from a young professor, F. J. Alway, who had studied organic chemistry in Germany. With Alway, Bonner published three papers on organic chemistry; he was elected to

Phi Beta Kappa and received the B.S. degree in 1906. At Wesleyan University he met Miss Grace Gaylord, also a student of chemistry, whom he married in 1909.

Persuaded by Alway, Bonner applied for and received a fellowship at Princeton where he studied under G. A. Hulett who, being of a more modern and farsighted temperament, soon convinced Bonner that physical chemistry was the more fundamental subject to pursue. With Hulett he published his now classic quantitative work on constant boiling hydrochloric acid solutions. The powers that be at Princeton were allegedly displeased by Bonner's change to physical chemistry, and it became apparent to both him and Hulett that he should settle for an M.A. in 1908 and go on to the University of Toronto, Canada. There he worked under the already prominent Professor W. Lash Miller on phase rule studies and received his Ph.D. in 1911, as well as appointments as lecturer and then assistant professor at Queens University.

Walter Bonner was born, raised, and educated and he worked in a comparatively serene but remarkably significant period in the history of science and mathematics, and he was acutely aware of this. The physical sciences and mathematics advanced amazingly along quantitative and fundamental paths as well as in depth and breadth of philosophical understanding.

Such was the background and spirit of science when Professor Bonner was asked to join the faculty of the University of Utah and assume the headship of the chemistry department in 1915. There was one other member of the chemistry staff, newly appointed Professor Elton Quinn; later Thomas B. Brighton and still later a professor of physics, Orin

Tugman, were appointed. Work leading to the bachelor's degree could be given, but at first no further. The science building was attractive and rugged but the research facilities were meager. Both Bonner and Quinn were artists at glass blowing, and they made apparatus, did the teaching, and encouraged the undergraduates to embark on such researches as were then possible. There was a gentlemanly but stern dean (and professor of mathematics) who resisted all efforts to encourage research and advanced graduate work at the University, but through Bonner's patient insistence, and some delphic magic, more and more research on the part of seniors and master's candidates was done.

The stipends of the early graduate assistants were painfully small, as this writer can testify, and on numerous occasions Mrs. Bonner graciously provided hospitality. The monumental result of Bonner's more than 30 years of teaching, research, and encouragement was, besides many significant scientific papers and a book, over a hundred men who went on to advanced graduate work in chemistry and physics at other universities and colleges, and some two hundred more who went into medicine. Largely through his efforts such scholars as A. A. Noyes of Pasadena, Joel Hildebrand and G. N. Lewis of Berkeley, and others, lectured on occasions at the University. He never had a secretary.

Bonner was a man of even temper, warmth, and pleasant persistence. He was versed in literature of both ancient and modern origin, and well informed on current events and their significance. Though never sanctimonious or formally religious, he could quote the Holy Writ to good effect when he deemed it appropriate. His family counted six sons, all of whom went on to advanced degrees in the physical or biological sciences, and one daughter.

Here then is the account of a scholarly man and notable teacher who did splendidly, often under extremely adverse circumstances. He passed away on 4 January 1956 in New Haven, Connecticut.

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