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Volume Author/Editor: G. Warren Nutter assisted by Israel Borenstein and Adam Kaufman

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Chapter Author: G. Warren Nutter, Israel Borenstein, Adam Kaufman

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CHAPTER 8

Industrial Growth:
A Comparison with the United States

THE Soviet record of industrial growth may be placed in perspective by comparing it with the record of other countries. This is not so easy as it might seem, not only because it is difficult to design relevant comparisons, but also because so little is known about the course of industrial development in most countries. The latter factor alone has forced us, with our limited time and resources, to concentrate on comparisons with the United States, a country with relatively abundant historical statistics. The United States is an obvious first choice for comparative study in any case, since it presents a striking contrast in economic system while being similar in size and resource endowment. But while a comparative study reasonably starts with the United States, it should not end there, and we may hope that others will take up where we have left off.

Comparative study may help us in answering two quite different questions. First, we are interested in knowing, for a variety of reasons associated with the current state of world affairs, which country has shown the more rapid industrial growth over recent years, so that we may have some basis for intelligent guesses about relative growth over the very near future. Second, we are interested in knowing which country has been able to generate the more rapid industrial growth under conditions in which "physical" capacities for growth have been roughly equivalent. Our quest here is for a more fundamental test of the growth-generating efficiency of vastly different economic systems under comparable circumstances, a matter of concern for the longer view.

The first question is obviously easier to deal with than the second, because it requires only a description of the "facts" of growth in the two countries over the same span of years. Of course, the facts are in dispute, and the quantitative evidence of growth is more representative and reliable for the United States than for the Soviet Union. But this problem must always be faced, whether the issues at hand are analytical or purely descriptive. The essential point is that, in making comparisons of concurrent growth trends, we are primarily concerned with *what* is or has been happening, not *why*. Our attention is focused on trends likely to be carried forward over an immediate future by their own momentum, in the absence of revolutionary change in conditioning factors.

The second question involves a complex problem of analysis that by its very nature defies definitive solution. We try to find historical periods in two countries in which the important determinants of growth are the same in both cases, while the economic systems differ. To do this we need to know, first, what factors affect growth in what degrees and, second, what periods of history in the two countries are comparable. Neither economic theory nor history blesses our task: theory is mute and history mischievous. At best, the periods chosen will be "comparable" only in some rather crude sense. Even so, the exercise is worth doing, as an early step in the successive approximations that mark the path to knowledge.

If industrial economies do go through comparable stages of development in some meaningful sense, setting those American and Soviet periods side by side carries with it an important by-product: it enables us to project Soviet developments into a context with which we are more familiar, and thereby to reason by analogy in directions where direct evidence is lacking. There are also great hazards in reasoning by analogy, but judiciously applied it enriches our knowledge of the likely growth and present status of Soviet industry. Our vision of Soviet industrial growth is clarified by associating it with American developments bracketing the turn of the century, but at the same time the analogy must not be taken too far. The sets of industrial conditions in the two periods abound with anachronisms relative to each other.

Contemporaneous Growth

PRODUCTION

Over the same spans of years, industrial output has generally grown faster in the Soviet Union than in the United States (see Tables 61 and 62 and Chart 25).[1] This seems to be an old story since it was apparently true of the Tsarist era as well: according to our indexes, Russian industry grew slightly faster than American industry over the period 1870–1913, the respective average annual rates being 5.3 and 5.1 per cent. The differential is similar for the Soviet period as a whole: output grew over 1913–1955 at an average annual rate of 4.1 per cent in the Soviet Union, when adjusted to remove territorial gains, compared with 3.8 per cent in the United States. Growth including territorial gains has apparently been faster in the Soviet Union than in the United States for all major sectors of industry except food and allied products (see Table 65). If territorial gains were removed, chemicals and textiles and allied

[1] Throughout these comparisons, industry is defined in accord with Soviet usage, including manufacturing, mining, logging, fishing, and generating of electricity.

TABLE 61

INDEXES OF INDUSTRIAL OUTPUT, OUTPUT PER UNIT OF LABOR, AND OUTPUT PER CAPITA:
TSARIST RUSSIA, SOVIET UNION, AND UNITED STATES, BENCHMARK YEARS, 1860–1955
(1913 = 100)

	Output		Output per Man-Hour Engaged in Industry		Output per Person Engaged in Industry		Output per Head of Population	
	Russia or Soviet Union[a]	United States[b]	Soviet Union[c]	United States[d]	Soviet Union[c]	United States[d]	Russia or Soviet Union[e]	United States[f]
1860	10	7					19	22
1865	9	8					16	22
1870	13	12					21	29
1875	17	14					25	30
1880	22	20					31	38
1885	28	23					36	39
1890	38	35					46	54
1895	52	40					59	56
1900	74	51					77	65
1905	72	74					69	86
1910	102	85					89	89
1913	{ 118 / 100	100	100	100	100	100	{ 99 / 100	100
1920	20	124					20	114
1928	102	172	137	168	111	136	93	140
1933	153	120	146	184	103	129	133	93
1937	285	178	188	205	135	145	238	135
1940	318[g]	214	157	224	141	156	221	159
1945	264[g,h]	344[h]					208[h]	241[h]
1950	393[g]	366	155	272	143	199	298	236
1955	620[g]	473	218	323	186	236	434	280

[a] 1860–1913, Table A-19, Borenstein-Goldsmith index with imputed weights; 1913–1955, Table 53, moving-weight index for all products. 1920 interpolated by indexes for industrial materials in Table 47. For 1913, first figure applies to Tsarist territory; second, to interwar territory (see Table D-1, note b). Otherwise, current territory.

[b] Table A-32. Current territory.

[c] Table 40.

[d] Table A-36.

[e] From population as given in Table C-3.

[f] From population as given in *Historical Statistics of the United States, Colonial Times to 1957*, Washington, 1960.
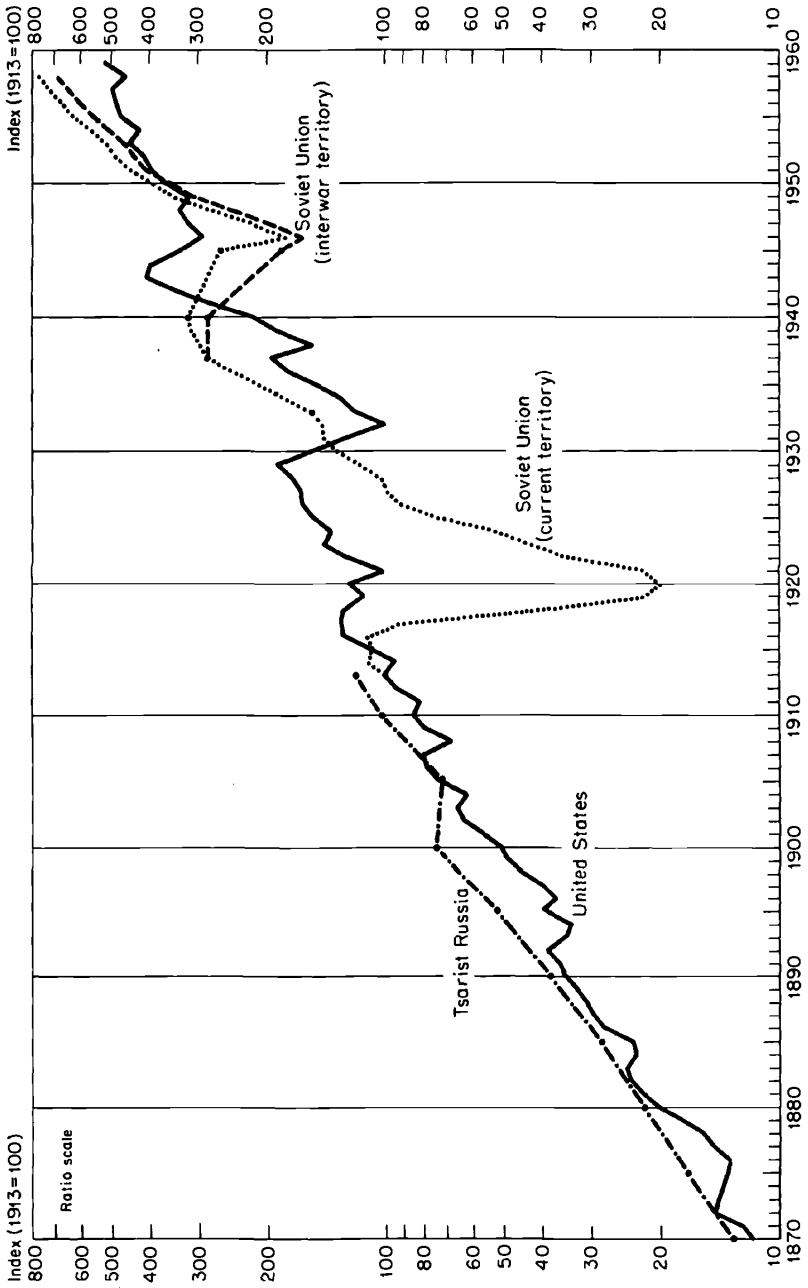
[g] Adjusted to exclude territorial gains (estimated as 11 per cent of production beginning with 1940, as explained in Chapter 6), these figures would be as follows: 1940, 286; 1945, 184; 1950, 354; and 1955, 558.

[h] Output is probably exaggerated significantly because of difficulties in measuring output of military products (see Table A-32 and section on military products in Chapter 5).

products would probably be additional exceptions.

Over the Plan period Soviet growth in percentage terms has out-distanced U.S. growth by a wider margin, making up for a differential in the other direction for the earlier years. American output grew at

CHART 25

Industrial Production: Tsarist Russia, Soviet Union, and United States, 1870–1959

Index (1913=100)

800
600
500
400
300
200

100
80
60
50
40
30
20
10

Ratio scale

Soviet Union
(interwar territory)

Soviet Union
(current territory)

Tsarist Russia

United States

Index (1913=100)

800
600
500
400
300

200

100
80
60
50
40
30
20

10

1870 1880 1890 1900 1910 1920 1930 1940 1950 1960

Source: Tables 47, 53, 61, and A-32.
Note: Soviet index interpolated for 1913–1928 and extrapolated for 1955–1958 by industrial materials index. For 1913, output in Tsarist territory taken as 118 per cent of output in interwar territory; for 1940–1959, output in the latter taken as 90 per cent of output in postwar territory.

TABLE 62

AVERAGE ANNUAL GROWTH RATES OF INDUSTRIAL OUTPUT, OUTPUT PER UNIT OF LABOR, AND
OUTPUT PER CAPITA: TSARIST RUSSIA, SOVIET UNION, AND UNITED STATES,
SELECTED CONCURRENT PERIODS
(per cent)

	Output		*Output per Man-Hour*		*Output per Person Engaged*		*Output per Head of Population*	
	Russia or Soviet Union	United States	Soviet Union	United States	Soviet Union	United States	Russia or Soviet Union	United States
1870–1913	5.3	5.1	n.a.	n.a.	n.a.	n.a.	3.7	2.9
1913–1955	4.1	3.8	1.9	2.8	1.5	2.1	3.5	2.5
1913–1928	0.1	3.7	2.1	3.5	0.7	2.1	−0.5	2.3
1928–1955	6.5	3.8	1.7	2.4	1.9	2.1	5.8	2.6
1928–1940	8.9	1.8	1.2	2.4	2.0	1.1	7.4	1.1
1940–1955	4.6	5.4	2.2	2.5	1.9	2.8	4.6	3.8
1928–1937	12.1	1.4	3.6	2.2	2.2	0.8	11.0	−0.9
1950–1955	9.6	5.3	7.1	3.5	5.4	3.5	7.8	3.5

SOURCE: Table 61. For Soviet Union, figures on output adjusted to exclude territorial gains. Average annual growth rates calculated from data for terminal years by the compound interest formula.

about the same rate over both sets of years—namely, 3.7 or 3.8 per cent a year—while the Soviet rate rose from 0.1 per cent for the pre-Plan years to 6.5 per cent for the Plan years, territorial gains excluded. In turn, relative performance has varied within the Plan period itself. Over 1928–1940, industrial output grew 8.9 per cent a year in the Soviet Union, compared with only 1.8 per cent in the United States, reflecting accelerated activity in the one case and depressed activity in the other.[2] Over 1940–1955, on the other hand, the average annual growth rate was higher in the United States than in the Soviet Union: 5.4 per cent compared with 4.6 per cent.

Moving to the recent postwar years 1950–1955, we find the Soviet growth rate of 9.6 per cent a year exceeding the American rate of 5.3 per cent by a significant margin. A discrepancy in favor of the Soviet Union has persisted through 1958, though the Soviet growth rate has declined to around 7.1 per cent as far as one can see from the published data (see Table 68, industrial materials). It is too early to say whether

[2] If one starts from the bottom of the Great Depression, competing growth rates may be found for the United States: 7.0 per cent for 1932–1955 and 9.9 per cent for 1932–1940. The parallel is not wholly far-fetched, since Soviet growth started with a large reserve of employable resources in 1928.

the decline is permanent or only temporary, whether this reflects a persistent retardation or a temporary fluctuation. It is also too early to say what is happening to the tempo of American industrial growth, which averaged only 2.2 per cent a year over 1955–1959. In any case, the record for postwar years and for other peacetime · years in the Plan period suggests that Soviet industrial growth will continue to be more rapid than U.S. growth over the near future.

We commented in the two preceding chapters on the apparent retardation in Soviet industrial growth, both between the Tsarist and Soviet periods and within the Soviet period. A similar retardation seems to apply to U.S. growth over the two periods of forty-odd years before and after the second decade of the 1900's. However, there are few signs that growth has continued to retard over the more recent long period: the growth rate for 1928–1955 is about the same as for 1913–1928.[3]

PRODUCTION AND POPULATION

The picture of comparative growth in output per head of population is much the same as what we have just sketched for total output (see Chart 26). However, population has grown more slowly in the Soviet Union than in the United States: 1.5 per cent a year over 1870–1913 compared with 2.1 per cent, and 0.9 per cent over 1913–1955 compared with 1.3 per cent. For this reason, the per capita growth rates show a larger discrepancy in favor of the Soviet Union than the total growth rates.

This result points up a defect in making international comparisons of per capita growth rates without taking account of the growth in population by itself. Population growth in the United States, from both internal and external sources, has been directly related to economic progress. This has not been the case in the Soviet Union. In fact, the economic policies of the 1920's and 1930's—and probably the immediate postwar period—directly caused population to grow much more slowly than otherwise, and even to decline temporarily. Of course, the huge wartime losses had the same effect, though they fall into another category. In any case, population has not been a factor limiting growth significantly in the Soviet Union, because a large segment of the population has been "underemployed" in relation to available technology. Hence output

[3] In my earlier report (*Some Observations on Soviet Industrial Growth*, NBER Occasional Paper 55, New York, 1957, p. 625), I argued that there was little evidence of a long-run tendency for U.S. industrial growth to retard. This conclusion now appears to have been too strong, since retardation shows up clearly in *measured* growth. It may still be, of course, that measures for the nineteenth century have an upward bias relative to those for the twentieth, but this would not affect the conclusions drawn here in comparing the Soviet and U.S. growth records since such a bias would not be peculiar to the U.S. measures.

CHART 26

Industrial Production per Head of Population: Tsarist Russia, Soviet Union, and United States, 1870–1959
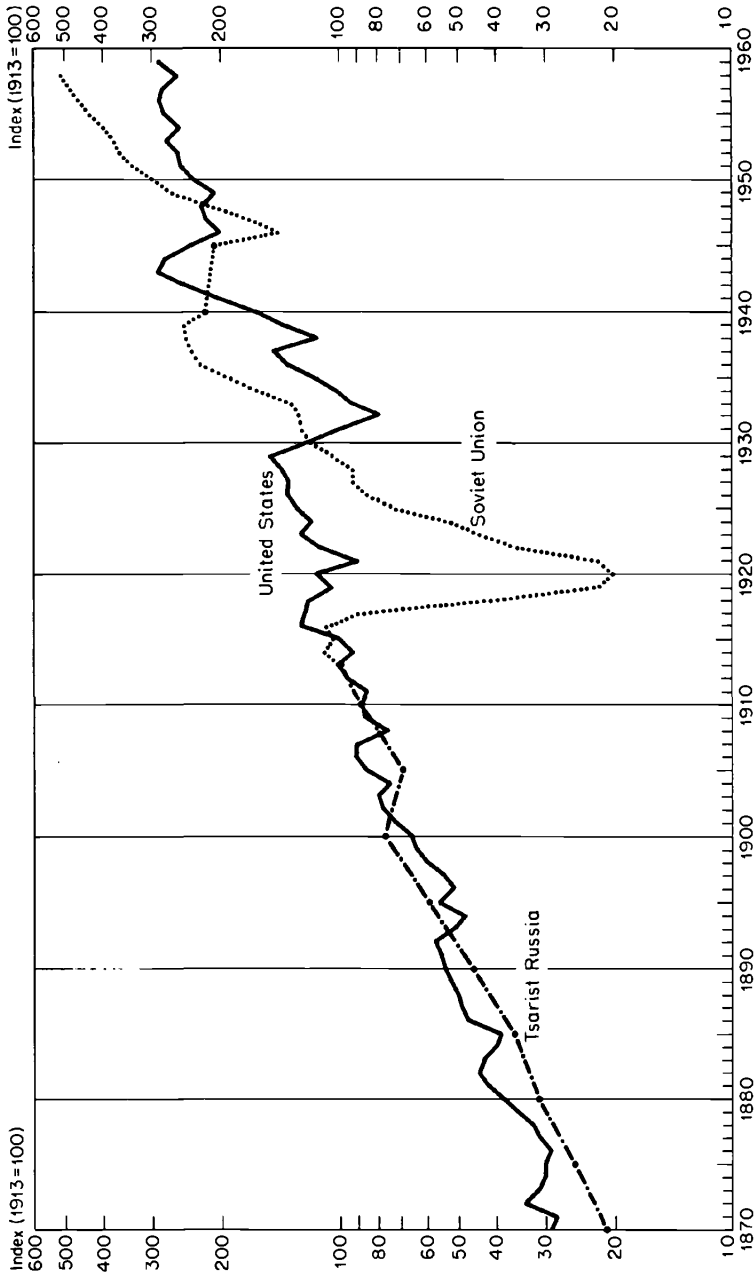
Source: Tables 47, 53, A-32, and C-3. See note to Chart 25.

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per capita could increase as a consequence of a slower growth in population. Put the other way around, the growth in per capita output almost certainly would have been slower if the population had grown faster. This would not have applied—at least not with the same force—to the United States.

PRODUCTION AND EMPLOYMENT

Except for the periods 1928–1937 and 1950–1955, industrial labor productivity, as we have been able to measure it, has grown faster in the United States than in the Soviet Union (see Table 62 and Chart 27). In the United States, growth in industrial output has come primarily from improved labor productivity: had there been no improvement in output per man-hour (or person engaged), output would have multiplied 31 (or 42) per cent as much as it did over 1913–1955 and 52 (or 58) per cent as much over 1928–1955. That is, improved labor productivity accounted for 58 to 69 per cent of the multiplication in output over 1913–1955 and for 42 to 48 per cent over 1928–1955, the percentage depending on whether productivity is measured in terms of persons engaged or man-hours. By contrast, improved labor productivity accounted for only 46 to 54 per cent of the multiplication in Soviet output over 1913–1955 and for only 37 to 40 per cent over 1928–1955.

The faster growth in labor productivity on the part of the United States held generally throughout industrial groups (see Table 65). In terms of output per person engaged—the only measure we can make for Soviet industrial groups—Soviet growth over 1913–1955 was faster than U.S. growth over a similar period, 1909–1953, only in the cases of metals (3.2 per cent a year compared with 1.2 per cent) and machinery and allied products (3.1 per cent compared with 2.0 per cent). Soviet growth rates on a man-hour basis were undoubtedly also higher in these sectors than U.S. rates.[4] Over 1928–1955, Soviet growth in output per person engaged was faster than U.S. growth over 1929–1953 in only four industrial groups: the two already mentioned plus fuel and textiles and allied products. In the last two cases, however, Soviet growth was almost certainly slower than U.S. growth on a man-hour basis.[5]

[4] If it were assumed that the average annual hours of work changed in these Soviet industrial groups by the same percentage as for all industry, the Soviet growth rates on a man-hour basis would be higher than the U.S. rates: 3.6 per cent compared with 1.7 per cent in the case of metals, and 3.5 per cent compared with 2.4 per cent in the case of machinery and allied products. The U.S. rates are computed from data in Table A-37.

[5] On the same assumption about Soviet man-hours as given in the preceding footnote, the average annual growth rate for output per man-hour would be 3.0 per cent for the Soviet Union compared with 3.4 per cent for the United States in the case of fuel, and 1.0 per cent compared with 1.9 per cent in the case of textiles and allied products.

CHART 27
Indexes of Output, Employment, and Output per Unit of Labor, by Industrial Group: Soviet Union (1913–1955) and United States (1909–1953)

Output
Persons engaged
Man-hours
Output per person engaged
Output per man-hour

Soviet Union United States
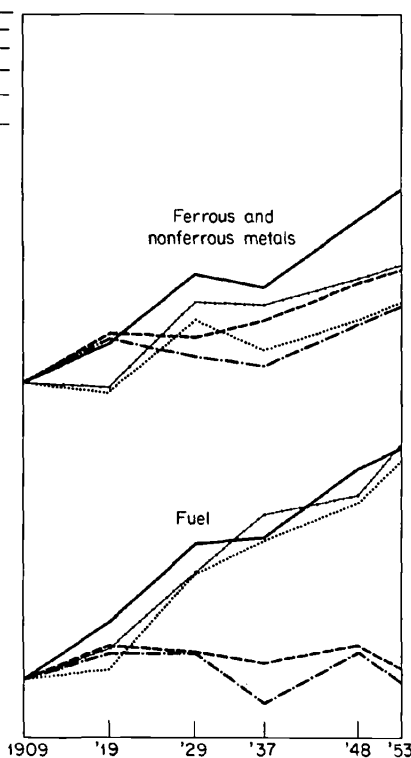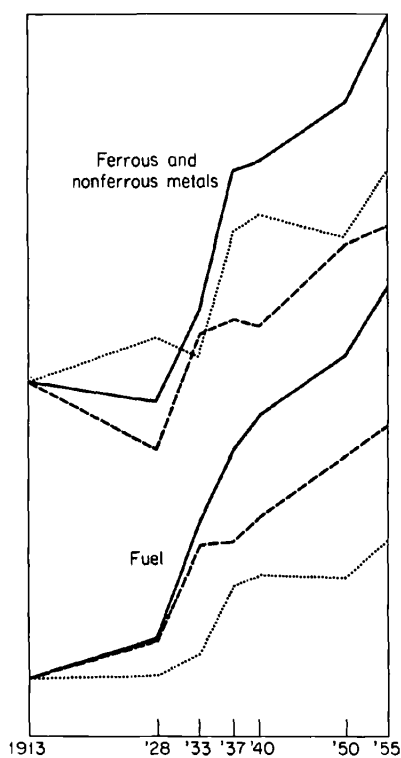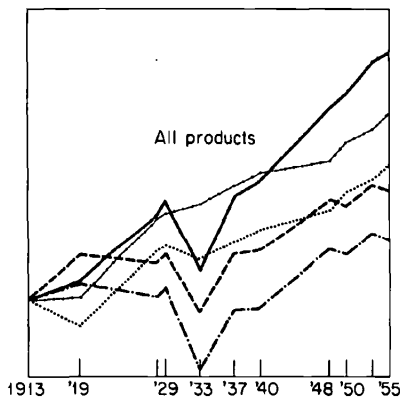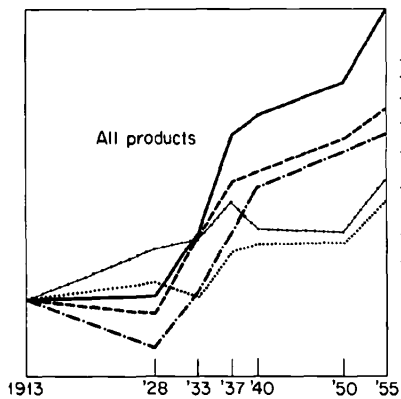
% change
+800
+700
+600
+500
+400
+300
+200
+150
+100
+50
0
−10
−20
−30
−40
−50

All products

Ferrous and nonferrous metals

Fuel

1913 '28 '33 '37 '40 '50 '55

1913 '19 '29 '33 '37 '40 '48 '50 '55

1909 '19 '29 '37 '48 '53

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CHART 27 (continued)

———— Output	·············· Output per person engaged
– – – – Persons engaged	———— Output per man-hour
—·—·— Man-hours	

Soviet Union   United States

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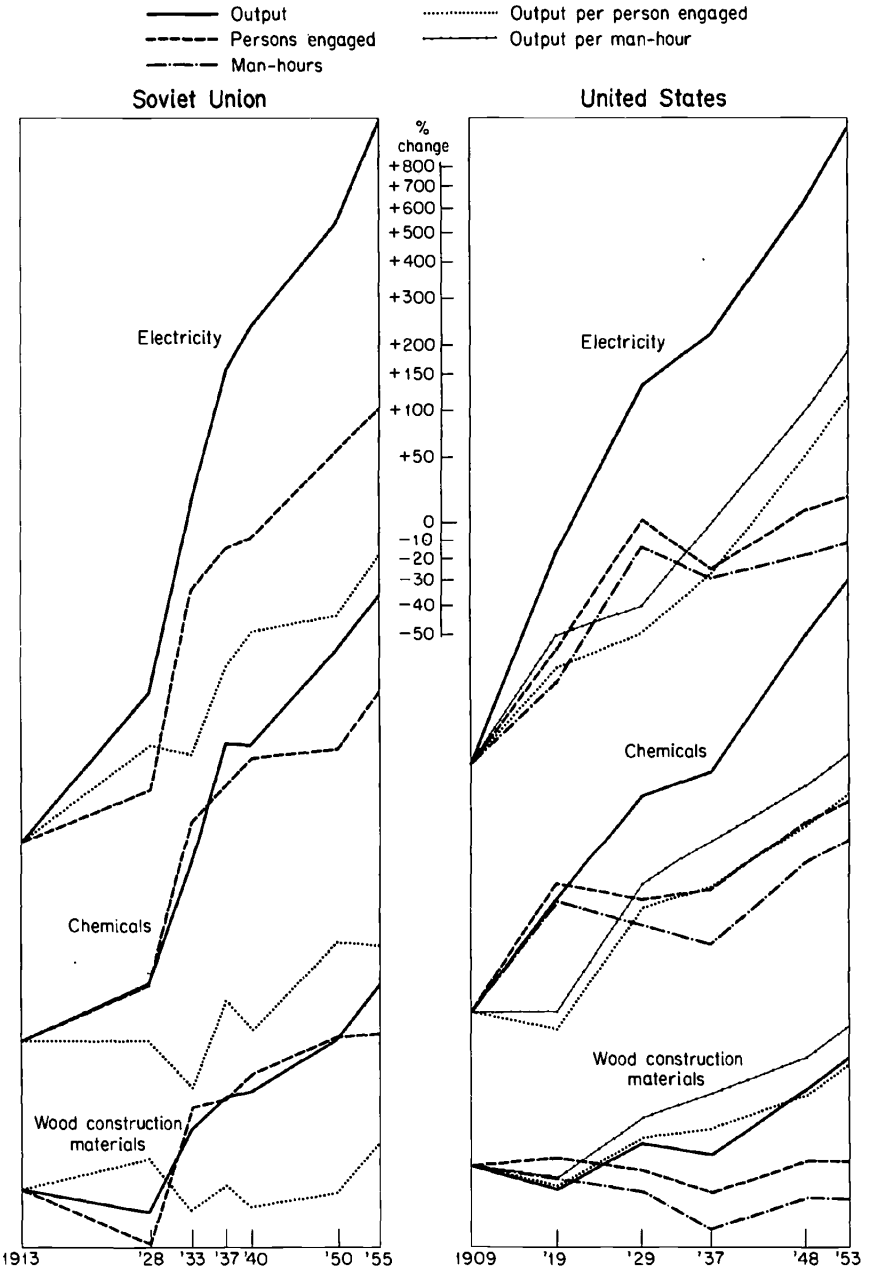
CHART 27 (concluded)

——— Output	·············· Output per person engaged
––––– Persons engaged	——— Output per man-hour
—·—·— Man-hours	

Soviet Union   **United States**
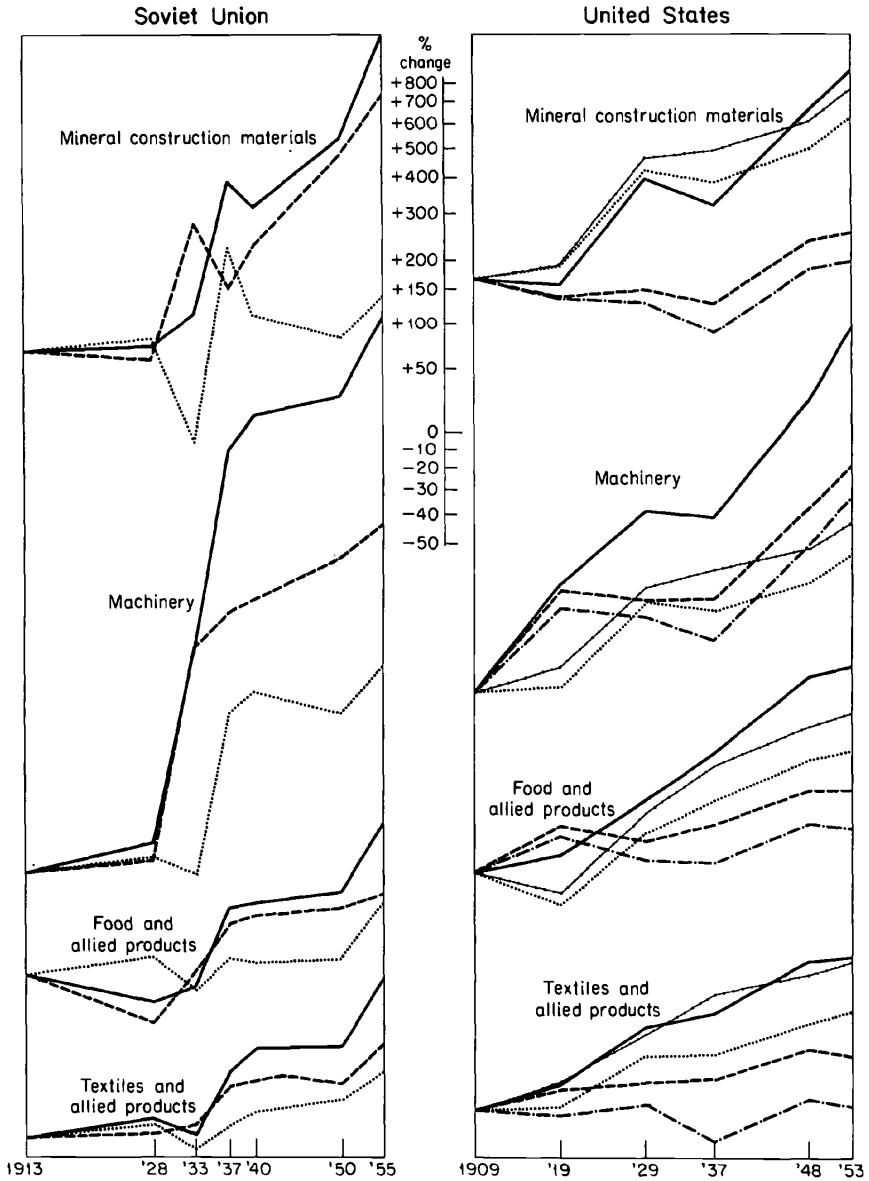
It is not at all clear whether there is any trend in the growth rate of labor productivity in either of the two countries. If we concentrate on output per man-hour, which seems to be the more meaningful measure, we note (Table 62) that the growth rates for both countries declined between 1913–1928 and 1928–1955, but increased between 1928–1940 and 1940–1955 and between 1928–1937 and 1950–1955. Under these circumstances, the wisest conclusion is that more time and evidence is needed to discover whether there is any long-run drift in these growth rates.[6]

The next and obvious step in a study of growth in labor productivity is to analyze the causes, particularly the role played by the substitution of capital for labor. We are just reaching the stage of knowing something tolerably reliable about the relations among capital inputs, labor inputs, and output during the economic history of the United States. In the recent important work by John W. Kendrick, the ratio of output to capital in U.S. manufacturing and mining is measured as increasing at the average annual rate of 1.0 and 1.3 per cent over 1899–1953, and the ratio of capital to labor at 1.2 per cent.[7] Unfortunately, the poor state of statistics on Soviet capital inputs does not permit equally reliable calculations. A very recent report by Norman Kaplan and Richard Moorsteen reaches the tentative conclusion, based on deficient data, that the stock of Soviet industrial capital grew steadily and considerably faster than output over 1928–1955, though the divergence may have diminished significantly over 1950–1955.[8] In any case, if we were to assume that Soviet capital grew at least as fast as output, the ratio of capital to labor (man-hours) would be found to have grown at an average annual rate of at least 1.9 per cent over 1913–1955, or considerably faster than for the United States over 1899–1953. Put another way, the Soviet Union has apparently had a considerably larger percentage growth in its stock of industrial capital than the United States, but a significantly smaller percentage growth in labor (and capital) productivity.

[6] In a recent paper, I drew the conclusion that U.S. growth in labor productivity had been retarding in recent years (see my "The Structure and Growth of Soviet Industry: A Comparison with the United States," in *Comparisons of the United States and Soviet Economies,* Joint Economic Committee, Congress of the United States, Washington, 1959, pp. 112 and 120, and also in *Journal of Law and Economics,* October 1959, pp. 164 and 174). A more careful reading of the evidence suggests that this conclusion was hasty and incautious. While it is true that both output and labor productivity have grown much more slowly since 1955 than over 1950–1955, this is too limited an experience for such a sweeping conclusion. There appears to be no other evidence of retardation, at least since 1928.

[7] *Productivity Trends in the United States,* Princeton for NBER, 1961, pp. 166 and 148.

[8] "Indexes of Soviet Industrial Output" (mimeographed), RAND Corporation, RM-2495, Santa Monica, 1960, pp. 179 ff and 272.

COMPARATIVE LEVELS OF PRODUCTION, POPULATION, AND EMPLOYMENT

The comparisons so far have been based on various indexes computed directly for each country, and they can be roughly checked by another, essentially independent set of estimates that at the same time reveals some interesting information of its own. Evaluating the value added of industry in both rubles and dollars for each country, we may estimate Soviet industrial production as a fraction of the U.S. level in 1913, 1928, and 1955. The estimates represent only orders of magnitude; constructed in different ways and with better data, they might vary as much as 10 per cent, possibly more, in either direction. For example, U.S. products are generally of better quality than Russian counterparts, and the differential has tended to widen over the Soviet period, except in special cases of machinery and military products. Yet both U.S. and Soviet products are evaluated at the same prices, thus overstating Soviet production. Similarly, both the output and value of Soviet products tend to be overstated in official statistics. Other errors of unknown direction are introduced by estimative procedures.[9] Despite such shortcomings, these estimates cannot be dismissed as inherently worse than other summary indexes calculated for the Soviet Union.

According to these estimates (Table 63), Soviet industrial output rose from 11 to 14 per cent of the American level in 1913 up to 20 to 23 per cent in 1955; similarly, output per head of population rose from 7 to 10 per cent up to 17 to 20 per cent. On the other hand, output per person engaged changed little, from 17 to 22 per cent up to 19 to 22 per cent, and output per man-hour from 18 to 24 per cent down to 18 to 21 per cent. In each pair of numbers, the lower one is based on a valuation in ruble prices. These findings are generally consistent with our more direct calculations, which indicated that industrial output and output per

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[9] Perhaps the least reliable datum in Table 63 is the estimate of Soviet value added in 1955. This has been taken as the sum of employee compensation, profits, and net "commercial" and unallocated outlays, all of which are rather indirectly derived (see Table F-3). In view of the questionable "rationality" of Soviet pricing and allocative policies, none of these magnitudes can be taken as a reliable measure, by Western standards, of the element of productive activity it seems to represent. This is particularly true of the magnitudes taken to measure the productive contribution of capital (profits and other net outlays), since Soviet authorities avowedly make no effort to compensate capital services on the basis of their alternative costs.

Another possible procedure for 1955 would be to compare only the outlays for employee compensation in U.S. and Soviet industry, which amounts to assuming that employee compensation was the same percentage of value added in both countries. By this procedure (explained in note *d* of Table 63), Soviet value added in 1955 would be derived as 7.8 per cent higher than the figure shown in Table 63, with corresponding changes in other affected data.

TABLE 63
Comparative Levels of Industrial Production and Productivity: Soviet Union and United States, 1913, 1928, and 1955

	Soviet Union			United States			Soviet Union as % of United States		
	1913[a]	1928[b]	1955[c]	1913[a]	1928[b]	1955[c]	1913	1928	1955
Value added of industry									
1. Billion dollars	$1.70	$3.16	$35.3[d]	$12.2	$33.9	$150.7	13.9	9.3	23.4
2. Billion rubles	R3.77	R7.89	R258[d]	R35.7	R126.8	R1,311	10.6	6.2	19.7
Persons engaged in industry									
3. Million full-time equivalents	5.82	5.38	19.4	9.10	11.5	18.2	64.0	46.8	106.6
Man-hours engaged in industry									
4. Billion hours	14.8	11.0	42.1	25.7	26.3	37.8	57.6	41.8	111.4
Population									
5. Million inhabitants	138.0	151.4	197.6	97.2	120.5	165.3	142.0	125.6	119.5
Value added per person engaged									
6. Dollars	$292	$587	$1,820	$1,340	$2,950	$8,280	21.8	19.9	22.0
7. Rubles	R648	R1,470	R13,300	R3,920	R11,000	R72,000	16.5	13.4	18.5
Value added per man-hour engaged									
8. Dollars	$0.115	$0.287	$0.838	$0.475	$1.29	$3.99	24.2	22.2	21.0
9. Rubles	R0.255	R0.717	R6.13	R1.39	R4.82	R34.7	18.3	14.9	17.7
Value added per head of population									
10. Dollars	$12.3	$20.9	$179	$126	$281	$912	9.8	7.4	19.6
11. Rubles	R27.3	R52.1	R1,310	R367	R1,050	R7,930	7.4	5.0	16.5

[a] Dollar values in 1914 U.S. prices; ruble values in 1913 Soviet prices.

[b] Dollar values in 1929 U.S. prices; ruble values in 1928 Soviet prices.

[c] Dollar values in 1954 U.S. prices; ruble values in 1955 prices, excluding most of the applicable turnover taxes.

[d] If employee compensation were taken to be 56 per cent of value added, the fraction applying to U.S. manufacturing in 1955 (see text surrounding Table F-3), value added would be derived as $38.1 billion and 278 billion rubles, or 7.8 per cent higher than shown. Other data would change accordingly.

Notes continue on page 239.

capita grew faster in the Soviet Union than in the United States, while labor productivity grew slower.

At the same time, they imply more rapid growth for Soviet industry than our direct indexes. In the case of value added evaluated in dollars, Soviet growth is indicated as about 60 per cent faster than American growth over 1913–1955; in the case of value added per capita similarly evaluated, about 100 per cent faster. Hence, if we calculate Soviet growth indirectly on the basis of the U.S. production index, Soviet output is indicated as multiplying 7.5 times (6.7 times excluding territorial gains) and per capita output, 5.6 times. By direct calculations, the two multiples are 6.2 (5.6 excluding territorial gains) and 4.3, respectively.

Put alternatively, output is shown as growing at 4.9 per cent a year when calculated indirectly, compared with 4.4 per cent when calculated directly; excluding territorial gains, the two rates are 4.6 and 4.1 per cent. Similarly, growth in per capita output is calculated indirectly as 4.1 per cent a year and directly as 3.5 per cent; growth in output per person engaged, as 1.9 and 1.5 per cent; and growth in output per man-hour, as 2.3 and 1.9 per cent.

The disparity in the results between direct and indirect measures of Soviet industrial growth is somewhat reduced if we make the indirect measure in terms of value added in constant dollars. By this procedure (see the upper part of Table 64), Soviet output is shown as multiplying 7.1 times over 1913–1955 and 6.3 times over 1928–1955, compared with 6.2 and 6.1 times as shown by our production index for all products. Incidentally, the multiplication in U.S. output over both periods is not

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Notes to Table 63 (continued)
Line
1   *Soviet Union*: Line 2 divided by ruble-dollar ratio with Soviet output weights. For 1913 and 1928, ratio for basic sample of forty-five industries (Table A-30); for 1955, estimated weighted ratio for all industry (Table A-31).
     United States: Table A-42.
2   *Soviet Union*: Table A-43.
     United States: Line 1 multiplied by ruble-dollar ratio with U.S. output weights. For coverage of ratios used, see line 1, Soviet Union.
3   *Soviet Union*: Table A-20.
     United States: Table A-36.
4   *Soviet Union*: Table A-23.
     United States: Table A-36.
5   *Soviet Union*: Table C-3.
     United States: *Statistical Abstract of the United States, 1958*, Washington, 1958, p. 5. Continental United States.
6, 7 Line 1 or 2 divided by line 3.
8, 9 Line 1 or 2 divided by line 4.
10, 11 Line 1 or 2 divided by line 5.

TABLE 64

COMPARATIVE LEVELS OF INDUSTRIAL VALUE ADDED IN CONSTANT DOLLARS:
SOVIET UNION AND UNITED STATES, 1913, 1928, AND 1955
(billion 1954 dollars)

	1913	1928	1955
Deflated value added [a]			
United States	34.9	61.7	150.7
Soviet Union	5.0	5.6	35.3
Gap (U.S. minus S.U.)	29.9	56.1	115.4
Projected value added[b]			
United States	31.9	54.9	150.7
Soviet Union	5.7	5.8	35.3
Gap (U.S. minus S.U.)	26.2	49.1	115.4

[a] Value added in Table 63 deflated by price indexes. For the United States, price index is for manufacturing (1914, 35.0; 1929, 54.8; 1954, 100.0) and is taken as NBER index (D. Creamer, S. P. Dobrovolsky, and I. Borenstein, *Capital in Manufacturing and Mining, Its Formation and Financing,* Princeton for NBER, 1960, p. 261) extrapolated from 1948 by BLS index (*Historical Statistics of the United States, Colonial Times to 1957,* Washington, 1960, Series E-59, p. 118). For the Soviet Union, price index (1914, 34.2; 1929, 56.1; 1954, 100.0) is derived implicitly from value added for forty-five Soviet industries in "current" and constant dollars. Data in "current" dollars are from Table A-26; in constant dollars, from same table as projected by production indexes for Soviet industrial materials with appropriate U.S. weights (see Table 21). Price index is chained for links 1913–1928 and 1928–1955, and each link is taken as the geometric average of the two possible implicit price indexes.

[b] 1955 value added for each country (in 1954 dollars) projected by production index for all industrial products (Table 61).

larger but smaller when measured by the same indirect procedure than when measured by our production index: 4.3 and 2.4 times, compared with 4.7 and 2.8 times.

By way of digression, we should note an important point that emerges from these estimates of value added in constant dollars (Table 64): namely, that the absolute gap between U.S. and Soviet output has steadily grown despite the narrowing in the relative gap. This simply means that the absolute increase in production has been larger in the United States than in the Soviet Union even though the percentage increase has been smaller. By our estimates, the gap in value added measured in 1954 dollars grew by $85 to $90 billion (or by 285 to 340 per cent) between 1913 and 1955 and by $60 to $65 billion (or by 105 to 135 per cent) between 1928 and 1955. In this sense, U.S. growth has exceeded Soviet growth by a wide margin.

Returning to the question of discrepancies between direct and indirect measures of percentage growth, we may observe that differences of the order of magnitude shown by our various estimates for the Soviet Union

should not be surprising, given the problems in making accurate and meaningful measures. It is, however, much more difficult to reconcile our figures with the conventional Western estimate—and apparently the latest official Soviet position—that Soviet industrial production was about a third of the U.S. level in 1955.[10] Since, to our knowledge, a full explanation of this widely accepted estimate has never been published, we cannot easily analyze the reasons for the substantial divergence from our estimates. From context, it would seem that the conventional estimate has been derived from inspection of physical output ratios for a list of commodities that can be compared,[11] a method that can be quite misleading for reasons we shall explore later.

For the moment we may point out the implications of this conventional estimate. Taken together with the widely accepted estimate that Russian industrial production, within Soviet boundaries, was 11 to 14 per cent of the U.S. level in 1913,[12] the conventional estimate for 1955 implies that industrial production multiplied 2.4 to 3 times as much in the Soviet Union as in the United States between 1913 and 1955. Since U.S. production multiplied 4.7 times, it would follow that Soviet production multiplied 11 to 14 times, a factor much higher than is shown by any index constructed in the West except that of Seton (see Table 33). It is about twice as high as is shown by our moving-weight index for all products.

The conventional estimate also implies that the 1955 value added of Soviet industry amounted to around $50 billion or, multiplying by a ruble-dollar price ratio of 7.3 (see Table A-31), 370 billion rubles. Since employee compensation seems to have been around 150 billion rubles (see Table F-3), it is implied to be 40 per cent of total value added. In U.S. manufacturing, employee compensation has amounted to around 55 per cent of total value added.[13] It is difficult to believe that labor services in the Soviet Union could be relatively so much less important, or capital services so much more important, than in the United States.

[10] See, e.g., *Soviet Economic Growth: A Comparison with the United States,* Joint Economic Committee, Congress of the United States, Washington, 1957, p. 11. The most recent official Soviet position is that their industrial output was about half the U.S. level in 1958 (see footnote 24 in Chapter 2). Projecting this backward to 1955 by the ratio of the official Soviet to the Federal Reserve Board production index, we find a fraction of 36 per cent for that year.

[11] This procedure is followed by Professor Rolf Wagenführ in his recent article, "Der Wettlauf der Grossmächte," *Frankfurter Allgemeine Zeitung,* July 23, 1960.

[12] Both Khrushchev and Allen Dulles, Director of the Central Intelligence Agency, seem to agree with us that the fraction was within this range (see *Vestnik statistiki* [Statistical Bulletin], 1959, No. 11, p. 17, and *Comparisons of the United States and Soviet Economies, Hearings,* 1960, p. 4).

[13] *Statistical Abstract of the United States, 1958,* p. 774.

The converging lines of evidence now open to us support the view that Soviet industrial production was about a fifth of U.S. production in 1955; they do not support the view that it was a third. Why has the latter seemed so plausible? The answer will become plain as we move to consider the differing structures of industry in these two countries.

SOME STRUCTURAL COMPARISONS

We have already observed that percentage growth in output over contemporaneous periods has been generally faster throughout the different sectors of industry in the Soviet Union than in the United States, while growth in labor productivity has been generally slower (see Table 65 and Chart 27). We may go on to note that the pattern of growth in labor productivity among industrial groups does not seem to be related in the two countries,[14] while the pattern of growth in output does: those industrial groups with relatively faster rates of growth in the one country also tend to have relatively faster rates in the other.[15]

This similarity in growth pattern is largely superficial, however, applying to broad categories of products but not to specific kinds of products within each category. Soviet industrial development, as we pointed out much earlier, has concentrated on quantitative growth of a limited list of products; U.S. development, on proliferation of products and qualitative improvements. For this reason, comparisons of performance by a sample of industries can give a misleading impression of comparative over-all growth, attention being focused on a sector of industry much more important in the Soviet Union than in the United States.

We may see this by examining comparative growth for such a list of commodities (Tables 66 and 67 and Chart 28). Out of forty-seven industries whose performance can be compared over the entire Soviet period,[16] thirty-nine showed a more rapid growth in output in the Soviet

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[14] The rank correlation between the two sets of growth rates in labor productivity is only 0.200 for the longer periods compared and 0.333 for the shorter ones, neither of which is significant at the 10 per cent level. The correlation applies to the nine most narrowly defined industrial groups in Table 65, the breakdown of machinery and allied products ignored.

[15] The rank correlation between the two sets of growth rates in output is 0.717 for the longer periods compared and 0.750 for the shorter ones. The first is significant at the 5 per cent level; the second, at the 2 per cent level.

[16] The list of industries—more accurately, commodities—is determined by the availability of data and the feasibility of identifying Soviet and U.S. counterparts. Since Soviet industries are seldom carefully defined in original sources, choice of U.S. counterparts is bound to be somewhat arbitrary, though we have done our best to match what seemed to be the most similar industries. One should also keep in mind that Soviet

TABLE 65

AVERAGE ANNUAL GROWTH RATES OF INDUSTRIAL OUTPUT, OUTPUT PER
PERSON ENGAGED, AND OUTPUT PER CAPITA, BY INDUSTRIAL GROUP:
SOVIET UNION AND UNITED STATES, SELECTED CONCURRENT PERIODS
(per cent)

	Soviet Union		United States	
	1913–1955	1928–1955	1909–1953	1929–1953
		OUTPUT		
Ferrous and nonferrous metals	5.6	9.4	2.9	2.0
Fuel and electricity	7.4	10.0	5.5	4.1
Fuel	6.0	8.4	3.5	2.3
Electricity	10.8	16.6	9.8	6.1
Chemicals	6.9	9.4	6.6	5.1
Construction materials	3.4	5.9	2.3	2.2
Wood materials	3.1	5.4	1.6	1.9
Mineral materials	4.8	7.4	3.1	2.5
Machinery and allied products	8.6	13.0	5.5	4.3
Civilian machinery and equipment	8.8	12.5	6.1	4.6
Metal products	n.a.	n.a.	4.2	3.5
Food and allied products	2.3	4.2	3.2	3.2
Textiles and allied products	2.4	3.3	2.3	1.7
	OUTPUT	PER PERSON	ENGAGED	
Ferrous and nonferrous metals	3.2	3.9	1.2	0.4
Fuel and electricity	3.2	4.3	3.3	4.3
Fuel	2.1	3.2	3.3	2.7
Electricity	4.3	4.4	5.5	5.5
Chemicals	1.4	2.2	3.3	2.7
Construction materials	0.5	0.1	2.0	1.6
Wood materials	0.7	0.4	1.5	1.7
Mineral materials	0.9	1.0	3.8	1.2
Machinery and allied products	3.1	4.5	2.0	1.1
Civilian machinery and equipment	3.4	4.9	2.1	1.2
Metal products	n.a.	n.a.	1.7	0.8
Food and allied products	1.1	1.2	1.9	1.9
Textiles and allied products	1.0	1.2	1.5	1.1
	OUTPUT PER HEAD	OF POPULATION		
Ferrous and nonferrous metals	4.7	8.3	1.6	0.8
Fuel and electricity	6.4	8.9	4.1	2.9
Fuel	5.1	7.3	2.2	1.1
Electricity	9.8	15.5	8.4	4.8
Chemicals	5.9	8.3	5.2	3.9
Construction materials	2.5	4.9	1.0	1.0
Wood materials	2.2	4.4	0.3	0.7
Mineral materials	3.9	6.3	1.8	1.3
Machinery and allied products	7.6	11.9	4.1	3.1
Civilian machinery and equipment	7.8	11.4	4.7	3.4
Metal products	n.a.	n.a.	2.9	2.3
Food and allied products	1.4	3.2	1.9	2.0
Textiles and allied products	1.5	2.3	1.0	0.5

SOURCE: Tables A-24, A-37, and C-3. Note that some industrial groups have a different coverage
from that in Tables 37 and 54. For the Soviet Union, figures on output reflect territorial gains. Average
annual growth rates calculated from data for terminal years by the compound interest formula.

TABLE 66

AVERAGE ANNUAL GROWTH RATES COMPARED FOR FORTY-SEVEN INDUSTRIES:
SOVIET UNION AND UNITED STATES, 1913–1955 AND 1928–1955
(per cent)

| | AVERAGE ANNUAL GROWTH RATE[a] | | | | Ratio of Soviet to U.S. Output[b] | | |
| | Soviet Union | | United States | | | | |
	1913–1955	1928–1955	1913–1955	1928–1955	1913	1928	1955
Iron ore	5.0	9.5	1.4	2.5	14.6	9.7	67.7
Pig iron	5.0	9.0	1.9	2.7	13.4	8.5	47.2
Steel ingots	5.8	9.2	2.7	3.3	13.3	8.1	42.6
Rolled steel	5.5	9.0	2.7	3.5	14.5	9.0	43.0
Copper	6.1	9.8	0.8	1.6	3.6	1.9	18.1
Lead	13.7	20.1	1.2	1.5	0.3	0.2	37.1
Zinc	11.1	19.0	2.0	3.2	0.8	0.4	20.1
Electric power	11.2	13.9	7.6	7.0	7.0	4.6	27.2
Coal	6.4	9.3	−0.3	−0.8	4.5	4.7	48.1
Coke	5.6	9.1	1.2	1.6	10.5	8.8	63.9
Crude petroleum	5.0	6.9	5.6	4.0	27.0	9.4	20.7
Natural gas	14.6	13.4	6.8	6.9	0.2	0.7	3.4
Soda ash	5.4	7.2	4.4	4.5	20.0	15.0	32.3
Caustic soda	5.7	8.7	6.9	7.0	32.4	10.2	15.9
Sulfuric acid	8.6	11.3	5.2	5.3	7.9	6.1	26.6
Mineral fertilizer	12.5	17.1	5.6	6.7	2.1	24.0	34.9
Synthetic dyes	7.0	7.6	8.9	2.4	136.2	23.4	105.2
Paper	5.5	7.2	2.9	2.7	5.9	4.9	15.9
Motor vehicle tires	16.1	19.4	6.2	2.3	0.4	0.1	9.1
Cement	6.6	9.7	3.0	2.5	9.6	6.1	43.8
Construction gypsum	4.2	9.7	3.4	2.9	22.0	5.1	29.9
Construction lime	6.1	9.6	2.3	3.0	15.6	13.0	74.1
Lumber	4.1	6.7	−0.2	0.7	13.5	16.1	81.9

Rails	3.7	7.7	−1.9	−2.0	17.9	14.5	258.7
Window glass	3.5	4.0	2.0	3.8	57.1	64.5	66.5
Railroad freight cars	3.1	5.6	−3.5	−1.2	5.1	16.6	81.8
Railroad passenger cars	1.2	5.8	−2.0	−3.8	35.5	22.9	180.3
Flour	0.3	1.1	−0.2	−0.1	233.3	206.9	304.8
Butter	3.6	6.6	1.6	−0.5	29.9	11.8	73.8
Vegetable oil	2.2	2.4	3.1	3.1	42.4	50.0	42.4
Meat slaughtering	1.8	4.5	2.2	2.2	27.8	13.2	24.4
Sausages	6.3	10.4	1.6	2.7	10.6	8.2	59.2
Fish catch	2.4	4.5	2.0	2.1	108.8	60.1	125.8
Soap	3.5	4.1	−0.8	−3.3	14.7	16.5	168.3
Salt	2.6	3.4	3.8	4.2	44.8	31.9	27.7
Raw sugar consumption	2.2	3.7	1.7	0.9	35.4	21.4	44.4
Canned food	8.7	12.8	4.5	3.6	2.4	1.7	16.6
Beer	2.0	5.9	0.9	12.1	10.5	79.2	17.4
Cigarettes	5.4	5.3	8.0	5.3	133.7	45.4	48.0
Boots and shoes	3.8	3.7	1.5	1.9	21.0	28.3	47.6
Rubber footwear	3.7	4.9	0.5	−0.6	46.5	35.6	177.6
Cotton fabrics	2.0	3.0	1.4	1.3	37.4	27.3	45.7
Pure silk and nylon fabrics	0.4	11.2	2.5	−0.3	18.7	0.4	7.7
Rayon and mixed fabrics	7.5	14.7	7.7	15.7	23.3	23.3	20.6
Woolen and worsted fabrics	2.1	2.9	−0.3	−0.3	29.2	34.4	80.9
Bicycles	16.4	23.0	3.8	6.5	1.4	3.9	169.6
Sewing machines	4.3	6.6	−0.3	−0.4	35.8	39.7	233.5
Median	5.0	7.7	2.0	2.5	15.6	13.0	44.4

SOURCE: Tables B-2 and E-1.

a Calculated from output in terminal years by the compound interest formula. U.S. output taken as centered nine-year moving average, with minor modifications. Soviet output covers interwar territory for 1913 and postwar territory for 1955.

b Calculated from actual U.S. output in these years, not from centered moving average.

TABLE 67

GROWTH RATES COMPARED FOR FIFTEEN NEW SOVIET INDUSTRIES:
SOVIET UNION (1932–1955) AND UNITED STATES (1928–1955)
(per cent)

	Average Annual Growth Rate[a]		Ratio of Soviet to U.S. Output, 1955[b]
	Soviet Union, 1932–1955	United States, 1928–1955	
Primary aluminum	45.1[c]	12.8[d]	n.a.
Automobiles	11.3[e]	2.9	1.4
Trucks and buses	12.2	3.2	27.0
Tractors	5.4	3.5	43.3
Tractor-drawn plows	2.3	4.1[f]	43.4[f]
Tractor-drawn cultivators	7.5	9.7[f]	59.5[f]
Grain combines	7.1	5.5	75.1
Diesel engines[g]	18.3	15.6[h]	37.7[h]
Electric motors[g]	7.5	6.0[h]	65.4[h]
Margarine	10.7	6.3	66.0
Cheese	9.1	4.0	17.3
Hosiery	5.2[e]	1.6[f]	32.1[f]
Phonographs	12.4	4.9	27.1
Radios	23.2	6.2	24.3
Television sets	111[i]	117.9[j]	6.4
Median	10.7	5.5	34.9

SOURCE: Tables B-2 and E-1.

[a] [b] See same footnotes, Table 66.

[c] 1933–1940, only period for which data are available.

[d] 1928–1940.

[e] 1933 instead of 1928.

[f] 1953 instead of 1955.

[g] Output measured in rated capacity, not in simple units.

[h] 1954 instead of 1955.

[i] 1950–1955.

[j] 1946–1955.

(Continuation of Note 16)

products are often of lower quality—less expensively made—than their U.S. counterparts, and their physical outputs are often relatively overstated. This is particularly true for years after 1913 and, to a lesser degree, 1928, so that the bias mounts over time.

The upward bias in output or quality is likely to be most significant for the following Soviet products: coal, mineral fertilizer, synthetic dyes, paper, lumber, window glass, railroad freight and passenger cars, meat slaughtering, fish catch, canned food, boots and shoes, woolen and worsted fabrics, and sewing machines. In the case of all fabrics, U.S. output in linear measure has been adjusted upward to compensate for the narrower width of Soviet fabrics. Two other adjustments could have been made, but the possibility was not discovered until analysis had gone too far to turn back. One applies to window glass: American output should be adjusted upward by at least 35 per cent to compensate for the lesser thickness of the Soviet product. The other applies to electric power: Soviet output should be adjusted downward to exclude consumption by power stations, which is not counted in American output. The fraction of output represented by such consumption has risen from around 2 per cent in 1913 to around 6 per cent in recent years (see *Promyshlennost' SSSR* [Industry of the USSR], Moscow, 1957, p. 21).

Coverage of U.S. output data is described briefly in Appendix E. Chart A-2 contains graphs of Soviet and U.S. output for the sample of forty-seven industries.

CHART 28
Frequency Distributions of Growth Rates for Forty-Seven Industries: Soviet Union and United States, 1913–1955 and 1928–1955
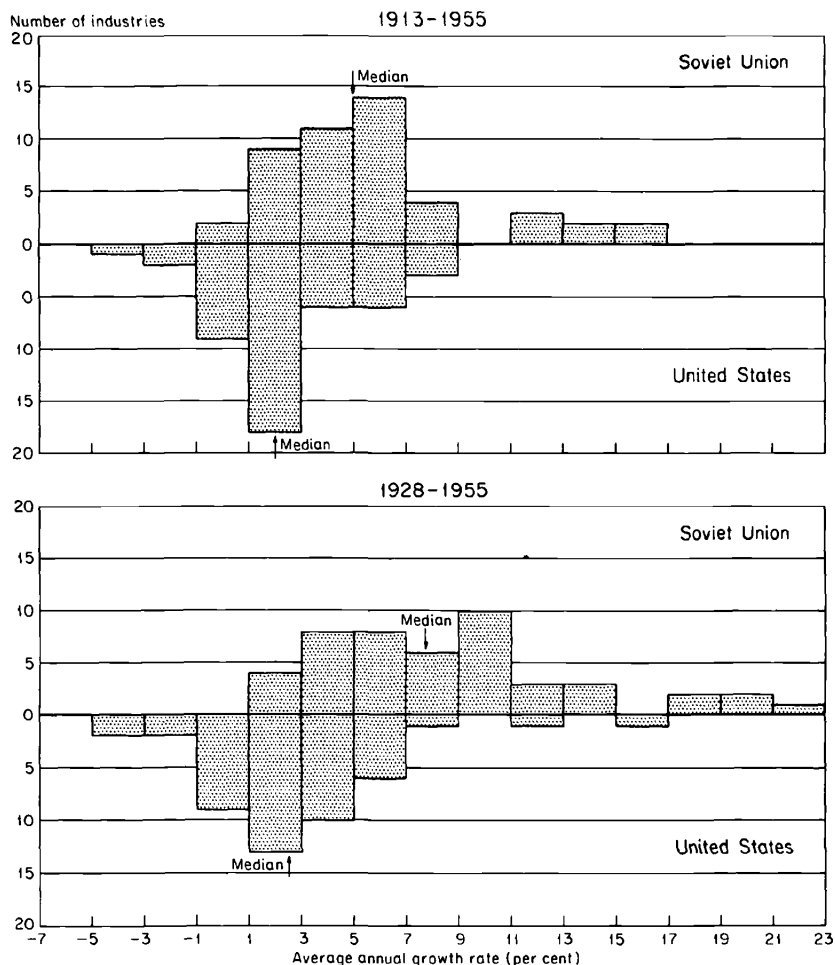
Source: Table 66.

Union than in the United States over 1913–1955, and forty-two showed a more rapid growth over 1928–1955. The median average annual growth rate over 1913–1955 was 5.0 per cent for the Soviet Union compared with 2.0 per cent for the United States; over 1928–1955, 7.7 per cent compared with 2.5 per cent. A similar picture is revealed for fifteen industries that essentially came into being in the Soviet Union

during the Plan period: Soviet output grew faster percentagewise in twelve of these industries, and the Soviet median average annual growth rate was 10.7 per cent compared with the U.S. median of 5.5 per cent.

From Table 68 we see that the median growth rate for the forty-seven industries is higher than the weighted average rate given by production indexes in the case of the Soviet Union, but lower in the case of the United States. Hence inferences about comparative growth made from

TABLE 68

AVERAGE ANNUAL GROWTH RATES OF INDUSTRIAL OUTPUT CALCULATED IN DIFFERENT WAYS: SOVIET UNION AND UNITED STATES, 1913–1955 AND 1928–1955

(per cent)

	1913–1955		1928–1955	
	Soviet Union[a]	United States	Soviet Union[a]	United States
Production indexes				
All products	4.4	3.8	6.9	3.8
All civilian products	4.3		6.6	
Industrial materials	4.0	3.3	6.2	3.3
Median growth rate for 47 industries[b]	5.0	2.0	7.7	2.5

SOURCE: Tables 25, 35, 62, and A-26. Average annual growth rates calculated from data for terminal years by the compound interest formula.

[a] Includes gains from territorial expansion.

[b] For seventy industries, the median Soviet growth rates are 5.3 per cent for 1913–1955 and 8.0 per cent for 1928–1955 (see Table A-1).

this sample of counterpart industries contain a substantial bias in favor of the Soviet Union. The same point is illustrated somewhat differently by the fact that the ratio of Soviet to U.S. industrial output derived from the sample of industries consistently overstates the ratio derived directly for all industry, and the overstatement increases markedly between 1913 and 1955 (see Table 69). This follows from the fact that the fraction of industrial value added accounted for by this sample of industries has always been higher, over the period in question, in the Soviet Union than in the United States and has declined relatively much more sharply in the latter than in the former (see Table 70).

It is now easy to understand how the ratio of Soviet to U.S. industrial output for recent years could be significantly overestimated: the kinds of products for which direct comparisons can be made constitute a much smaller portion of industry in the United States than in the Soviet Union. Thus, the 1955 Soviet value added (in dollars) of forty-five industries[17]

[17] Two of the sample of forty-seven industries (synthetic dyes and sausages) are not included here because of difficulties in estimating value added for all years.

TABLE 69

COMPARATIVE LEVELS OF VALUE ADDED FOR ALL INDUSTRY AND A SAMPLE OF FORTY-FIVE
INDUSTRIES: SOVIET UNION AND UNITED STATES, 1913, 1928, AND 1955
(per cent)

	Soviet Union as % of United States		
	1913	1928	1955
Value added, all industries			
Dollar prices	13.9	9.3[a]	23.4[a]
Ruble prices	10.6	6.2[a]	19.7[a]
Value added, 45 industries			
Dollar prices	20.8	15.8	40.8[b]
Ruble prices	15.7	10.6	32.7
Median physical output ratio, 47 industries	15.6	13.0	44.4

SOURCE: Tables 63, A-26, and B-2.

[a] The fractions for 1913 projected by the ratio of Soviet to U.S. production indexes for all products (Table 61) give the following (in per cent):

	1928	1955
Dollar prices	8.3	18.2
Ruble prices	6.3	13.9

[b] For forty-seven industries, the median Soviet lag in output behind the United States was thirty-five years in 1955 (see Table 79). Hence U.S. output of these industries in 1920 was about equal to Soviet output in 1955. From a production index for a comparable set of products (Moore's index for industrial materials as given in R. V. Greenslade and P. A. Wallace, "Industrial Growth in the Soviet Union: Comment," *American Economic Review*, September 1959, p. 689), we find that 1955 Soviet output (that is, 1920 U.S. output) was about 41 per cent of 1955 U.S. output, a figure identical with the one calculated directly.

TABLE 70

VALUE ADDED FOR A SAMPLE OF FORTY-FIVE INDUSTRIES AS A PERCENTAGE OF VALUE
ADDED FOR ALL INDUSTRY: SOVIET UNION AND UNITED STATES, 1913, 1928, AND 1955
(per cent)

	1913	1928	1955
Direct calculation[a]			
Soviet Union	67.1	63.1	50.3
United States	45.1	37.0	27.6
Indirect calculation[b]			
Soviet Union	67.1	67.1	55.3
United States	45.1	39.6[c]	27.9

[a] From Tables 63 and A-26. Soviet values in rubles, U.S. in dollars.

[b] Fraction for 1913 projected by ratio of production index for industrial materials (with coverage comparable to the forty-five industries considered here) to production index for all products. Indexes for all products from Table 61; Soviet index for industrial materials from Table 53; U.S. index for industrial materials from Table 25.

[c] 1929.

TABLE 71

SOVIET AND U.S. VALUE ADDED FOR FORTY-FIVE INDUSTRIES COMPARED WITH
U.S. VALUE ADDED FOR ALL INDUSTRIES, BY INDUSTRIAL GROUP, 1955

	United States		Soviet Union,
	All Industries[a]	45 Industries[b]	45 Industries[b]
	MILLION 1954 DOLLARS		
Ferrous and nonferrous metals	13,972	7,668	3,253
Fuel and electricity	17,864	15,755	4,267
Chemicals	13,084	5,247	828
Construction materials	14,958	3,820	2,839
Machinery and allied products[c]	53,131	333	492
Food and allied products	15,172	5,800	3,775
Textiles and allied products	14,889	2,901	1,473
Printing and publishing	6,628		
Total	149,698	41,524	16,928
	PER CENT OF U.S. TOTAL		
Ferrous and nonferrous metals	9.3	5.1	2.2
Fuel and electricity	11.9	10.5	2.9
Chemicals	8.7	3.5	0.6
Construction materials	10.0	2.6	1.9
Machinery and allied products[c]	35.5	0.2	0.3
Food and allied products	10.1	3.9	2.5
Textiles and allied products	9.9	1.9	1.0
Printing and publishing	4.4		
Total	100.0	27.7	11.3

[a] 1954 census value added for each group projected to 1955 by Federal Reserve Board production index as given in *Statistical Abstract of the United States, 1958*, pp. 718 and 775. Indexes for subgroups (for coverage of industrial groups as used here, see Table A-35) combined by 1957 weight factors as given in *Federal Reserve Bulletin*, December 1959, p. 1467. Summed value added differs slightly from the figure $150,682 million derived from aggregate value added and production index (see Tables A-42 and 63).

[b] From Table A-26.

[c] Includes consumer durables.

was 41 per cent of the U.S. value added of the same industries (see Table 69), but only 11 per cent of the U.S. value added of all industry (see Table 71). In the case of the Soviet Union, those forty-five industries accounted for around half the value added of all industry; in the case of the United States, for only around a quarter. If we then suppose that Soviet production had come to about 40 per cent of the U.S. level in all other Soviet industries, just as it did in the sample of forty-five industries, then those other industries would have accounted for an additional 11 or 12 per cent of the value added of all U.S. industry. Value added in Soviet industry

would then have been about 23 per cent of the U.S. level, or the figure we derived earlier by direct calculation.[18]

Industry is simply more austere in the Soviet Union than in the United States. Many important products now produced in the United States are produced in negligible or relatively small amounts in the Soviet Union. For example, apparel, furniture, paper products, newspapers and periodicals, electronic equipment and parts, and motor vehicles and parts together accounted for more than 17 per cent of U.S. industrial value added in 1954. From casual inspection of the 1954 Census of Manufactures, one can draw up a long list of other products also produced in relatively small volume in the Soviet Union around 1955 but accounting for an additional 13 per cent of U.S. industrial value added.[19]

[18] These same considerations also help to explain why Soviet labor productivity has been overestimated relative to the United States. For example, Walter Galenson estimates that the Soviet output per wage earner immediately before the war was around 40 per cent of the U.S. level (*Labor Productivity in Soviet and American Industry*, New York, 1955, p. 240), a figure more than double our estimate for 1955. If we assume that Galenson's calculations are accurate, the group of industries from which he derives this estimate could not have been equally representative of labor productivity in the two economies. To see this, let us suppose that, in all counterpart industries, Soviet productivity had been 40 per cent of the U.S. level. Then, since the industrial labor forces were of roughly the same size, Soviet production would also have been 40 per cent of the U.S. level. But if our estimates of relative output in 1928 and growth in the two industrial economies in the interwar period are anywhere near correct, Soviet production was less than 25 per cent of the U.S. level just before World War II.

Put another way, the industries included in this comparison then accounted for about a fifth of industrial employment and value added in both the Soviet Union and the United States. Hence U.S. production of this group of products was almost as large as total Soviet industrial production, although only a fifth as many employees were required to produce it.

It is interesting to note that a Soviet economist has recently claimed that Soviet labor productivity was 45 to 49 per cent of the U.S. level in 1954 (A. Kats, "Comparison of Labor Productivity in the Industry of the USSR and the Chief Capitalist Countries," *Current Digest of the Soviet Press*, XI, 32, p. 5; original text in *Sotsialisticheskii trud*, 1959, No. 1, pp. 42–55). This figure is hardly consistent with Galenson's from the Soviet point of view, if we were to grant their persistent claims that labor productivity is growing much faster in the Soviet Union than in the United States. Projecting Kats' figure backward to 1937 by the ratio of the official Soviet index of labor productivity (*Promyshlennost'*, 1957, p. 25) to our U.S. index based on persons engaged (Table A-36), we would find the fraction to be about 30 per cent in 1937.

[19] The list contains the following products: dehydrated fruits and vegetables; packaged seafood; frozen fruits and vegetables; biscuits and crackers; chewing gum; flavoring; miscellaneous food preparations, n.e.c.; cigars; full-fashioned hosiery; hard-surface floor coverings; coated fabric; millwork; synthetic fibers; drugs and medicines; cleaning and polishing preparations (except soap); paints, varnishes, and allied products; toilet preparations; insecticides and fungicides; chemical products, n.e.c.; rubber industries, n.e.c.; leather dress gloves; luggage; handbags and purses; small leather goods; hardware, n.e.c.; plumbing fixtures and fittings; heating and cooking equipment; office and store machines; domestic laundry equipment; laundry and dry cleaning machines; vacuum cleaners; refrigeration machinery; measuring and dispensing pumps; service and household machines, n.e.c.; electrical appliances; engine electrical equipment; storage batteries, primary batteries; X-ray and therapeutic apparatus;

Some, though far from all, differences in structural developments are revealed in the industrial distributions of employment over the years (see Table 72). In both countries, the share of employment in the so-called heavy industries has been increasing at the expense of the share in food processing and textiles and apparel. Machinery and allied products have rather consistently accounted for a larger share in the United States than in the Soviet Union, though some of the discrepancy is made up by the differing importance of consumer goods: in the mid-1950's, they represented about 7 per cent of industrial employment in the United States and about 3 per cent in the Soviet Union.[20] At the same time, the following industrial groups accounted for a larger fraction of employment in Soviet than in U.S. industry: fuel, wood construction materials, mineral construction materials, food and allied products, and textiles and allied products. The following accounted for a smaller fraction: ferrous and nonferrous metals, electricity, chemicals, and machinery and allied products. In general the 1955 Soviet distribution of employment seems to resemble the U.S. distribution more closely for the years 1909 and 1919 than for any other years.

The data compiled here provide some evidence that can shed light on the effects of industrial structure on production indexes for the two countries. It will be recalled from the first section of Chapter 5 that the movements of a production index depend in part on the path of expansion followed by an economy: other relevant things the same, the larger the share of production accounted for by commodities whose relative unit costs are declining over time, the higher is the growth that will be measured by a production index. If we accept unit physical labor cost (the inverse of labor productivity) as an ordinal measure of total unit cost, we may array industries in each country according to reduction in unit cost: the larger the growth in labor productivity, the greater is the reduction in unit cost. Those industries with greater than average growth in productivity may then be taken as having declining relative unit costs,

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electrical products, n.e.c.; truck trailers; auto trailers; medical equipment and supplies; photographic equipment; jewelry and silverware; musical instruments and parts; toys and sporting goods; office supplies; costume jewelry and notions; plastic products, n.e.c.; brooms and brushes; cork products; fireworks and pyrotechnics; jewelry and instrument cases; lamp shades; miscellaneous manufactured products, n.e.c. (except ordnance).

Total industrial value added was taken as $134.2 billion for 1954 (see Table A-42). All other values were taken from the 1954 census of manufactures.

[20] The U.S. figure is based on the 1957 weights for the Federal Reserve Board index (*Federal Reserve Bulletin*, December 1959, p. 1467) covering automotive products, appliances, television and radio sets, and miscellaneous home goods. The Soviet estimate is taken from Table D-9.

TABLE 63

COMPARATIVE LEVELS OF INDUSTRIAL PRODUCTION AND PRODUCTIVITY: SOVIET UNION AND UNITED STATES, 1913, 1928, AND 1955

	Soviet Union			United States			Soviet Union as % of United States		
	1913[a]	1928[b]	1955[c]	1913[a]	1928[b]	1955[c]	1913	1928	1955
Value added of industry									
1. Billion dollars	$1.70	$3.16	$35.3[d]	$12.2	$33.9	$150.7	13.9	9.3	23.4
2. Billion rubles	R3.77	R7.89	R258[d]	R35.7	R126.8	R1,311	10.6	6.2	19.7
Persons engaged in industry									
3. Million full-time equivalents	5.82	5.38	19.4	9.10	11.5	18.2	64.0	46.8	106.6
Man-hours engaged in industry									
4. Billion hours	14.8	11.0	42.1	25.7	26.3	37.8	57.6	41.8	111.4
Population									
5. Million inhabitants	138.0	151.4	197.6	97.2	120.5	165.3	142.0	125.6	119.5
Value added per person engaged									
6. Dollars	$292	$587	$1,820	$1,340	$2,950	$8,280	21.8	19.9	22.0
7. Rubles	R648	R1,470	R13,300	R3,920	R11,000	R72,000	16.5	13.4	18.5
Value added per man-hour engaged									
8. Dollars	$0.115	$0.287	$0.838	$0.475	$1.29	$3.99	24.2	22.2	21.0
9. Rubles	R0.255	R0.717	R6.13	R1.39	R4.82	R34.7	18.3	14.9	17.7
Value added per head of population									
10. Dollars	$12.3	$20.9	$179	$126	$281	$912	9.8	7.4	19.6
11. Rubles	R27.3	R52.1	R1,310	R367	R1,050	R7,930	7.4	5.0	16.5

a Dollar values in 1914 U.S. prices; ruble values in 1913 Soviet prices.

b Dollar values in 1929 U.S. prices; ruble values in 1928 Soviet prices.

c Dollar values in 1954 U.S. prices; ruble values in 1955 prices, excluding most of the applicable turnover taxes.

d If employee compensation were taken to be 56 per cent of value added, the fraction applying to U.S. manufacturing in 1955 (see text surrounding Table F-3), value added would be derived as $38.1 billion and 278 billion rubles, or 7.8 per cent higher than shown. Other data would change accordingly.

and the volume of resources devoted to them—measured by employment—may be determined.[21]

Out of the nine industrial groups into which we have divided all industry (the breakdown of machinery and allied products is, of necessity, ignored), four had greater than average growth in labor productivity over 1913–1955 in the Soviet Union and over 1909–1953 in the United States (compare Tables 62 and 65). They were not the same industrial groups in the two cases, though the same in number. These industrial groups accounted for the following fractions of persons engaged:

United States		*Soviet Union*	
Year	Per Cent	Year	Per Cent
1909	20.8	1913	24.1
1919	20.4		
1929	21.5	1928	26.4
1937	20.4	1937	41.6
1948	19.3	1950	46.0
1953	17.6	1955	47.0

It therefore appears that the share of employment for industrial groups with greater than average growth in labor productivity has been larger in the Soviet Union than in the United States, no matter what benchmark years are compared.

Similar results obtain for the Soviet period 1928–1955 and the U.S. counterpart 1929–1953. For the Soviet Union, there were five industrial groups with greater than average growth in labor productivity; for the United States, there were three groups. These industries accounted for the following fractions of persons engaged:

United States		*Soviet Union*	
Year	Per Cent	Year	Per Cent
1929	16.9	1928	28.3
1937	16.2	1937	44.7
1948	14.8	1950	48.9
1953	13.4	1955	50.4

[21] The arrays with cumulated percentages of employment are given in Tables A-39 and A-40. It clearly would have been preferable to use value added instead of employment, but the needed Soviet data do not exist. As may be seen from the data in the cited tables, for industries with the most rapid growth in labor productivity, the percentage share of value added tends to be higher than the percentage share of employment. Moreover, the relevant share of employment in the case of the United States—for which this can be studied—has a growing downward bias over time, apparently because industries with the most rapid growth in productivity experience a more rapid percentage decline in the ratio of unit physical labor cost to total unit cost than other industries do.

We may therefore conclude that industrial groups with relatively declining unit costs over time have accounted for a larger fraction of industrial resources in the Soviet Union than in the United States. On this score, conventional production indexes overstate industrial growth in the Soviet Union relative to the United States. That is to say, if the Soviet path of expansion had more closely paralleled the U.S. path in this respect, the measured growth of Soviet industry would probably have been lower than it is.

To bring the discussion of contemporary structure to a close, we may make a few observations about comparative military production. Some estimates for recent years are brought together in Table 73 covering

TABLE 73

OUTPUT OF CONVENTIONAL MILITARY PRODUCTS: UNITED
STATES AND SOVIET UNION, 1954 AND 1955

VALUE OF CONVENTIONAL MILITARY PRODUCTS[a]

Soviet Union, 1955	
Billion rubles	R42.5
Billion dollars[b]	$8.5
United States, 1954	
Billion rubles[c]	R70.8
Billion dollars	$11.8

VALUE OF MILITARY PRODUCTS AS PERCENTAGE
OF VALUE ADDED OF INDUSTRY

Soviet Union, 1955	
Ruble prices	16%
Dollar prices	26%
United States, 1954	
Ruble prices	6%
Dollar prices	9%

SOVIET VALUE OF MILITARY PRODUCTS AS
PERCENTAGE OF U.S. VALUE

Ruble prices	60%
Dollar prices	72%

SOURCE: Tables A-10, A-31, and A-44.

[a] Excludes atomic energy. However, Soviet value is probably substantially overstated (see annex to technical note 4 of Appendix A). Value applies to items delivered to military authorities and hence excludes double counting. Including atomic energy, the U.S. value is $13.7 billion or 82.2 billion rubles.

[b] Value in rubles divided by ruble-dollar price ratio for machinery (5.0) based on Soviet output weights (see Table A-31).

[c] Value in dollars times ruble-dollar price ratio for machinery (6.0) based on U.S. output weights (see Table A-31).

conventional military products—that is, excluding atomic energy.[22] In using these figures, it should be borne in mind that the Soviet magnitudes may be substantially overstated, in view of some recent evidence summarized in the annex to technical note 4 of Appendix A. Military production is without doubt relatively much more important in Soviet industry than in U.S. industry, the value of military products constituting more than a quarter of industrial value added in the former and less than a tenth in the latter, according to our estimates (all values expressed in dollars).[23] The 1955 Soviet value of military products, as we estimate it, was almost equal to three-quarters of the 1954 U.S. value, both again expressed in dollars.[24] Hence Soviet production relative to the United States in this area far exceeds the average for all industry, a conclusion that holds true for any likely error in the Soviet magnitudes.

Comparable Growth

Once industrialization has gotten under way in a country, the pace of industrial growth at any moment would seem to depend on the resource potential, the state of industrial arts, the prevailing level of industrial output (i.e., the extent to which potential is being utilized), and that catchall, the economic system. The process of economic growth is mysteriously complex and cannot be summarized in these brief comments, but this is not the place to discuss the manifold preconditions and environmental factors essential for sustained economic growth. We take it for granted that industrialization and the accompanying process of growth are a fact in the Soviet Union, just as they were, more incipiently, in Tsarist Russia. We are therefore concerned here only with the more fundamental conditioning factors making that growth faster or slower than it would otherwise be. As far as such things can be quantified, the

[22] Expenditures on the atomic energy program in the United States amounted to $1,895 million in 1954 (*Statistical Abstract of the United States, 1958*, p. 242), or 16 per cent of the value of conventional military products.

[23] Ruble measures are not very meaningful for such comparisons because of the arbitrarily low prices attached to military products in the Soviet Union. Note that the *value* of military products, *not* the value added by industries processing materials into military products, is being compared with the value added for all industry. Hence all stages of industrial processing of military products are being taken into account.

[24] If the overstatement in our estimate of Soviet production of conventional military products is taken to be large enough to offset the missing item of atomic energy, Soviet production is only 62 per cent of the U.S. level including atomic energy (see Table 73, note a).

It is interesting that military production multiplied more than four times in the Soviet Union over 1947–1955 by our estimate (see Table A-10) and over five times in the United States over 1947–1957 (see my "Reply," *American Economic Review*, September 1959, p. 698). The U.S. growth probably started from a lower level relative to the wartime peak, however.

larger the resource potential, the more advanced the technology, and the smaller the output, the more rapid the growth in output will be, given the economic system. None of these factors can be clearly defined, but they can all be represented by certain more or less adequate indicators. Our immediate problem is to find indicators that will allow us to select periods in Soviet and American industrial history that are comparable except with respect to economic system.

What is a good indicator of resource potential? If we may judge from the general practice of comparing economies in per capita terms, it would seem that population is typically used to indicate resource potential. But it is often a poor indicator since populations grow in response to economic development and differently in different economies. Moreover and more importantly, population can grow from immigration as well as from natural increase. As a concrete example for the problem at hand, in the United States the expanding industrial labor force in the latter part of the nineteenth century was recruited in important measure from the economically underutilized population in other countries, including Russia.[25] The expansion in the Soviet Union during the twentieth century came, on the other hand, from the large internal pool of under-utilized population. Hence, compared with the Soviet Union, population understates the resource potential of the nineteenth century United States.

The resource potential of an economy is more adequately described by the volume of all resources at its disposal, including climate and terrain. If this can be precisely and accurately measured, it remains to be done. In the meantime, we are perhaps justified in making the impressionistic judgment that the Soviet Union and the United States have roughly similar resource potentials. Both countries are rich in natural resources, though the specific endowments obviously differ. Against the larger size of the Soviet Union must be offset the substantial climatic and topo-graphical disadvantages—at least in the present state of civilization. Although in total area the Soviet Union is about two and a half times as large as the United States, in inhabitable area it is only about as large. Other relevant things the same—like tastes, technology, population, economic system, and so on—we suppose that the two countries would be able to support roughly equivalent levels of industrial production on the basis of resource endowments.

This leads us to suppose further that, if the state of industrial arts and

[25] Foreign-born persons accounted for about 18 per cent of the net increase in total gainfully occupied population or labor force over 1870–1900 (see Simon Kuznets and Ernest Rubin, *Immigration and the Foreign Born*, NBER Occasional Paper 46, New York, 1954, p. 46).

the aggregate levels of industrial output were the same in the two countries, differences in the rate of growth of industrial output should be attributable to differences in economic systems. Unfortunately, we cannot standardize both the level of output and the state of technology simultaneously in the two countries. To find dates at which output was roughly equivalent, one must go back a number of years in American history. Thus, as we shall see, the level of Russian output in 1913 within the interwar Soviet territory was reached in the United States around 1875. But the state of industrial arts—at least the available body of technology—was less advanced in the United States in 1875 than in the Russia of 1913: the same body of technical knowledge, if not skills, has been available to the two countries at roughly the same dates in history. Therefore, when we standardize the level of output from which growth starts—as we are about to do—any difference that we observe between growth rates in the two countries must be attributed to differences in both technology and economic system. While the effects of each cannot be fully isolated, we can at least say in whose favor the difference in technologies operates and thereby narrow the range of ignorance.

These remarks make the issues seem simpler than they are, because they presuppose that the periods to be compared represent normal times. This is, of course, not so for the Soviet Union, unless we view periodic disasters as a part of normal times there. Since the founding of the Soviet Union, no span of years longer than a decade has been free from major disturbances or recoveries from them. As we have emphasized before, we cannot possibly know which period has had a growth rate similar to what would be expected from a long stretch of normal years, and we must therefore choose several Soviet periods, representing differing circumstances, in making comparisons with American industrial growth.

Subject to the outlined qualifications, a Soviet period would have as its counterpart in the United States a period whose terminal years had the same total industrial output, unadjusted for differences in population, as obtained in the Soviet Union in 1913 and 1955, or whatever years we might wish to choose. If industrial output is measured by weighted aggregates, the Soviet periods 1913–1955 and 1928–1955 are "comparable" with the American period 1875–1914; that is, for both countries industrial output started and ended at roughly the same levels within these periods, insofar as we are justified in making such broad intertemporal and international comparisons.[26] If output is measured by the median

[26] The American dates are derived as follows. Soviet industrial output, calculated in dollar values, was 13.9 per cent of the American level in 1913. Looking back into

performance of a group of individual industries, the Soviet periods are comparable to the American period 1885–1920 (see the annex to this chapter). The dating of these periods implies that it took thirty-five to forty years in the United States to register the same growth as was accomplished over forty-two years in the Soviet Union—or, if the depressed pre-Plan years are ignored, over twenty-seven years.

We must remind ourselves that these periods are comparable only with respect to two of the factors influencing rate of growth: resource potential and prevailing level of industrial output. They are not comparable with respect to the state of the industrial arts. The advantage—a substantial one—is in favor of the Soviet Union, since it has had the technology of the twentieth century at its disposal in working out its industrialization. One can only dream about what difference it would have made to U.S. industrial growth in the nineteenth century if it had proceeded under twentieth century technology.

The choice of comparable stages of development in the industries of the Soviet Union and the United States is, therefore, unavoidably hazy and arbitrary to some degree. We shall summarize here the records of industrial growth in the Soviet Union and the United States over periods of equal length that are comparable in the sense that the beginning year in each case represents roughly the same level of output in the two countries.

We start with the longest period studied for the Soviet Union, 1913–1955. The growth rate over this period—4.1 per cent a year, excluding gains from territorial expansion—is slower than the rate for a comparable U.S. period: 5.1 per cent a year over 1875–1917 or 4.3 per cent over 1885–1927 (see Table 74). On a per capita basis, the Soviet growth rate is higher: 3.5 per cent a year compared with 3.0 per cent. But we must recall the misleading nature of comparisons of per capita rates, in view of the fact that population growth overstates growth in resource potential in the United States compared with the Soviet Union.[27]

American industrial history and smoothing out the cyclical fluctuations in our U.S. production index by means of a nine-year moving average, we find that output in 1875 was also around 14 per cent of the level of 1913. A similar procedure gives the American date 1914 as roughly equivalent, in level of output, to the Soviet date 1955.

[27] If population were taken as a guide to industrial potential, we might identify as comparable "stages of development" those periods in which industrial output per head of population was the same in both countries. This procedure is not only difficult to justify for the reasons just stated, but it is also impossible to apply. The Soviet level of industrial output per capita in 1955 corresponds roughly with the American level in 1887; the Soviet level in 1913 was lower than the American level in 1860, the earliest year for which aggregate industrial output can be calculated. Similar results are found by taking the median dates at which per capita output of a group of industries was the same in both countries.

TABLE 74

AVERAGE ANNUAL GROWTH RATES OF INDUSTRIAL OUTPUT AND OUTPUT PER CAPITA:
SOVIET UNION AND UNITED STATES, SELECTED COMPARABLE PERIODS[a]
(per cent)

Period for Soviet Union	Output		Output per Head of Population		Period for United States
	Soviet Union[b]	United States	Soviet Union	United States	
1913–1955	4.1	5.1	3.5	3.0	1875–1917
		4.3		2.6	1885–1927
1928–1955	6.5	5.5	5.8	3.4	1875–1902
		4.8		2.9	1885–1912
1928–1940	8.9	6.7	7.4	4.4	1875–1887
		4.6		3.0	1885–1897
		6.5		5.0	1939–1951
1950–1955	9.6	3.2	7.8	1.2	1909–1914
		8.0		5.9	1908–1913

SOURCE: Table 61. Average annual growth rates calculated from data for terminal
years by the compound interest formula. For the U.S. periods comparable with 1913–1955
and 1928–1955, a centered nine-year moving average is used for each terminal year.
  [a] Periods are comparable for growth in output only, not output per capita. See text.
  [b] Excludes territorial gains.

For lack of sufficient data, we cannot compare growth in labor
productivity.

If we turn to the Plan period, 1928–1955, we observe that the Soviet
growth rate, again adjusted to exclude territorial gains, is higher than for
a comparable U.S. period: 6.5 per cent a year compared with 5.5 per
cent over 1875–1902 and 4.8 per cent over 1885–1912. The difference in
per capita rates is even larger in favor of the Soviet Union. We therefore
do not observe comparable U.S. periods, in the limited sense we are using,
in which the speed of industrial growth has matched that during the Plan
period in the Soviet Union.

For shorter spurts of growth, the Soviet performance also seems to have
the edge: the Soviet growth rate over 1928–1940 exceeds the U.S. rates
over 1875–1887 and 1885–1897 by a substantial margin. In a sense, this
period of Soviet growth may be likened to the twelve years in the United
States following the Great Depression; in both cases, growth was beginning
again after a decade of depression and stagnation. The Soviet rate is
faster in this comparison as well: 8.9 per cent a year compared with
6.5 per cent.

To illustrate a point, we also include a comparison with the Soviet

growth rate of 9.6 per cent a year over 1950–1955. If the U.S. period 1909–1914 is chosen for comparison, the U.S. counterpart is 3.2 per cent; if, however, the dates are moved one year back to cover 1908–1913, the counterpart is 8.0 per cent. The point of this is that it proves nothing. The experience of a five-year period, plucked from history, carries no permanent message with it.

A similar picture emerges in comparing growth rates for a group of individual industries. One way of doing this is to proceed industry by industry, studying in each case what has happened to the Soviet lag behind U.S. output as of specific dates for Soviet output. For example, the Soviet output of steel ingots in 1913 had been reached in the United States around 1892; the Soviet output in 1955, around 1926. Hence the Soviet lag was twenty-one years in 1913 and twenty-nine years in 1955. Since the lag increased over this period, it follows that, starting from the same level, U.S. output of steel ingots grew faster, both absolutely and relatively, than Soviet output. Put another way, the same absolute and percentage growth occurred in the United States in thirty-five years as occurred in the Soviet Union in forty-two.

We have studied the behavior of Soviet lags for forty-seven counterpart industries as of a number of benchmark years, and the details are given in the annex to this chapter. The results may be summarized in the form of movements in median lags—that is, those lags exceeded by half the industries and fallen short of by the other half. The median number of years of lag run as follows (for more details, see Table 81):

1913	29
1928	44
1937	36
1950	42
1955	35

We observe that, on the average, Soviet output of this group of industries grew more slowly over 1913–1955, but more rapidly over 1928–1955, than U.S. output over comparable periods. Relative to comparable periods in the United States, Soviet growth was slower over 1913–1928, faster over 1928–1937, slower again over 1937–1950, and faster over 1950–1955. In these comparisons, territorial gains are counted as part of Soviet growth, and in this respect the Soviet Union is favored.

It will be noticed that the Soviet and U.S. periods compared for any one product may differ considerably in length, since what is being compared is the number of years required in each case to accomplish the same

TABLE 75

AVERAGE ANNUAL GROWTH RATES COMPARED FOR FORTY-SEVEN INDUSTRIES: SOVIET UNION AND UNITED STATES, SELECTED COMPARABLE PERIODS

(per cent)

	Soviet Union, 1913–1955 (1)	United States Comparable Period[a] (2)	United States 1880–1920 (3)	Soviet Union, 1928–1955 (4)	United States Comparable Period[a] (5)	United States 1880–1905 (6)	Soviet Union, 1928–1937 (7)	United States Comparable Period[a] (8)	Soviet Union, 1950–1955 (9)	United States, Comparable Period[a] (10)
Iron ore	5.0	4.4	5.8	9.5	7.6	7.6	18.3	8.5	12.6	0.4
Pig iron	5.0	5.0	5.9	9.0	7.3	7.5	17.9	8.7	11.7	4.7
Steel ingots	5.8	4.9	9.1	9.2	8.3	11.5	17.2	12.6	10.6	4.8
Rolled steel	5.5	4.7	6.6	9.0	6.5	7.7	15.9	4.7	11.1	3.7
Copper	6.1	8.4	7.6	9.8	10.4	11.0	14.0	13.2	8.8	8.5
Lead	13.7	5.4	4.9	20.1	6.3	5.5	44.0	13.7	18.1	7.2
Zinc	11.1	11.2	7.8	19.0	13.1	8.4	48.0	19.5	14.9	8.4
Electric power	11.2	11.3	34.1	13.9	11.1	47.9	24.6	15.7	13.3	3.5
Coal	6.4	6.6	5.1	9.3	6.4	6.4	14.4	6.9	8.5	6.3
Coke	5.6	5.6	6.9	9.1	7.9	9.2	18.9	18.3	9.5	3.8
Crude petroleum	5.0	7.5	8.1	6.9	8.7	7.5	10.5	10.4	13.3	10.5
Natural gas	14.6	17.7	15.5	13.4	15.4	26.7	24.5	37.2	9.3	9.1
Soda ash	5.4	5.6	10.3	7.2	5.3	13.9	10.4	-17.6	13.9	3.4
Caustic soda	5.7	6.3	n.a.	8.7	6.5	n.a.	12.1	8.9	11.6	8.1
Sulfuric acid	8.6	8.5	n.a.	11.3	9.8	n.a.	23.1	15.5	12.3	6.0
Mineral fertilizer	12.5	9.2	6.4	17.1	10.1	7.3	40.3	18.3	11.7	10.0
Synthetic dyes	7.0	6.9	n.a.	7.6	7.4	n.a.	13.1	15.5	9.6	5.4
Paper	5.5	6.7	5.8	7.2	7.5	7.3	12.7	6.9	9.3	8.6
Motor vehicle tires	16.1	13.8	n.a.	19.4	16.2	n.a.	46.8	21.0	6.6	32.6
Cement	6.6	5.8	10.3	9.7	9.6	12.7	12.8	15.7	17.1	7.3
Construction gypsum	4.2	4.7	9.1	9.7	10.3	11.3	20.0	16.7	10.8	6.4
Construction lime	6.1	n.a.	0.6	9.6	n.a.	0.3	24.4	n.a.	8.4	4.7
Lumber	4.1	3.9	1.5	6.7	4.0	3.2	10.3	4.0	8.8	5.4
Rails	3.7	3.8	2.1	7.7	4.7	4.1	13.1	8.3	10.5	9.8
Window glass	3.5	3.1	3.8	4.0	2.1	4.7	9.8	1.6	5.4	6.7
Railroad freight cars	3.1	6.0	5.3	5.6	10.9	10.0	15.9	23.2	-7.5	3.4
Railroad passenger cars	1.2	-2.5	3.8	5.8	7.5	9.0	10.0	12.2	14.2	2.9

	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Flour	0.3	n.a.	1.1	1.5	n.a.	2.3	1.7	n.a.	7.8	n.a.
Butter	3.6	4.6	6.6	7.6	5.6	9.5	9.4	8.4	6.6	4.4
Vegetable oil	2.2	3.9	2.4	8.9	2.8	11.0	−1.5	4.4	7.4	2.8
Meat slaughtering	1.8	3.7	4.5	3.1	5.4	3.6	2.0	6.1	9.1	6.0
Sausages	6.3	5.7	10.4	n.a.	6.6	n.a.	24.1	7.0	9.4	5.2
Fish catch	2.4	2.3	4.5	0.7	1.5	0.7	7.5	0.9	9.3	2.0
Soap	3.5	4.5	4.1	4.0	4.6	4.4	3.6	4.6	5.7	4.2
Salt	2.6	3.3	3.4	5.4	4.1	6.0	3.6	5.2	4.8	4.7
Raw sugar consumption	2.2	3.5	3.7	4.3	4.0	6.6	7.3	4.7	6.3	3.7
Canned food	8.7	8.1	12.8	6.2	10.8	6.0	25.7	11.4	15.9	8.2
Beer	2.0	5.2	5.9	1.6	8.6	5.4	9.7	11.8	7.1	8.0
Cigarettes	5.4	7.3	5.3	12.1	7.5	9.5	6.8	8.6	9.6	5.6
Boots and shoes	3.7	n.a.	3.7	n.a.	n.a.	n.a.	6.6	n.a.	6.2	2.1
Rubber footwear	3.8	n.a.	4.9	n.a.	n.a.	n.a.	9.9	n.a.	3.5	n.a.
Cotton fabrics	2.0	2.8	3.0	3.6	2.7	2.5	2.8	2.6	8.7	2.6
Pure silk and nylon fabrics	0.4	6.5	11.2	7.5	15.5	8.0	17.3	18.2	32.3	8.2
Rayon and mixed fabrics	7.5	2.8	14.7	n.a.	8.2	n.a.	11.7	11.5	37.3	35.0
Woolen and worsted fabrics	2.1	2.1	2.9	1.3	2.8	1.1	−0.9	5.5	10.2	5.2
Bicycles	16.4	n.a.	23.0	n.a.	n.a.	n.a.	54.5	n.a.	34.7	10.6
Sewing machines	4.3	n.a.	6.6	n.a.	n.a.	n.a.	6.7	n.a.	26.3	n.a.
Medians										
Covered industries[b]	5.0	5.3	7.7	5.8	7.5	7.5	12.8	10.9	9.6	5.5
41 industries[c]	5.4	5.3	8.7	n.a.	7.5	n.a.	13.1	10.9	9.6	5.6
37 industries[d]	5.4	n.a.	7.2	5.8	n.a.	7.5	13.1	10.9	9.6	5.4

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SOURCE: Appendixes B and E. Average annual growth rates calculated from output in terminal years by the compound interest formula. In some cases, output series were extended or filled in for a few years by logarithmic extrapolation or interpolation. U.S. output taken as centered nine-year moving average, with minor modifications.

[a] For each industry, the comparable period is as long as the Soviet period with which it is compared and begins with a year in which U.S. output was at about the same level as for the initial year in the Soviet period, the comparable periods hence differing from one industry to another. They are derived from the lag analysis described in the annex to this chapter.

[b] For the Soviet Union, forty-seven industries. For the United States, forty-seven industries in cols. 2, 5, and 8; thirty-seven in cols. 3 and 6; and forty-four in col. 10.

[c] The sample of industries in col. 2.

[d] The sample of industries in col. 3.

TABLE 76

<small>Average Annual Growth Rates for Thirteen New Soviet Industries:
Soviet Union and United States, Comparable Periods</small>
(per cent)

	Average Annual Growth Rate		Comparable Period of Growth, United States[c]
	Soviet Union[a]	United States[b]	
Primary aluminum	45.1[d]	21.3	1905–1912
Automobiles	11.3[e]	29.4	1903–1925
Trucks and buses	12.2	15.6	1914–1937
Tractors	5.4	6.0	1917–1940
Tractor-drawn plows	2.3	7.3	1923–1946
Tractor-drawn cultivators	7.5	9.1	1929–1955
Grain combines	7.1	10.0	1926–1949
Diesel engines	18.3	18.6	1922–1945
Electric motors	7.5	3.9	1917–1940
Margarine	10.7	5.1	1906–1929
Hosiery	5.2[e]	4.9	1890–1912
Radio receiving sets	23.2	29.6	1921–1944
Television sets	111[f]	278	1946–1951
Median	10.7	10.0	

Source: Appendixes B and E. Average annual growth rate calculated from output in terminal years by the compound interest formula.

[a] 1932–1955, except as noted below.

[b] Growth rates were in general calculated from actual output in beginning year and moving average in ending year. Exceptions are as follows: tractor-drawn plows, tractor-drawn cultivators, and margarine—moving average in beginning year; diesel engines, electric motors, hosiery, and television sets—actual output in ending year. Wherever data were missing for the years used, they were logarithmically interpolated or extrapolated graphically.

[c] A comparable period is taken as twenty-three years beginning with the year in which the level of output first became approximately equal to the Soviet output in 1932, except as noted below.

[d] 1933–1940. Output in 1932 was at an experimental level.

[e] 1933–1955.

[f] 1950–1955.

growth. Similarly, the U.S. periods comparable with any given Soviet period (as 1913–1955) may vary from one industry to another, since the Soviet pattern of output at any particular time has never been precisely duplicated in the United States.

Another method that can be used is to compare growth rates for a group of industries over periods of equal length in the two countries (see Tables 75 through 77 and Chart 29).[28] Here we may proceed as in

[28] The sample of industries compared is the same for both countries in the tables and the upper panel of the chart, but different in the lower panel. In the latter case, the Soviet sample of seventy industries is taken from Table 8; the U.S. sample of sixty-eight industries from A. F. Burns, *Production Trends in the United States since 1870*, New York, NBER, 1934, pp. 309–312, industries numbered 21–91 except 29, 60, and 83.

CHART 29
Frequency Distributions of Growth Rates for Samples of Individual Industries: Soviet Union and United States, Comparable Periods
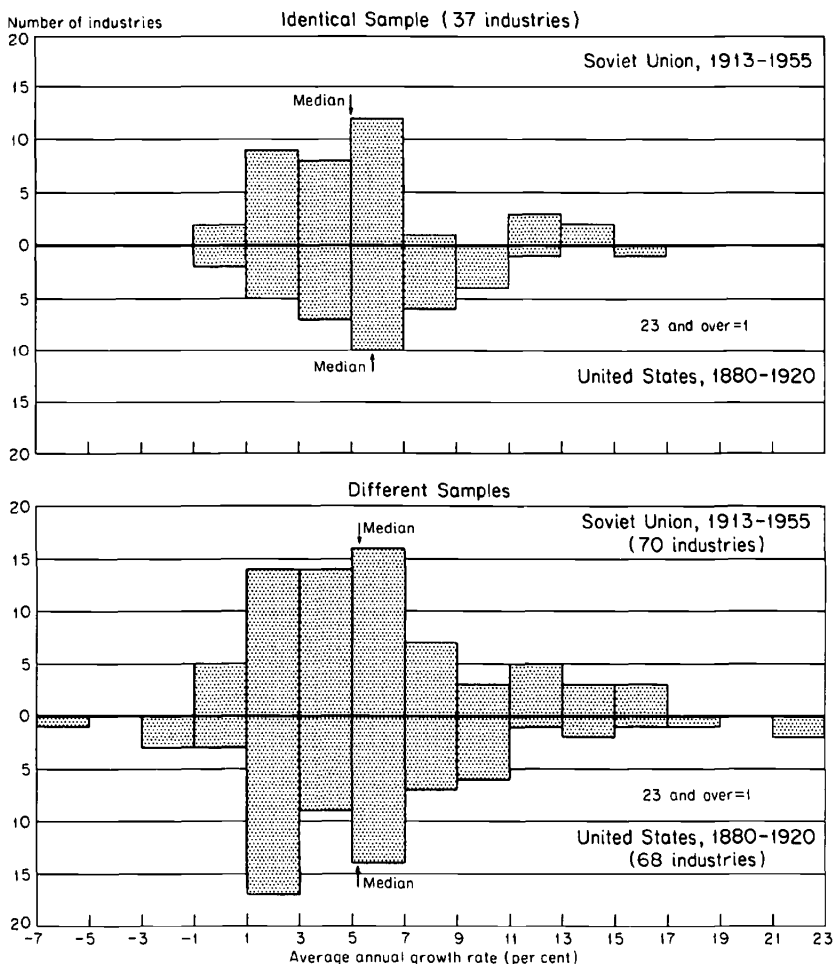
Source: Tables 8 and 75; A. F. Burns, *Production Trends in the United States since 1870*, New York, NBER 1934, pp. 309 ff. See footnote 28 of this chapter.

the study of lags, by choosing a comparable U.S. period for each industry separately, that period being one beginning with a year in which U.S. output was at about the same level as for the initial year of the Soviet period and extending over the same number of years as the Soviet period.

Average annual growth rates are calculated from output in terminal years by the compound interest formula. For six U.S. industries, growth covers 1885–1920.

TABLE 77

AVERAGE ANNUAL GROWTH RATES OF INDUSTRIAL OUTPUT OVER COMPARABLE PERIODS
CALCULATED IN DIFFERENT WAYS: SOVIET UNION AND UNITED STATES
(per cent)

	Soviet Union, 1913– 1955	United States, Comparable Period	Soviet Union, 1928– 1955	United States, Comparable Period
Production index, all products[a]	4.1	5.1	6.5	5.5
Median of growth rates				
41 industries[b]	5.4	5.3	8.2	7.5
37 industries[c]	5.0	5.8	7.2	7.5
Different samples of industries				
for each country[d]	5.3	5.2		

[a] From Table 74, U.S. periods 1875–1917 and 1875–1902. Soviet output excludes territorial gains.

[b] From Table 75. Comparable period applies to each industry separately and hence varies among industries. Soviet output includes territorial gains.

[c] From Table 75, U.S. periods 1880–1920 and 1880–1905. Soviet output includes territorial gains.

[d] From Chart 29, U.S. period 1880–1920. Covers seventy Soviet and sixty-eight U.S. industries. Soviet output includes territorial gains.

Or, for any given Soviet period, we may choose a standard U.S. period for all industries as a basis of comparison. We have done both, in the latter case using the U.S. periods 1880–1920 and 1880–1905 to compare with the Soviet periods 1913–1955 and 1928–1955. In both procedures, Soviet growth, when proper allowance is made for eliminating territorial gains, comes out slower over 1913–1955 than over comparable U.S. periods, but faster over 1928–1955, 1928–1937, and 1950–1955. It is interesting that, for a group of relatively new Soviet industries, Soviet and U.S. growth have been similar over comparable periods (see Table 76).

Concluding Remarks

What can be said about Soviet industrial achievements? In the first place, they have been impressive. In terms of its ability to generate sheer growth in industrial output—the questions of how much the growth has cost, what product mix has evolved, and how the products have been put to use being left aside—the Soviet system of centralized direction has proved itself to be more or less the peer of the market economy, as exemplified by the United States. This much seems beyond dispute even in the face of the questionable reliability of Soviet statistics.

Of course, the character of Soviet industrial growth has not been the same as in Western economies. Enhancement of state power has been

the primary objective, the consumer being treated essentially as a residual claimant. Investment goods and munitions have been emphasized at the expense of consumer goods; and other important sectors of the economy—agriculture, construction, and consumer services—have been relatively neglected to help foster industrial expansion. At times, large groups of the population have been sacrificed or made to work in forced labor to promote internal economic policies. Leisure has shown little tendency to grow. This is all well known but deserves repetition to place Soviet industrial achievements in perspective. The character of industrial growth being so different from that in the West, there is a sense in which the two sets of achievements cannot be compared at all.

The last point should be underlined: the pattern of industrial growth observed in the Soviet Union would never be duplicated by a market economy. Sovereign consumers would not choose the paths of growth chosen by Soviet rulers. This raises the awkward question of whether a highly generalized measure of growth has much meaning even as an indicator of expansion in productive capacity available for whatever use it may be put to. As we demonstrated at the beginning of Chapter 5, measures of economic growth, as they are conventionally made in the form of index numbers, depend in fact on the path of growth—on the uses to which productive capacity is put. And, as noted in this chapter, the Soviet path of growth has favored measured growth relative to the United States. If we bowed to the stern dictates of logic, we would be able to compare Soviet and U.S. industrial growth only if both economies served either consumer welfare or state power. But that is ruled out by the very difference in social order whose influence on growth we wish to assess. This dilemma can be mastered only by admitting it—by avoiding the delusion that there is some single-dimensioned, neutral measure of growth, equally meaningful for all types of economies.

The question of economic waste is a related matter and equally difficult to treat. Growth is measured in terms of things "produced," not in terms of things usefully consumed. In a market economy, the two magnitudes are similar but not at all identical: mistakes are made by both entrepreneurs and consumers, rendering some productive activity worthless. The same kinds of mistakes are made in the Soviet Union, probably on a larger scale since centralized planning is involved. In addition, because of the weak position of most buyers, substandard goods often pass for standard quality, goods are damaged and spoiled in transit beyond normal experience in a market economy, and so on. Although Soviet industry does not experience business cycles as they are known in

market economies, it is periodically faced with the need to re-allocate resources on a large scale, and the accompanying waste that would appear in the form of temporarily unemployed resources in a market economy will appear, at least in part, in the form of unwanted accumulation of inventories. It is difficult enough to say something sensible about which type of economy has the more waste inherent in it. It is even more difficult to say what all this has to do with problems of measuring growth. Unless wastage has, in some meaningful sense, been growing at different rates in American and Soviet industry, there is nothing to be gained by taking account of this factor as far as comparing growth of industrial output is concerned.

These qualifications serve as warnings against careless comparisons of either the relative size or the relative growth of Soviet and U.S. industry. In particular, broad aggregative measures of industrial output tell us nothing about capacities for specific tasks, such as waging war or promoting consumer welfare. While Soviet industrial output in 1955 may have been, in the aggregate, about a fifth of the American level, production directly available for military purposes was a much larger fraction (almost three-quarters), and production available for consumers a much smaller one. Similarly, growth in the two areas has differed in the same way in the two countries.

It remains to be noted once again that the quantitative achievements of Soviet industry have not been understated by Soviet authorities. The official Soviet index of industrial production embodies a myth that should be dispelled from the popular mind. On this matter, Western scholars speak as one, though they may disagree as to the gravity of the myth. The official Soviet index shows industrial output as multiplying twenty-seven times between 1913 and 1955; the indexes presented here, based on official Soviet data on physical output and unit values and constructed according to conventional Western methods, show output as multiplying five to six times. If our indexes are taken as reasonably accurate, the official index contains a four- to fivefold exaggeration of growth over this period.

Bearing all these qualifications in mind, what may we conclude about the industrial performance of the Soviet Union relative to the United States? First, in level of output, Soviet industry was in 1955 roughly four decades behind the United States; in level of output per head of population, almost seven decades. Second, Soviet growth in output has been somewhat slower over the entire Soviet period, at least through 1955, than U.S. growth over the four decades bracketing the turn of this

century, periods that are comparable in the sense that output started at roughly the same level in both cases; on the other hand, Soviet growth in output per head of population has been faster, because of fundamentally different relations in the two countries between population growth and economic growth. Third, Soviet growth in output, both total and per capita, has been faster over the Plan years than U.S. growth over a comparable period. In this and the preceding comparisons, the Soviet Union is favored in that it has had a more advanced technology at its disposal. Fifth, Soviet percentage growth—and Russian percentage growth over the last half century of Tsarist rule—has been faster over concurrent periods than U.S. percentage growth in the cases of total and per capita output, but slower—at least in the Soviet instance—in the case of output per unit of labor. At the same time, absolute growth has been significantly smaller—the gap in absolute industrial production between the two countries has grown steadily. Sixth and finally, industrial output in both countries has experienced a retardation in measured percentage growth between long periods on either side of the second decade of this century. Soviet growth has also retarded within the Soviet and Plan periods, but U.S. growth apparently has not.

Our eyes wander irresistibly toward the future, and we must wonder whether and in what respects Soviet industry might outdistance the industrial sectors of the more dynamic Western economies, such as the United States. Nobody can see a certain answer to that question; it depends on too many imponderables. Growth has not been a mechanical process in either the Soviet Union or the United States. It remains to be seen what strength will be shown by the forces driving growth, so fundamentally different in the two economies.

The first thing to observe is that, even if Soviet industry were to continue indefinitely growing faster, at any time, than U.S. industry, it might never overtake U.S. industry in level of output, though it would get relatively closer and closer. This would be the case if Soviet industry tended to repeat the growth rates experienced earlier in the United States at each successive level of output, with a similar rate of retardation. To catch up in this way does not, of course, imply superior performance. A son will get closer and closer percentagewise to his father in age but will never catch up, despite the fact that every year his percentage increase in age exceeds his father's. The absolute difference in age will never diminish. And, similarly, the absolute difference in industrial production between the United States and the Soviet Union may never vanish—may even continue to increase as it has been—even if percentage growth continues

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higher in the Soviet Union than in the United States but with similar retardations in both countries.

On the other hand, if the differentials in percentage growth already experienced over concurrent periods were to persist long enough—if the Soviet Union were not to duplicate the growth record of the United States over comparable periods—Soviet output would catch up to the U.S. level at some point in time (see Table 78). For example, if Soviet output in

TABLE 78

YEAR IN WHICH SOVIET AND U.S. INDUSTRIAL OUTPUT WOULD BE
EQUAL UNDER HYPOTHETICAL CONDITIONS

Assumed Average Annual Growth Rate (per cent)		*Year of Equality If 1955 Soviet-U.S. Output Ratio Was*	
Soviet Union	United States	22%	33%
TOTAL OUTPUT			
4.1	3.8	2515	2355
6.5	3.8	2016	1998
9.6	5.3	1993	1983
7.1	2.2	1985	1979
PER CAPITA OUTPUT			
3.5	2.5	2132	2086
5.8	2.6	2011	1997
7.8	3.5	1997	1986
5.4	0.5	1991	1982

NOTE: The pairs of growth rates apply as follows, from top to bottom: 1913–1955, 1928–1955, 1950–1955, 1955–1958 for the Soviet Union and 1955–1959 for the United States.

1955 is taken as 22 per cent of the U.S. level and the respective growth rates over 1928–1955 are projected indefinitely into the future, total and per capita industrial outputs in the two countries would become equal about a half century from now. Even as the percentage gap steadily closed under these conditions, the absolute gap would continue to increase in favor of the United States for more than thirty years from now.[29] If Soviet output in 1955 were taken as 33 per cent of the U.S. level—the conventional but, in our opinion, less reliable estimate—Soviet industrial output would overtake the U.S. level about four decades from now. Under a variety of similar assumptions, the time required for overtaking could range from two to sixty decades.

[29] At the point of maximum absolute gap, which would be reached around 1992, value added of industry in 1954 dollars would be about $600 billion for the United States and about $340 billion for the Soviet Union.

Finally, it is not out of the question that the Soviet growth rate might retard to, or even below, the U.S. rate before outputs have become equal in the two countries. In this case, Soviet industry would stop catching up and never overtake in level of output.

In a word, many things can happen, none of them inconsistent with what we know about the mysterious subject of economic growth. This should make us pause before making hasty estimates of the comparative future performance of Soviet and U.S. industry.

Annex to Chapter 8

Soviet Lags in Industrial Output Behind the United States

As mentioned in the body of this chapter, one way to assess comparative performance of Soviet and U.S. industry is to make an industry-by-industry study of the behavior of Soviet lags behind the United States in physical output. Such a study is presented here.[30] The rationale underlying it is that most individual industries tend, in the Soviet Union as well as elsewhere, to grow more slowly percentagewise as they get older and larger. Comparison of U.S. and Soviet growth rates over contemporaneous periods may therefore give a misleading impression of relative economic performance to the extent that mature U.S. industries are being compared with youthful Soviet counterparts. Analysis of Soviet lags behind U.S. output provides a simple and direct method of comparing growth over periods in which Soviet and U.S. industries were of equivalent size.

For example, in 1913 the Russian production of steel ingots within the interwar Soviet territory was roughly equal in metric tons to the production achieved in the United States around 1892, or twenty-one years earlier. Hence the lag in 1913 was twenty-one years. The lag had risen to thirty-two years in 1937, falling somewhat from that point to a level of twenty-nine years in 1955 and nineteen years in 1958, when it leapt across the gap caused by the Great Depression. Thus Soviet production of steel ingots was eight years further behind American production in 1955 than it had been in 1913, which is to say that it has taken the Soviet Union forty-two years (1913–1955) to accomplish what the United States had done in thirty-four (1892–1926). On the other hand, in 1958 it was two fewer years behind than in 1913, so that the Soviet Union in this period (1913–1958) accomplished in forty-five years what the United States did in forty-seven years (1892–1939). On a per capita basis, the

[30] The discussion here is essentially an extension and revision of my earlier report, *Some Observations on Soviet Industrial Growth*, NBER Occasional Paper 55, New York, 1957.

lag increased from thirty years in 1913 to forty in 1937, and to forty-nine in both 1955 and 1958. Production per capita was nineteen years further behind in 1955 and 1958 than it had been in 1913; an equal expansion in per capita output had taken place in the United States in twenty-three or twenty-six years, instead of forty-two or forty-five.

Making comparisons of this sort for a number of industries raises the familiar problems of defining each industry in a relevant way and of finding comparable industrial categories for different economies.[31] In general, the industries—it is perhaps more accurate to say "commodities" —chosen for study here are the most narrowly defined categories for which the Soviet Union has published data on physical output covering the entire Soviet period. Relying on narrow concepts of industries makes for obvious difficulties in interpreting differences in growth between economies with differing endowments of resources. These difficulties can be counteracted in part by making comparisons between broadly defined industrial categories. One such comparison is made below between energy-producing industries taken as a whole.[32]

It goes without saying that, even under the best of conditions as far as reliability of data and relevance of counterpart industries are concerned, marked differences are to be expected between the details of industrial growth in the two countries. This industry will grow more rapidly in the United States than in the Soviet Union, while that one will grow more slowly. Where retardation in growth has been so strong in the United States as to cause output of an industry to reach a peak and then decline, there can be the seeming paradox of an increasing Soviet lag despite the fact that Soviet output has come to exceed the U.S. level, as in the case of soap. The two countries have had, in the periods compared, different levels of technological achievement, different economic tastes or objectives, and dissimilar resource endowments. For the purpose at hand, the focus should therefore not be so much on the details of the comparison as on the general outline.

In Tables 79 and 80, the Soviet lag in both total and per capita output is listed for forty-seven industries as of a number of benchmark dates,

[31] For comments on some of the difficulties in selecting counterparts, see footnote 16 of this chapter.

[32] Taking energy-producing industries as an example, we find that the petroleum industry has shown a much more rapid development in the United States than in the Soviet Union over comparable periods, while the coal industry has not. The comparatively slower growth of coal output in the United States is essentially the result of an earlier shift to other sources of energy than occurred in the Soviet Union, not of any relatively depressive factors applicable to the energy-producing industry as a whole. It is therefore useful to examine comparative developments in the entire energy-producing industry as well as in its components.

TABLE 79
Lag of Soviet Union Behind United States in Output, Benchmark Dates, Forty-Seven Industries[a]

	Lag (number of years) as of							
	1913	1928	1937	1950	1955	1958	1960 Plan[b]	1965 Plan[c]
Iron ore	28	49	36	35	15	14	[d]	[d]
Pig iron	30	48	36	47	39	18	13	10
Steel ingots	21	36	32	38	29	19	17	14
Rolled steel	27	42	35	38	29	18	16	14
Copper	32	47	50	51	51	n.a.	51	n.a.
Lead	94	103	60	62	52	n.a.	49	n.a.
Zinc	46	62	43	50	46	n.a.	46	n.a.
Electric power	13	26	21	24	16	15	13	12
Coal	45	58	49	48	47	44	[d]	[d]
Coke	31	46	36	44	30	18	n.a.	n.a.
Crude petroleum	14	26	26	35	34	25	26	19
Natural gas	32	44	52	51	51	34	n.a.	17
Soda ash	23	36	31	36	24	n.a.	22	n.a.
Caustic soda	20	33	25	29	24	n.a.	22	n.a.
Sulfuric acid	20	31	24	30	19	19	n.a.	n.a.[d]
Mineral fertilizer	43	52	27	13	12	13	9	[d]
Synthetic dyes	10	12	15	14	11	n.a.	n.a.	n.a.
Paper	44	53	46	54	54	54	52	50
Motor vehicle tires	12	24	25	36	39	42	n.a.[d]	n.a.[d]
Cement	19	32	33	42	32	9	[d]	[d]
Construction gypsum	13	33	31	42	35	n.a.	n.a.	n.a.
Construction lime	33+	48+	51	11	7	n.a.	n.a.	n.a.[d]
Lumber	62	77	66	67	61	59	62	[d]
Rails	42	61	57	53	52	n.a.	n.a.[d]	n.a.[d]
Window glass	13	19	0	9	10	6	[d]	[d]
Railroad freight cars	33	48	51	62	69	71	72	n.a.
Railroad passenger cars	21	43	46	59	53	57	54	n.a.
Flour	[d]	[d]	[d]	[d]	[d]	n.a.	n.a.	n.a.
Butter	21	39	38	37	35	30	31	[d]
Vegetable oil	5	17	26	35	28	19	15	16
Meat slaughtering	36	58	64	66	65	59	46	23
Sausages	39	53	36	41	38	12	n.a.[d]	n.a.[d]
Fish catch	−11	26	4	14	[d]	[d]	[d]	[d]
Soap	43	50	52	53	52	50	n.a.	n.a.
Salt	17	29	32	37	36	n.a.	n.a.	n.a.[d]
Raw sugar consumption	26	42	35	47	45	35	[d]	[d]
Canned food	49	62	45	50	44	44	46	n.a.
Beer	42	58+	66	72	73	n.a.	n.a.	n.a.
Cigarettes	−1	8	11	18	16	17	n.a.	n.a.
Boots and shoes	24+	39+	44	53	44	33	18	14
Rubber footwear	14+	29+	19	[d]	[d]	n.a.	n.a.	n.a.
Cotton fabrics	36	40	44	57	48	50	46	49
Pure silk and nylon fabrics[e]	27	62	51	63	67	n.a.	n.a.	n.a.
Rayon and mixed fabrics[e]	16	38	37	21	21	n.a.	n.a.	n.a.
Woolen and worsted fabrics	59	73	83	90	65	56	23	22
Bicycles	14+	29+	38+	15	[d]	[d]	[d]	n.a.
Sewing machines	14+	29+	38+	51+	[d]	[d]	[d]	n.a.
Median[f]	29	44	36	38	35	22	19	12

Notes on page 275.

TABLE 80
LAG OF SOVIET UNION BEHIND UNITED STATES IN PER CAPITA OUTPUT,
BENCHMARK DATES, FORTY-SEVEN INDUSTRIES[a]

	Lag (number of years) as of						
	1913	1928	1937	1955	1958	1960 Plan	1965 Plan
Iron ore	73	88+	52	54	55	51	46
Pig iron	48	84	52	56	57	55	53
Steel ingots	30	46	40	49	49	47	39
Rolled steel	28+	43+	50	52	50	47	39
Copper	52	69	57	65	n.a.	65	n.a.
Lead	105+	120+	109	76	n.a.	75	n.a.
Zinc	53	68	57	59	n.a.	56	n.a.
Electric power	14	27	26	25	20	20	18
Coal	66	80	69	69	64	63	68
Coke	36	53	49	56	57	n.a.	n.a.
Crude petroleum	27	40	34	41	38	39	32
Natural gas	33	45	52	69	49	n.a.	23
Soda ash	27	40	43	45	n.a.	33	n.a.
Caustic soda	19	34	40	35	n.a.	30	n.a.
Sulfuric acid	26	38	32	34	35	n.a.	n.a.
Mineral fertilizer	43+	58+	40	16	17	15	b
Synthetic dyes	14+	12	20	18	n.a.	n.a.	n.a.
Paper	54+	69+	67	71	70	70	71
Motor vehicle tires	13	26	31	42	44	n.a.	n.a.
Cement	30	45	38	47	38	10	b
Construction gypsum	17	43	36	49	n.a.	n.a.	n.a.
Construction lime	33+	48+	57+	75+	n.a.	n.a.	n.a.
Lumber	114+	129+	102	111	113	115	116
Rails	63	78+	77	84	n.a.	n.a.	n.a.
Window glass	34+	44	−2	15	11	b	b
Railroad freight cars	33+	48+	57+	75+	78+	80+	n.a.
Railroad passenger cars	30	48+	57	69	71	66	n.a.
Flour	b	b	b	b	n.a.	n.a.	n.a.
Butter	30	46	50	58	49	49	44
Vegetable oil	16	28	40	44	43	37	38
Meat slaughtering	33+	48+	57+	75+	78+	80+	85+
Sausages	24+	39+	48+	59	54	n.a.	n.a.
Fish catch	33+	48+	57+	19	10	b	b
Soap	34+	49+	58+	76+	79+	n.a.	n.a.
Salt	33+	43	46	58	n.a.	n.a.	n.a.
Raw sugar consumption	43+	58+	66	79	68	60	49
Canned food	43+	58+	62	60	58	56	n.a.
Beer	43+	58+	67+	85+	n.a.	n.a.	n.a.
Cigarettes	0	11	16	23	23	n.a.	n.a.
Boots and shoes	23+	38+	47+	65+	68+	70+	75+
Rubber footwear	14+	29+	38+	56+	n.a.	n.a.	n.a.
Cotton fabrics	43+	58+	67+	85+	88+	87	95+
Pure silk and nylon fabrics[c]	38	58+	64	82	n.a.	n.a.	n.a.
Rayon and mixed fabrics[c]	14+	29+	38+	23	n.a.	n.a.	n.a.
Woolen and worsted fabrics	43+	58+	67+	85+	88+	90+	95+
Bicycles	14+	29+	38+	7	b	b	n.a.
Sewing machines	14+	29+	38+	b	b	b	n.a.
Median[d]	d	d	d	56	52	51	44

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including the 1960 and 1965 Plans. More continuous measures may be made as desired from the graphs of output series in Chart A-2. The sample of industries has been dictated by availability of data on physical output, but it does cover a fair number of so-called "basic" industrial materials and consumer "staples." As we have already noted (see Table 70), it is more representative, and increasingly so, of Soviet industry than of U.S. industry, at least since 1913. When U.S. industry of the latter nineteenth century is substituted in this comparison, the differential certainly narrows, though we cannot say by how much. We can say this: the Soviet lags calculated from estimates of aggregate industrial production in the two countries are generally somewhat longer than the median lags calculated from our list of industries; and this suggests that the list comprehends a larger portion of Soviet industrial production than it does of the U.S. production of some thirty to forty years earlier.

Notes for Table 79

SOURCE: Appendixes B and E; announced goals of the Sixth Five Year Plan (*Current Digest*, VIII, 3, pp. 3 ff) and of the Seven Year Plan (*ibid*, XI, 9, pp 3 ff).

ᵃ U.S. output taken as centered nine-year moving average, with minor modifications. Soviet output covers interwar territory of the Soviet Union for 1913, 1928, and 1937; postwar territory for other years. A Soviet lead is indicated by a negative sign before the figure. Where U.S. data do not go back far enough to give the full lag, the calculable lag is followed by a plus sign. For basic data, see Chart A-2 and Appendixes B and E.

ᵇ Based on original goals of Sixth Five Year Plan, since discontinued.

ᶜ Based on goals of Seven Year Plan, taken as midpoints of the given range of "control figures." For lumber, meat slaughtering, butter, and vegetable oil, goals apply to a smaller coverage than for earlier years; they have been adjusted upward by ratio of 1958 outputs on larger and smaller coverage.

ᵈ Soviet output exceeds peak U.S. output to date.

ᵉ For combined silk, nylon, and rayon fabrics, lags are: twenty-six years for 1955, twenty-one for 1958, and seventeen for 1965 Plan.

ᶠ Calculated from data for the following numbers of industries: through 1955, forty-seven; 1958, thirty; 1960 Plan, thirty; and 1965 Plan, twenty-one. For 1913 and 1928, median lag cannot be precisely calculated because of lags of unknown length (lags with plus signs); it has been taken as the approximate midpoint of bounding limits (twenty-six and thirty-one for 1913, and forty-two and forty-seven for 1928). The median lags for the twenty-one industries (twenty in the case of the 1960 Plan) covered for the 1965 Plan are: 1913, twenty-seven; 1928, forty-two; 1937, thirty-six; 1950, forty-two; 1955, thirty-five; 1958, twenty-five; 1960 Plan, sixteen; and 1965 Plan, twelve.

Notes for Table 80

SOURCE: Table C-3 and other sources given in Table 79.

ᵃ See notes *a*, *b*, and *c* of Table 79. Soviet population is taken as 212 million in 1960 and 229 million in 1965.

ᵇ Soviet output exceeds peak U.S. output to date.

ᶜ For combined silk, nylon, and rayon fabrics, lags are: forty-one years for 1955, thirty for 1958, and twenty-eight for the 1965 Plan.

ᵈ For 1913, 1928, and 1937, the median lag cannot be calculated because of lags with unknown length (lags with plus signs); the median must exceed thirty-one for 1913, forty-five for 1928, and forty-eight for 1937. Medians cover only thirty-two industries for 1958, twenty for the 1960 Plan, and twenty-one for the 1965 Plan.

TABLE 81

CHANGES IN LAG OF SOVIET UNION BEHIND UNITED STATES IN OUTPUT,
BENCHMARK PERIODS, FORTY-SEVEN INDUSTRIES[a]

	Increase or Decrease (−) in Lag (number of years)						
	1913–1928	1928–1937	1937–1950	1950–1955	1913–1955	1928–1955	1955–1965 Plan
Iron ore	21	−13	−1	−20	−13	−34	−15+
Pig iron	18	−12	11	−8	9	−9	−29
Steel ingots	15	−4	6	−9	8	−7	−15
Rolled steel	15	−7	3	−9	2	−13	−15
Copper	15	3	1	0	19	4	n.a.
Lead	9	−43	2	−10	−42	−49	n.a.
Zinc	16	−19	7	−4	0	−16	n.a.
Electric power	13	−5	3	−8	3	−10	−4
Coal	13	−9	−1	−1	2	−11	−47+
Coke	15	−10	8	−14	−1	−16	n.a.
Crude petroleum	12	0	9	−1	20	8	−15
Natural gas	12	8	−1	0	19	7	−34
Soda ash	13	−5	5	−8	1	−12	n.a.
Caustic soda	13	−8	3	−4	4	−9	n.a.
Sulfuric acid	11	−7	6	−11	−1	−12	n.a.
Mineral fertilizer	9	−25	−14	−1	−31	−40	−12+
Synthetic dyes	2	3	−1	−3	1	−1	n.a.
Paper	9	−7	8	0	10	1	−4
Motor vehicle tires	12	1	11	3	27	15	n.a.
Cement	13	1	9	−10	13	0	−32+
Construction gypsum	20	−2	11	−7	22	2	n.a.
Construction lime	15	b	−40	−4	−26+	−41+	n.a.
Lumber	15	−11	1	−6	−1	−16	−61+
Rails	19	−4	−4	−1	10	−9	n.a.
Window glass	6	−19	9	1	−3	−9	−10+
Railroad freight cars	15	3	11	7	36	21	n.a.
Railroad passenger cars	22	3	13	−6	32	10	n.a.
Flour	c	c	c	c	c	c	n.a.
Butter	18	−1	−1	−2	14	−4	−35+
Vegetable oil	12	9	9	−7	23	11	−12
Meat slaughtering	22	6	2	−1	29	1	−42
Sausages	14	−17	5	−3	−1	−15	n.a.
Fish catch	37	−22	10	−14+	c	−26+	c
Soap	7	2	1	−1	9	2	n.a.
Salt	12	3	5	−1	19	7	n.a.
Raw sugar consumption	16	−7	12	−2	19	3	−45+
Canned food	13	−17	5	−6	−5	−18	n.a.
Beer	16+	c	6	1	31	d	n.a.
Cigarettes	9	3	7	−2	17	8	n.a.
Boots and shoes	c	b	9	−9	b	b	−30
Rubber footwear	15	−10+	−19+	c	−14+	−29+	n.a.
Cotton fabrics	4	4	13	−9	12	8	1
Pure silk and nylon fabrics	35	−9	12	4	40	5	e
Rayon and mixed fabrics	22	−1	−16	0	5	−17	e
Woolen and worsted fabrics	14	10	7	−25	6	−8	−43
Bicycles	d	b	−23+	−15+	−14+	−29+	n.a.
Sewing machines	15+	c	13	−51+	−14+	−29+	n.a.
Median[f]	15	−5	6	−4	8	−9	−22

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Cyclical fluctuations have been smoothed out of the U.S. output series—essentially through centered nine-year moving averages—so that comparisons would not be made with unusual temporary peaks in U.S. output. On the other hand, Soviet series have not been similarly smoothed because their fluctuations are fundamentally different in nature from our own cycles, and also because sharp discontinuities in the series create serious technical problems. Similarly, no adjustment has been made for gains in Soviet output resulting from territorial expansion during and after World War II; that is, such gains are included in the Soviet data. Therefore, on these scores as well as those mentioned in the preceding paragraph, the lags are computed favorably for the Soviet Union, at least as a general rule.[33]

Bearing in mind the various qualifications that must attend analysis of lags, we note (Table 79) that the median lag in output—that is to say, the lag exceeded in the case of half the industries and fallen short of in the case of the other half—was twenty-nine years in 1913, thirty-six years in 1937, and thirty-five years in 1955. By this measure of average performance, Soviet industrial growth over forty-two years (1913–1955) is seen to correspond roughly with U.S. industrial growth over thirty-six years (1885–1921). Put in terms of changes in lags, the increase in median lag was six years over the period 1913–1955, broken down into an increase of seven years for 1913–1937 and a decrease of one year for 1937–1955. Quite similar conclusions are reached on the basis of median changes in lags (see Table 81). Moreover, we may note that thirty-one out of forty-four industries for which changes and lags can be measured showed an increase for 1913–1955.

[33] Smoothing by a moving average may cause the average to be persistently above actual output when output is rising rapidly and consistently. Hence, in a few cases, lags may have been lengthened for earlier benchmark dates beyond what they would have been under other smoothing devices, though never by more than one or two years. It was considered preferable to adhere to a mechanical rule for smoothing and calculating lags, rather than to try to make minor improvements by *ad hoc* methods.

Notes for Table 81

Source: Table 79.

[a] See notes *a* and *c* to Table 79. Changes in lags that cannot be precisely calculated are footnoted or followed by a plus sign.

[b] Probable decrease in lag of unknown magnitude.

[c] Insufficient data to indicate whether lag increased or decreased.

[d] Probable increase in lag of unknown magnitude.

[e] For all silk, nylon, and rayon fabrics combined, decrease of nine years in lag.

[f] Calculated from data for the following numbers of industries: 1913–1928, forty-five; 1928–1937, forty-four; 1937–1950, forty-six; 1950–1955, forty-five; 1913–1955, forty-five; 1928–1955, forty-six; and 1955–1965 Plan, twenty. For 1928–1937, taken as midpoint of bounding limits, −4 and −6.

The picture changes when the analysis is brought forward to 1958 and projected to the future expected by Soviet officials. However, the sample of industries falls sharply—to thirty-two for 1958 and twenty-one for the 1965 Plan—so that comparison with earlier dates is impaired. On the basis of the 1958 sample, the median lag is shown as falling from about thirty years in 1913 to twenty-two years in 1958, a decline of eight years. The basic reason for this sudden sharp decline in lag is that Soviet output in a number of industries came to exceed U.S. production on both sides of the Great Depression. Soviet performance over forty-five years is indicated as equivalent to U.S. performance over fifty-three. On the basis of the even smaller 1965 Plan sample of industries, the median lag is also shown as falling but by only two years between 1913 and 1958— from twenty-seven years to twenty-five years—with an additional "planned" fall of thirteen years between the 1958 and 1965 Plans.

The median lag in per capita output (Table 80) was fifty-six years in 1955, and fifty-two years in 1958. Equally precise calculations cannot be made for other benchmark dates because many per capita lags are so long they cannot be measured—U.S. statistics on physical output do not go back far enough to show output per capita as small as in the Soviet Union. Changes in per capita lags can, however, be measured for thirty-six industries over 1937–1955 and for twenty-nine industries over 1913–1955. The median of these changes is an increase of four years over 1937–1955 (with twenty-six out of the thirty-six industries showing an increase) and of fourteen years over 1913–1955 (with twenty-one out of the twenty-nine industries showing an increase). On the basis of these figures and the median lag of fifty-six years for 1955, the median per capita lag would be estimated as around forty-two years in 1913 and around fifty-two years in 1937. According to our earlier calculations from aggregative data (see footnote 27), the estimate for 1913 considerably understates the lag at that time, so that it is best to avoid pursuing the analysis of per capita lags any further.

The various summary statistics given so far reflect conditions in industries where growth has been deliberately retarded by Soviet authorities as well as in industries where growth has been promoted. The difference in performance between the neglected and favored sectors may be indicated in part by computing separate summary statistics for industries producing consumer goods, on the one hand, and for all other industries, on the other hand. This is done in Table 82, where the last twenty items in Table 79 are taken as consumer goods, and the first twenty-seven items as "other goods." The median lags for consumer goods

TABLE 82

SUMMARY STATISTICS ON SOVIET LAGS BROKEN DOWN BY INDUSTRIES
PRODUCING CONSUMER AND OTHER GOODS
(number of years)

| | *Sample of 47 Industries* | | | Energy-Producing Industry[b] |
	All	Consumer Goods[a]	Other Goods[a]	
	MEDIAN LAG[c]			
1913	29[d]	31[e]	26	42
1928	44[d]	46[e]	43	56
1937	36	38	36	46
1950	42	44	42	49
1955	35	37	34	48
	CHANGE IN MEDIAN LAG[c]			
1913–1928	+16	+15	+17	+14
1928–1937	−8	−8	−7	−10
1937–1950	+6	+6	+6	+3
1950–1955	−7	−7	−8	−1
1913–1955	+7	+6	+8	+6
1928–1955	−9	−9	−9	−8

SOURCE: Table 79 and technical note 9 of Appendix A.

[a] Consumer goods are taken as the last twenty items in Table 79; other goods, as the remaining twenty-seven.

[b] Excludes firewood. For reasons, see technical note 9 of Appendix A.

[c] For energy-producing industry, lag in aggregate output as measured in thermal units. All changes in median lag agree in direction with median changes in lags that can be calculated from Table 79.

[d] Midpoints of possible bounding limits (twenty-six and thirty-one for 1913, and forty-two and forty-seven for 1928) consistent with lags of imprecise length (lags with plus signs).

[e] Calculated from bounding limits (twenty-four and thirty-eight for 1913, and thirty-nine and fifty-three for 1928) consistent with lags of imprecise length.

are smaller in 1913 and larger in 1937 and 1955 than the median lags for other goods. That is to say, consumer goods have tended to grow more slowly relative to their American counterparts than other goods have. Despite this fact, the medians for nonconsumer goods do not differ significantly from those for all industries taken together.

Another line of evidence on this general issue leads to a similar conclusion. The production of energy may be taken as an indicator of industrial growth, particularly of growth in so-called "basic" industries. One way of estimating the production of energy is to translate the output of coal, petroleum, and so on into their energy content (in, say, British thermal units) and add the energy contents together. This has been done for U.S. and Soviet energy-producing industries to the extent permitted by

available data (see Table A-27 and A-28 and Chart A-4). It will be seen (Table 82) that Soviet production of energy has lagged further behind U.S. production than is the case for our sample of forty-seven industries, but between 1913 and 1955 the lag increased by about the same number of years.[34]

We might next raise the question whether Soviet performance relative to the United States resembles Russian performance in the Tsarist

TABLE 83

LAG OF RUSSIA BEHIND UNITED STATES IN OUTPUT,
BENCHMARK DATES BETWEEN 1880 AND 1913, THIRTEEN INDUSTRIES[a]

	Lag (number of years)			*Increase or Decrease (−) in Lag*		
	1880	1900	1913	1880–1900	1900–1913	1880–1913
Iron ore	36+	21	27	−15+	6	−9+
Pig iron	36	22	29	−14	7	−7
Steel ingots	5	14	20	9	6	15
Copper	25	37	33	12	−4	8
Lead	67	92+	92	25+	−0+	25
Zinc	11	29	35	18	8	24
Coal	36	39	43	3	4	7
Crude petroleum	16	−1	14	−17	15	−2
Rails	22	31	40	9	9	18
Salt	−1	3	16	4	13	17
Raw sugar consumption	10+	24	22	b	−2	b
Cigarettes	−9	−10	−3	−1	7	6
Cotton consumption	32	24	29	−8	5	−3
Median	22	24	29	4	6	8

SOURCE: Appendixes B and E.
[a] Russian output covers Tsarist territory excluding Finland.
[b] Inadequate data to indicate whether lag increased or decreased.

period. Such information as could be gathered on this question is presented in Table 83, where Russian lags are computed for thirteen industries as of three benchmark dates: 1880, 1900, and 1913. As far as this very small sample of industries is concerned, there is a clear tendency for lags to increase. Russian growth in output over thirty-three years of the Tsarist period (1880–1913) is indicated as corresponding roughly

[34] If firewood is included as an energy source, the lag in energy production shows a decline over 1913–1955. It is doubtful that much weight should be placed on this last finding, however, since estimates of output of firewood in both the United States and the Soviet Union are necessarily crude and subject to wide margins of error (see the discussion in the text around Tables A-27 and A-28).

with U.S. growth over twenty-six earlier years (1858–1884), but this conclusion is based on too small a sample to be taken literally.[35]

Finally, we may note that Soviet lags have declined substantially over the Plan years taken alone. Since Soviet industry experienced virtually no growth in the aggregate between 1913 and 1928, the median lag in output increased by fifteen years between 1913 and 1928 (see Table 79). Beginning with 1928, the median lag decreased by nine years by 1955 and by twenty-two years by 1958. Soviet output of these industries attained in twenty-seven (or thirty) years a growth that required thirty-six (or fifty-two) years in the United States.

The question remains whether this more rapid growth since 1928 represents the establishment of a new trend, or whether it is in part explained by a process of catching up to an interrupted trend. No firm answer can yet be given to this question, but there is some relevant evidence that can be examined, namely, the performance of Soviet industries that have essentially come into existence during the period 1928–1955. If these new Soviet industries have also gained historical ground on their American counterparts, then there is good support for the belief that a new, more rapid trend of Soviet growth has been established. If not, there is less reason to believe so. The data so far available for fifteen new Soviet industries (Table 84) do not indicate a decline in median lag since 1932, at least through 1958. The Soviet lag has clearly decreased in only three of the fifteen industries: primary aluminum, electric motors, and margarine.

As evidence on the other side, it should be pointed out that Soviet authorities look forward to a much more rapid rate of industrial expansion in the future than has characterized the Soviet period as a whole. The planned goals for 1960, since abandoned, and for 1965 imply considerable ground-gaining on the United States in a large number of industries, in part because of an implied leap across our Great Depression in the case of many products. It remains to be seen to what extent Soviet authorities will be correct in their anticipations.

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[35] The sample does not seem to be representative of conditions in 1913. We note from the sample of forty-seven industries in Table 79 that the median lag in Russian output within the interwar territory of the Soviet Union is calculated as twenty-nine years. When Russian output is taken within Tsarist territory, the median lag should be smaller, since Tsarist territory was larger than interwar Soviet territory. Contrary to this expectation, the median lag turns out to be the same (see Table 83). Unfortunately, there is no way of telling how this bias might affect the data on changes in median lag over the Tsarist period.

TABLE 84

Lag of Soviet Union Behind United States in Output,
Benchmark Dates Since 1932, Fifteen New Soviet Industries

| | | | *Lag (number of years) as of* | | | | *Increase or Decrease (−) in Lag* | |
	1932	1937	1940	1950	1955	1958	1932– 1955	1932– 1958
Primary aluminum	35	22	16	n.a.	n.a.	n.a.	n.a.	n.a.
Automobiles	30[a]	33	39	41	46	49	16	19
Trucks and buses	18	19	22	29	32	34	14	16
Tractors	15	20	33	32	30	19	15	4
Tractor-drawn plows	9	11	18	22	29	18	20	9
Tractor-drawn cultivators	3	1	11	12	16	14	13	11
Grain combines	6	−5	13	7	12	11	6	5
Diesel engines[b]	10	13	16	8	12	n.a.	2	n.a.
Electric motors[b]	15	19	22	6	9	4	−6	−11
Margarine	26	23	20	9	6	7[c]	−20	−19
Cheese	63+	68+	71+	81	75	n.a.	[d]	n.a.
Hosiery	42+	36	37	47	45	44	[d]	[d]
Phonographs	33+	22	32	40	35	n.a.	[d]	n.a.
Radios	11	14	17	26	26	26	15	15
Television sets	[e]	[e]	[e]	3	7	9	[e]	[e]
Median	17	20	21	24	28	18	14	9

Source: Appendixes B and E.

[a] From 1933.

[b] Output measured in rated capacity, not simple units.

[c] From 1957.

[d] Insufficient data to indicate whether lag increased or decreased.

[e] Output negligible before 1950