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THE INDUSTRIAL STRUCTURE OF THE USSR

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25 March 1953

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## THE INDUSTRIAL STRUCTURE OF THE USSR

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COLONEL SMARTT: The subject of the presentation this hour is "The Industrial Structure of the USSR." Our speaker is Mr. James H. Blackman, Lecturer and Research Associate, Department of Political Economy, Johns Hopkins University. I think perhaps that his work on "A Tentative Input-Output Table for the USSR, 1941 Plan" qualifies him exceedingly well for the discussion of today's topic.

This is Mr. Blackman's first appearance at the Industrial College. It is indeed a pleasure to welcome our speaker and to present him to the student body for this talk. Mr. Blackman.

MR. BLACKMAN: The appetite of modern military machines is so immense that the size and structure of the supporting economies become of great, if not decisive, importance. According to the Soviet economist, Gatovski, the victory of the USSR in World War II was due primarily to the fact that the Red Army received from the home front significantly more and better military materiel than did the German Army.<sup>1/</sup> Another economist, Dr. Raymond Goldsmith of the United States, has reached a similar conclusion that "what determined, or at least decisively influenced the course of World War II, is the actual volume of munitions production-- or more correctly, the level of munitions deliveries to the theaters of operation. . . ." <sup>2/</sup>

In the brief time allotted this morning I propose to examine certain aspects of the industrial structure of the USSR from the standpoint of its probable effectiveness in support of a total war. This is a large topic, and it is necessary at once to issue several cautions and disclaimers. It is very perilous to undertake to quantify the industrial strength of any country, even in cases where statistics are both plentiful and accurate. It is more difficult still to compare one country with another in regard to "industrial war capacity" since they often have differing strategic needs, differing weapons systems, and their resources and industrial structures have to be interpreted diversely in accordance with these different needs.

The indicators of industrial strength, which I shall present, reflect manifold empirical as well as conceptual difficulties. I shall by-pass here the considerable problems raised by Soviet economic censorship

1/ Gatovski, L., The Economic Victory of the Soviet Union in the Great Patriotic War, Moscow, 1946, p. 2.

2/ Goldsmith, R., "The Power of Victory--Munitions Output in World War II," Military Affairs, Spring 1946, p. 80.

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and statistical methods. On the conceptual side, however, it is important to bear in mind the principal qualifying assumptions which are made for purposes of this discussion.

I assume first that the hypotthesized total war which we are analyzing will be a protracted and devastating affair. This view, incidentally, conforms with Soviet military doctrine of the preatomic era which excluded the possibility of blitzkrieg war against a first-class opponent. The amassing of nuclear weapons may eventually compel the modification of this estimate, but Soviet military science apparently still minimizes the chances of waging a successful "lightning" war. My analysis will focus on this long-range aspect of industrial potential, abstracting from the effects, however large, of initial stocks and military strength in being.

A realistic comparison of the Soviet and the United States war-making potential should take into account the strength of their probable allies and of the territory which lies within range of easy conquest. Unfortunately, limitations of time preclude such an over-all assessment here, but other lectures, it is hoped, may enable you to strike the balance.

The vulnerability and recuperability of industry likewise should enter into a rounded judgment of industrial war capacity. I am able only to address a few passing comments to this topic, which necessarily limits the comprehensiveness of my conclusions.

Finally, attention is called to the limitations of an exclusively industrial approach. To some extent agricultural resources and requirements are weighed, but they enter, as it were, only through the back door in the evaluation of specific industrial scarcities.

With these introductory strictures in mind, let me go on to anticipate the major conclusions which emerge from this survey:

First of all, it is apparent that the Soviet Union has a much larger industrial base with which to supply its armies than it did either before the war or during its wartime munitions peak. It may even be able to double the substantial munitions output which it achieved in 1944, including the contributions of Lend-Lease.

This represents an impressive armament-making capability. It does not follow, however, that the Soviet Union has progressed relatively as well as absolutely in industrial war potential since World War II. There are, as we shall see, good reasons to suppose that the economy of the USSR might be less successful in conducting a 1953-model total war. The technological and resource demands of warfare have increased tremendously in the interim since 1944, as have the strengths of probable adversaries.

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Thus, for example, the current munitions capacity of the USSR remains far behind that of the United States, perhaps as much as one-half, judging by the size of the national incomes of the two countries and the production of certain key materials.

This gap between the USSR and the United States probably will narrow, though not radically, in the next 5 to 10 years if present growth trends continue. Even if the United States economy should stand still, however, the strength of the USSR in 1960 will remain considerably short of the United States level.

Before attempting to delineate the industrial war capacity of the USSR, I shall consider briefly the main features of the structural development of industry during the period of the five-year plans. The extraordinary tempos of industrialization which Soviet leaders have pursued to date reflect to an important degree their efforts to prepare for total war; indeed, the sacrifices which they have imposed on the country are difficult to explain on any other ground. The main link in their military-economic plans has been and remains the expansion of heavy industry, with machine building, metals, energy, and more recently chemicals, forming the core of the structure. Military considerations also have dictated a continuing shift of the industrial center of gravity of the country toward the East. Thus, the five-year plans have sought not only to increase the total economic resources of the land, thereby freeing it as nearly as possible from dependence on the outside world, but also to locate industry far from potential war areas.

When the first plan was launched in 1928, the country---in Stalin's words---was 100 years behind the capitalist nations of the West.<sup>3/</sup> It was still a semifeudal, predominantly agrarian society with only a few islands of industry clustered around the Leningrad and Moscow areas and the Donbas Basin to the South. The years intervening since the revolution had been spent largely in restoring agricultural and industrial production to their meager pre-1913 levels.

In the face of this situation, the government called for a high rate of investment to equip industry with the most modern techniques. At the same time it optimistically assumed that the standard of living would rise concurrently, though not in exact proportion to the growth of heavy industry. It is perhaps not surprising to report that only part of this ambitious project has been successful. High investment tempos and industrial growth rates have in fact been achieved (I shall later consider these results in some detail), but only at the expense of the level of real wages. The striking conclusion which is reached by Janet Chapman, of the Rand Corporation, on the basis of her study of retail price changes is that real wages were halved between 1928 and 1937,

<sup>3/</sup> Stalin, J., Selected Writings, International Publishers, N. Y., 1942, p. 249.

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notwithstanding the fact that the latter was a relatively good year.<sup>4/</sup> The Chapman study also refutes the rosy claims of the Soviet press in regard to the postwar rise in living standards. There has been a moderate recovery from the extremely low subsistence levels than 40 percent of the level achieved two decades earlier in the initial plan year. By 1950 real wages may have been restored to the 1937 level, but the great expansion of the defense program since that time probably has prevented any appreciable subsequent gains.

Let us look for a moment at the rates of investment which contributed to this sharp curtailment of living standards. According to the findings of Professor Bergson and Mr. Heymann, the share of the gross national product allocated to investment in nonwar years in the USSR has averaged about 25 percent.<sup>5/</sup> This is a large but not extraordinary proportion. The corresponding investment share in the United States has averaged about 19 percent of the gross national product since 1870, excluding war and depression years.<sup>6/</sup>

The closeness of the two rates may appear surprising in view of the divergence in real wages trends in the two countries. If other non-consumption outlays are taken into account, however, such problems of interpretation are largely resolved.

In the first place, Soviet investment expenditures have frequently been imposed on sizable defense outlays. In 1937, for example, the Russians spent on investment and defense nearly 33 percent of their gross national product, which compares with a corresponding figure for the United States of 20 percent. This considerable differential serves to explain, in part at least, the greater inflationary pressure which arose in the USSR.<sup>7/</sup>

Secondly, Soviet investments have taken place without substantial foreign aid, whereas the United States was a debtor nation throughout much of its early industrial expansion. This is another reason for the consumers' plight over there as compared with our picture.

Thirdly, it must be remembered that the Soviet investment and defense funds were drawn from a much smaller per capita economic pie than in the United States. This implies a relatively larger resource requirement for the maintenance of living standards.

<sup>4/</sup> Chapman, Janet, Retail Food Prices in the USSR, 1937-1948, The Rand Corporation, 13 Jan 1953, p. 47-48.

<sup>5/</sup> Bergson, A. and H. Heymann, Disposition of the Gross National Product of the USSR in 1937, 1940 and 1948, The Rand Corporation, 24 Jan 1950.

<sup>6/</sup> Bergson, A., "Soviet National Income and Product in 1937," Quarterly Journal of Economics, Aug 1950, p. 438-441.

<sup>7/</sup> Ibid.

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For purposes of structural analysis, the direction of investment is equally as important as, if not more so than, the rate of capital outlays. Here also significant contrasts with the United States arise. Briefly, investments in industry have constituted a very much larger proportion of total investment in the USSR than in the United States.<sup>8/</sup> Only in the 1941-1945 period did the United States ratio approach the normal prewar Soviet ratio, that is, about 40 percent of our total investments then were directed to industry. In other words the United States has distributed its investment in a similar pattern to the Soviet Union only at a time when it was controlled by military requirements rather than market considerations. In recent years, it should be noted, the Soviet ratio has shown a rising trend and industrial investments probably now constitute about half of the total.

The distribution of Soviet capital outlays within industry likewise shows marked differences to that of the United States.<sup>9/</sup> Taking the metal and metal product industries as representative of the "heavy" category, we find that before the war they absorbed annually about 12 percent of the total investments in the Soviet economy. The corresponding figure, as nearly as it can be determined for the United States, was under 8 percent. This means that the USSR has regularly allocated about 50 percent more of its capital funds to heavy industry than the United States has done over the past 70 years of its development.

In the USSR, furthermore, investments in the consumers' goods industries were confined mainly to amounts needed to promote the industrialization drive itself. Funds were allocated on the one hand to mechanize the new large-scale collective farms and thus release labor for industry and, on the other hand, to house after a fashion and provide a minimum volume of consumers' goods for the expanding urban population.

The industrial progress which has resulted from the concentration of investment in the producer goods sector is impressive indeed. According to official Soviet statistics the gross industrial output of the USSR rose sevenfold in the twelve-year span from 1928 to 1940. Most independent observers are agreed that the official indices seriously exaggerate the rate of growth of aggregate industrial production, the upward bias amounting to perhaps as much as one-third for the period under review. But even with drastic downward adjustments to correct for the official index biases, a most substantial gain in industrial production remains, roughly five times, during this 1928 to 1940 period.

<sup>8/</sup> Kaplan, N., Soviet Capital Formation and Industrialization, the Rand Corporation, 6 Mar 1952, p. 21, 25.

<sup>9/</sup> Ibid.

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Growth indicators which are expressed in physical rather than ruble terms tend to confirm the latter estimate. The 1940 production of such key items as coal, pig iron, steel, and petroleum show increases of approximately five times over 1928. The ton-kilometer volume of railroad traffic also grew at about the same rate.

Recently the annual value of mineral production in the USSR has been calculated by Demitri Shimkin of the Russian Research Center of Harvard University.<sup>10/</sup> His data, which are weighted in terms of United States prices in order to avoid the deficiencies of ruble statistics, indicate a fourfold rise in mineral production from 1928 through 1937. Application of similar statistical techniques to machinery output yields a 1937 index of 525.<sup>11/</sup>

The progress of Soviet industrialization is indicated perhaps as much by changes in the pattern of production as by the impressive gains, both absolute and relative, in the volume of industrial output. In 1928 at the start of the investment drive, the ratio of the gross material product of the nation to the total mineral consumption of the economy was 63 to 1. This same ratio as calculated by Shimkin for 1937 had fallen to 28 to 1. The corresponding ratio in a still more highly industrialized society, the United States, fluctuated in the vicinity of 15 to 1 during the interwar period.<sup>12/</sup>

Another measure of the fruits of the Soviet industrialization drive is recorded by the change in the ratio of agriculture production to that of industry. In 1913 the net agricultural output of Russia amounted to 164 percent of the net industrial production, compared with a figure at that time in the United States of 59 percent. At the close of the Second Five-Year Plan in 1937 this ratio had dropped to 29 percent, the same relationship which then prevailed in the United States.<sup>13/</sup> Thus, the Soviet Union was able to recapitulate the structural development of the United States, as disclosed by this coarse breakdown, in a very short span of years.

To some extent the similarity here may be more apparent than real owing to the aforementioned vagaries of Soviet output statistics and to the government's arbitrary price policy which consistently imposed adverse terms of trade on the agricultural community. Furthermore, although there can be no doubt as to the drastic nature of the shift toward industry, it

<sup>10/</sup> Shimkin, D., Minerals--A Key to Soviet Power, Cambridge, Mass., 1953, p. 305.

<sup>11/</sup> Gerschenkron, A., A Dollar Index of Soviet Machinery Output, 1927-1928 to 1937, the Rand Corporation, 6 Apr 1951, p. 25.

<sup>12/</sup> Shimkin, op. cit., p. 321.

<sup>13/</sup> Gerschenkron, A., The Rate of Industrial Growth in Russia, 1885-1940 (manuscript), Oct 1946, p. 23.

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is apparent that the majority of the labor force in the USSR has remained in agriculture. In 1940 it is estimated that some 56 percent of the Soviet labor force was required to provide agricultural necessities for the country as compared with a figure of some 12 percent in the United States in 1948.<sup>14/</sup>

The changing relative importance of the output of heavy and consumers' goods industries in the USSR reflects the concentration of investment in the heavy sphere which we noted earlier. In 1913 the output of producer goods industries (the Soviets refer to them as the "means of production") represented one-third of the gross industrial output. In 1940 the share of the "means of production" had risen to 61 percent and in 1952, according to my calculations, it was about 64 percent.<sup>15/</sup> Within large-scale industry, the output of the metalworking and machine construction branch showed a still more phenomenal rise. In 1928 the share of this branch amounted to about 14 percent of the output of large-scale industry; in 1936, to 33 percent; and by the onset of the war it approximated 40 percent of the total. An opposite trend is noted in the shares of light industry, for example, of textiles and food-stuffs. These percentages, it should be stated, are based on the values of output expressed in the so-called constant rubles of 1926 to 1927 and as a result they suffer from the same deficiencies as the global production indexes of which they are a part. This means that they tend to exaggerate the weight of heavy industry and of machine construction in particular.

It is perhaps unnecessary to add that, while the USSR has increasingly resembled the United States in its agricultural and industrial structure, extreme differences remain in the end uses to which the basic products are put. In the case of the USSR the fabrication of producer goods and armaments very nearly exhausts the output of raw materials. On the other hand in the United States, a predominantly consumer orientation prevails. Typically, for example, steel in the Soviet Union is used to turn out capital goods or simply to produce more steel, whereas in the United States it tends much more to go into durable consumer items such as automobiles and refrigerators. Soviet steel production--now about one-third that of the United States--should be contrasted with Soviet automobile production, which is less than one-tenth of our average volume.

It is interesting and instructive also to trace the rise of basic industries in the USSR in terms of the stages already undergone in the United States economy. Norman Kaplan of the Rand Corporation has

<sup>14/</sup> Kershaw, J., "The Economic War Potential of the USSR," American Economic Review, Papers and Proceedings, May 1951, p. 478.

<sup>15/</sup> Gudok, (calculated from percentage relationship), 6 Mar 1953 p. 3.

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investigated and compiled certain of these relationships for Soviet output covering the years 1928 to 1929 and 1950.<sup>16/</sup> In the first year 1928 to 1929, the Soviet output of coal (namely, 40 million tons) was equaled by the United States production in 1871; the pig iron volume of 4 million tons was achieved by the United States in 1881; the 11-million-ton crude petroleum output corresponded to the 1902 United States level, as did the output of copper and electric power. From this it may be inferred that the Soviet Union at the start of the plan period was 30 to 50 years behind the United States in the production of the chief raw materials of industry.

By 1950, despite the tremendous gains of industrialization, a lag of 25 to 50 years was still apparent in these basic items. The Soviet coal output in that year of 261 million tons was attained by the United States as early as 1901; pig iron was up only to the 1905 United States level, while petroleum production corresponded to the 1915 United States figure. The greatest relative gain was in electric power, where the output of 90 billion kilowatt-hours was equal to the volume attained by the United States in 1926. Somewhat paradoxically, in view of the power figure, the output of copper only approximated the 1899 volume in the United States.

The degree to which present output levels in the Soviet Union fall short of current production magnitudes in the United States is summarized in table 1, page 9. The table also sets forth certain announced production goals for the USSR for 1955 and 1960, which, it is interesting to note, still are appreciably smaller than current United States volumes. The so-called Stalin long-range goals for 1960 were announced immediately after the war, but the targets for 1955 were promulgated only last year in connection with the ratification of the Fifth Five-Year Plan. This difference in the dates of projection explains certain apparent anomalies where, as in the case of petroleum, a lower target figure is shown for 1960 than for 1955. Both the requirements for petroleum and its realized rate of growth have exceeded Stalin's original expectation, with the result that the goals subsequently were revised upward.

What, if anything, do the foregoing statistical indicators mean with respect to Soviet industrial capabilities for total war? A freehand impression of the Soviet-United States output ratios given in table 1 suggests that the USSR is now only about one-third as productive as the United States in regard to the basic industrial sinews of war. An accurate comparison of the national incomes of the two countries is not possible, but rough calculations here also indicate the existence of a substantial gap, the Soviet product being perhaps one-third to one-half

<sup>16/</sup> Kaplan, *op. cit.*, p. 38.

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that of the United States.<sup>17/</sup> Thus, if the United States economic capability for total war is given an index value of 100, a conservative estimate might place the relative strength of the Soviet Union at 50.

Table 1. Comparative industrial production--USSR and USA <sup>a/</sup>

(Millions of metric tons)

Item	USSR 1952	USA 1951	USSR as percentage of USA	USSR 5th FYP goal 1955	Stalin goals 1960
Coal	301.1	523.0	57.6	372.7	500
Petroleum	47.2	307.5	15.4	69.6	60
Pig iron	25.9	63.9	40.5	35.0	50
Steel	31.5	95.4	33.0	40.3	60
Electric power	116.3 <sup>b/</sup>	482.3 <sup>b/</sup>	24.1	162.5 <sup>b/</sup>	250 <sup>b/</sup>
Cement	14.5	41.2	35.2	23.3	---

<sup>a/</sup> Sources: Blackman, J. H., Soviet Industrial Production (Unpublished manuscript); United Nations, Statistical Yearbook 1952.

<sup>b/</sup> Unit is billion kilowatt-hours.

But there are many pitfalls and difficulties in this line of analysis, quite aside from the possibility of serious errors in the underlying quantitative estimates. On the one hand the list of basic products I have covered is too small to provide an adequate gage of war-making power. At best it can be taken only as representative, the assumption being that other essential items are proportionately developed. Ideally what is required is a detailed input-output table indicating the interstructural relationships for all industries as well as the absolute levels of production. The problem of economic war potential is a problem of simultaneous relationships, and a piecemeal approach such as I have employed for selected items may prove very wide of the mark. In brief it lacks the power to illumine systematically all the potential bottle-neck areas.

National product measures suffer from the opposite defect, though the results for our purposes are the same. They are much more comprehensive than selected output indicators, but they are too aggregative to be revealing, and like the individual products approach they may easily conceal items in short supply. Furthermore, in themselves, they provide no key to the military-use-value obtainable for each unit of the national

<sup>17/</sup> Kershaw, op. cit., p. 477-478.

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product. The latter, indeed, may be expected to vary considerably, depending not only on the size of the national income but also on the customary living standard and the types of weapons systems required by the Nation's over-all strategy. Consequently, intercountry comparisons on this level are extremely perilous.

This is not to suggest that the foregoing statistical measures be discarded, but only that they are inadequate to provide a solution for our problem. In all likelihood no single definition of industrial war capacity can be devised which is both operational and satisfactory conceptually. However, the nearness of the World War II experience does furnish additional insights which can render our measuring rods less crude. Specifically, it provides us with certain observable input-output relationships between munitions production on the one hand and minerals consumption on the other. These relationships can be extrapolated on the basis of various assumptions, as I shall indicate below.

The functional connection of minerals and munitions is readily apparent. Such metals as steel, aluminum, copper, lead, and zinc are universally required inputs for munitions production; most other metals have certain specific armament uses of importance. Accordingly, a comprehensive index of minerals consumption should cast considerable light on the problem of war potential.

Fortunately, such an index is available as a result of the monumental labors of Professor Shimkin of Harvard University.<sup>18/</sup> Professor Shimkin's index traces the consumption in the USSR of 17 major minerals, including liquid fuels, heavy chemicals and miscellaneous nonmetallics, over the period 1928 to 1950. The values which he obtained for 1944, the year of peak munitions output, and for 1950 are of special interest here, though they are admittedly less reliable than the early years of his series.

The Shimkin estimates point to the conclusion that mineral consumption in the USSR is now about double that of 1944, even allowing for the appreciable Lend-Lease supplies of that year. If, as a first approximation, it is assumed that munitions capacity has gone up in like proportion, it may be inferred that the Soviet Union is capable today of doubling its record munitions volume of World War II, allied contributions included. What this means in terms of specific 1944-model weapons is shown in table 2. Also, set forth in table 2 are comparative data relating to the average United States munitions output of 1942 to 1944.

<sup>18/</sup> Shimkin, op. cit., p. 3, 4, 320.

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Table 2. Comparative munitions output, World War II, USSR and USA, and estimated munitions output, USSR, 1952 a/

Item	USSR average last three years of war	USSR Estimated 1952 capacity	USA 1942-44 average
Tanks and self-propelled guns	30,000	60,000	28,700 <u>b/</u>
Airplanes	40,000	80,000	76,700 <u>c/</u>
Artillery	120,000	240,000	57,500
Machine guns	450,000	900,000	1,659,000
Rifles and carbines	5,000,000	10,000,000	3,578,000
Mortars	100,000	200,000	20,300
Shells, bombs, mines	240,000,000	480,000,000	. . .

a/ Sources: Gatovski, I., The Economic Victory of the Soviet Union in the Great Patriotic War, p. 24; E. Ames, American Economic Review, Papers and Proceedings, May 1951, p. 490.

b/ With scout and armored cars, 58,000.

c/ 111,000 by equivalent airframe weight.

On the evidence of table 2, it would appear that the Soviet Union now possesses a munitions capacity which considerably exceeds not only the production record it achieved with allied help in the Second World War, but also surpasses that of the strongest arsenal in the world, namely, the United States. From this it might be inferred that the Soviet economy can sustain a war effort similar at least in dimensions and product-mix to World War II. There are, however, a number of perplexities to contend with, both in regard to the data and the underlying assumptions.

In the first place, if adjustments are made in the minerals consumption index to allow for Shimkin's estimated range of error of 20 percent, significantly different results can be obtained. The adjustment combination with the maximum negative effect indicates an increment in minerals consumption from 1944 to 1950 of less than one-third, instead of nearly double. My impression is that the true value for the growth in mineral consumption probably lies somewhere between these limits, though according to Shimkin's error margins, the possibility exists of an increment in excess of 100 percent.

More important than the empirical question regarding the behavior of the index is the assumption of proportionality to munitions output, or at any rate, to munitions capacity. Before confidence can be placed in this assumption it is necessary to look behind the movement of the aggregate to the behavior of the individual components; and second, to

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investigate the movement of items which do not appear in the index, but which, nonetheless, are essential for munitions production. These two tasks exceed the limits of the present survey, but let me just illustrate some of the considerations involved.

The most important component of the index which exhibits a trend counter to the whole is aluminum. Roughly 70 percent of the aluminum supply of the USSR in World War II came from the United States and Canada. With these sources shut off, the aluminum consumption of the USSR at present is only about two-thirds of the 1944 level. The inference of a potential twofold increase in aircraft production based on the aggregate behavior of the minerals consumption index becomes patently absurd in view of the decline in available aluminum supplies. Equally drastic downward adjustments probably are not required for other armament types since, with the exception of copper and tin, most of the militarily useful items included in the index show very substantial estimated gains from 1944 to 1950. Some down-scaling, however, would appear in order.

The problem with respect to items not covered by the index is much more difficult to handle. Clearly, other resources than metals are needed for munitions production and they may place a limit on the output of munitions long before the available supply of metals is used up. Transportation services and electrical energy may fall in this category; perhaps manpower too will prove critically scarce due to the minimum demands of food production, or for other reasons. I propose to comment briefly on some of these so-called "bottleneck" factors in assessing the principal military weaknesses of the Soviet economy, with this caution, that my remarks be regarded as impressionistic and incomplete.

Before turning to a consideration of specific military-economic deficiencies, it may be observed that the preceding analysis is beset by still another general defect; namely, it is phrased in terms of the technology and end-product requirements of World War II. It is evident that a future war will not be fought successfully simply by reproducing the obsolete weapons of the last struggle. Furthermore, the enhanced resources demands of nuclear offense and defense may well outweigh the gains in industrial capacity which the Soviet Union has registered since the war, leaving it today relatively less capable of supporting an all-out struggle. The relative advantage of the United States also should rise with the increasing complexity of modern arms. Doubts have been raised by the ex-President of the United States, among others, as to the Soviet proficiency in the manufacture of the "new weapons." I am inclined to think his view is exaggerated, but if correct, the USSR would be severely handicapped in any attempt to conduct a 1953-style total war.

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My comments on Soviet military-economic weaknesses fall under four heads: first, basic resource scarcities; second, transportation difficulties; third, labor productivity and supply; and fourth, geographic vulnerability.

The Soviet Union has made great strides during the five-year plans toward peacetime self-sufficiency. The supplies of certain critical materials, however, are still inadequate to meet the magnified demands of total war. Perhaps the most important of these potential scarcities is petroleum, the output of which, as you will recall from table 1, is now less than one-sixth of the United States volume. The difficulty here is not one of crude oil reserves, which are the most abundant in the world, but rather of refining capacity, and to a lesser extent, of pipeline transportation. In the event of a long war, the USSR simply would have insufficient (domestic) petroleum available to take care of the minimum needs of transport, of mechanized agriculture, and of the tank and air arms of the military. In particular, it is short on cracking capacity for aviation gas. And, as I shall indicate later, the petroleum industry as a whole is especially vulnerable to attack.

I have already referred to the adverse aluminum position of the USSR. At the present time, using its own resources, the Soviet Union could produce only about 67 percent of the airframe weight that it turned out in World War II. To some extent substitutes may be employed (for example, wood frames), but the aluminum shortage, which is both a resource and a fabrication deficiency, is bound to prove embarrassing.

Certain other nonferrous metals also are likely to be inadequate for wartime consumption rates, the most important of which are copper, lead, tungsten, tin, molybdenum, and zinc. Current output levels of these basic munitions ingredients are roughly one-quarter those of the United States.

The production of sulfuric acid constitutes another weakness which might place severe limits on a wartime high-explosive program. In fact current production is less than sufficient to take care of the normal fertilizer needs of agriculture. This competing demand could be ignored during a war only at the risk of diminishing agricultural yields. The output of natural sulfur, according to Shimkin's estimates, now is less than 2 percent of the United States figure, which allows very little room for the building of compensatory stockpiles.

Probably, also, fissionable materials should be put on the critical list. Russia's reserves of uranium, so far as we know, are quite limited and consist for the most part of very low-content ores. It should be added, however, that the domestic lack is somewhat ameliorated by satellite resources. In addition, the possibility of finding new and rich deposits within the USSR proper should not be discounted in view of the extensive explorations which are now in progress.

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Finally, it should be noted that the availability of machine tools may in some cases impose a brake on war production sooner than the raw material scarcities discussed above. This judgment is based on a rough estimate of the present machine-tool stock of the USSR, which provides an index also of its machine-tool producing capacity. There is an important distinction to draw, however, in that the aforementioned raw materials are subject to depletion, whereas the machine-tool park, given its high priority rating, experiences net gains each year.

I come now to my second heading, namely, transportation. The huge physical size of the Soviet Union places a tremendous burden on the transport system of the economy, of which the railroad network is the chief link. Only by the most intensive working of the main rail arteries are the normal peacetime traffic needs of the nation met. The increased load imposed by conditions of war might therefore easily induce serious congestion, even if the transport net were untouched by enemy attack. The Soviet automotive industry, moreover, is not adequate to the job of producing both tanks and trucks, and the curtailment of the latter, without compensating Lend-Lease aid, would be bound to aggravate the manifold difficulties of war supply.

A discussion of Soviet manpower problems without reference to the human reserves of the satellite nations is particularly unrealistic. I shall limit myself therefore to several general observations. One of the most important results of the five-year plans has been the creation in the USSR of an industrial labor force of considerable breadth. In efficiency, however, the new labor force still lags far behind the performance of United States workers. According to most outside estimates, industrial labor productivity in the USSR is less than half that of the United States, and some observers place it as low as one-fifth.<sup>19/</sup> This gap in productivity more than cancels the Soviet superiority in numbers, which, in any event, was greatly reduced as a result of wartime losses. Today the Soviet Union faces a serious shortage of males in agriculture and of skilled workers in many phases of industry. This problem to some extent may be eased through productivity gains but substantial restraining factors in the organization of the economy point to this as a long-range rather than an immediate solution.

Of great significance in the evaluation of the war potential of Soviet industry is its vulnerability to attack. My comments in this regard will be directed solely to the effects of the government's geographic policy and to the existing locational pattern of industry. Concurrently with their drive to industrialize the nation, Soviet leaders have sought to shift the center of gravity of industry from the vulnerable western complex toward areas outside the likely range of military action. The chief result of this policy has been the creation of a new center of heavy industry in the Urals and another new metallurgical base at Kuznetsk some 1,500 kilometers further to the East.

<sup>19/</sup> Siegel, I., "Labor Productivity in the Soviet Union," Journal of the American Statistical Association, p. 75.

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At the outset of the five-year plans the bulk of heavy industry, as well as population, was concentrated in the West, particularly in the Moscow, Leningrad, Baku, and Donbas regions. The line between "west" and "east" which I employ here is the boundary that the Russians themselves use: roughly, it runs north from the Caspian Sea, passing east of the Volga River and west of the Ural mountains, up to the Arctic Ocean. In 1928 over four-fifths of the nation's coal and steel were produced in the West and nearly all of the petroleum. Three-quarters of the population lived in this so-called European area of Russia, and four-fifths or more of the railroad freight originated there. By 1950 these geographic shares had been radically altered. Coal, steel, and petroleum were produced in roughly equal proportions in the West and East, while the percentage of freight traffic originating in the East approached two-fifths of the total volume.

The movement to locate industry "behind the Urals" received a great stimulus under the impact of the German invasion, and the resulting growth of war plants in the East undoubtedly played an important role in the ultimate Soviet victory. The protection which the Urals barrier once afforded, however, is no longer of much significance. The advent of intercontinental bombers has reduced certainly, if not obliterated the geographic security which the Soviets won for their industry just prior to and during the Second World War.

The percentages which I have mentioned regarding the shift of heavy industry toward the East are perhaps satisfactory as indicators of its removal from threatened frontiers, but they fail to provide an adequate measure of industrial dispersal. In fact production for the most part remains highly concentrated in a few key plants or plant complexes, very nearly all of which are within bombing range of potential enemy bases. The bulk of locomotive production, tractors, tanks, rolling stock, automobiles, steel, and machine tools continue to be manufactured in centralized and vulnerable plant locations. Roughly one-half of the nation's oil supply still comes from a single field near the Iranian border and so on. At the same time the requisite labor force for these industries remains grouped in dense urban clusters.

The vast size of the nation does offer the possibility of real dispersal and some steps may now be occurring along this line which are hidden by the censorship screen. However, any such program would be, of necessity, a very long-range affair, severely circumscribed for some time, at least, by shortages of capital and the inadequacies of the transportation net. Decentralization of industry implies among other things an extensive highway system, which would have to be built up virtually from scratch. In addition, the present rail net which is only about one-third that of the United States would have to be radically expanded.

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The possession of a large continental territory may be a potential defensive asset, but given the initial weakness of the transport system it should also be regarded as a present handicap. The size of the USSR and the uneven distribution of resources are responsible, economically speaking, for a greater transport burden per unit of industrial output than exists in any other country in the world.<sup>20/</sup> The traffic densities on the few main arteries also are the highest in the world, which, needless to say, enhances the possibilities for disruptive attacks.

My observations, as presented thus far, have dealt with current Soviet capabilities and weaknesses. In concluding I shall refer briefly to the prospects for the future. For the past several decades, as we have seen, Soviet industrial production has been characterized by extremely rapid growth rates. This was particularly true of the heavy industrial items which were accorded high investment priorities. The average yearly tempos of selected basic industries are summarized in table 3, together with the rates of growth implied by the recently announced targets of the Fifth Five-Year Plan.

Table 3. Average annual rates of growth of selected basic industries in the USSR a/

(In percentages)

Industry	1929-40 <u>b/</u>	1948-52 <u>b/</u>	1953-55 Goal <u>b/</u>
Gross Industrial Production	16.84	19.23	9.69
Coal	13.72	10.67	7.43
Petroleum	8.63	12.60	13.96
Electric Power	20.80	15.33	11.87
Pig iron	13.50	17.29	10.52
Crude steel	12.84	18.74	8.58
Cement	9.74	24.24	17.20

a/ Blackman, J. H., Soviet Industrial Production.

b/ Years are inclusive.

The 1955 goals, it will be seen, are quite modest with respect to the previously realized percentage rates of growth, as are also the Stalin goals for 1960 which were set forth in table 1. The inference to be drawn is that Soviet planners are allowing for an appreciable

<sup>20/</sup> Bergson, A., ed., Soviet Economic Growth: Conditions and Perspectives, Spring 1953. See especially ch. 4 (by Blackman).

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retardation in the relative rates of growth of industrial production over the next 10 years or so. This official expectation is borne out by independent studies which indicate a condition in certain vital fields (for example, ferrous metallurgy) of increasing long-run costs.<sup>21/</sup>

There is every prospect, however, that the announced goals for 1955 and 1960 will be met and, in some cases, exceeded. This should enable the Soviet Union to improve somewhat its industrial position relative to the United States, assuming a continuance of present output trends in each country. At the same time the gap in productivity probably will remain large, as will the volume of output of most of the key items with which we have been concerned. Except perhaps for the solution of the machine-tool bottleneck the Soviet Union seems likely to be seriously plagued in 1960 by the same catalogue of military-economic weaknesses which I have discussed with reference to the present day. On the other hand by that time the importance of industrial war capacity may be considerably altered by the accumulated stocks of nuclear weapons.

QUESTION: My question was originally intended to be directed to Dr. Quigley but I would like to get a reaction from both of you. I would like to know what happens after that planned economy phase which both of you have described. It seems to me eventually the Soviet Union is going to be powerful enough that its people won't have to do any planning in the strict sense they have to do today. Also during this period of time the standard of living will improve substantially and the population will have more. The result would be a dictatorship or might be a reactionary form of government and they might be ripe for revolution. I would like to know, if that should happen, at that time will the Kremlin be flexible enough to remember that dictatorship is a form of expediency only?

DR. QUIGLEY: I don't think he is directing that question to me so much as to a fortune teller. Maybe we will get a classless society and we will all move over there.

MR. ELACKMAN: I doubt if I could answer it.

QUESTION: I am serious about the question. It seems to me unless we are willing to take military action against these people, this is what we have to think of or move forward to. Somebody has to be looking at it.

I have not considered the effect of morale on industrial war capacity--it definitely enters in, however. There was evidence in the last war of substantial disaffection in the Soviet ranks, particularly, in certain areas of the Ukraine. There was also evidence of effective,

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<sup>21/</sup> Ibid. (All chapters)

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fervent, and patriotic devotion to duty on the part of large sectors of the army and the population, sufficient to withstand enormous losses.

DR. QUIGLEY: I didn't mean to be unpleasantly facetious. I would like to say that the Russians cannot go on indefinitely getting bigger and bigger because they will ultimately reach the limits of their resources. Some have already been reached. One of their problems is water. A good deal of southern Russia is becoming rapidly drier, and its people may very definitely reach a limit there which will be highly injurious. If they do keep on with one five-year plan after another, they are going to use less and less good resources. For instance, the metal content of the ore will fall with lower and lower percentages of metal in the ore they will use. We are now working copper ore with infinitesimal quantities of copper.

COLONEL RINDLAUB: Mr. Leon Herman of the Department of Commerce is here. Perhaps you would add to that.

MR. HERMAN: I guess I can be as vague as the next person. I think Jim's emphasis has been, of course, on the primary materials component and the machinery end products that result from it, and in this area they show evidence of tremendous strides. I think what he has omitted from consideration because it bears rather modestly on their war-making capacity has been the whole area of communal comforts of urban living conditions and agricultural production which is the basis for consumer goods problems. I think for this area you can say, whereas the USSR in some of these primary products in Mr. Blackman's presentation is slowly coming up to where we were in 1902 to 1913, in the communal comforts, in the conveniences of decent living, they are probably somewhere in the region of 1890 or so. In some of their largest cities, as you know, they are just now getting gas. They are really where we were some 60 or 70 years back.

So we can assume that much of their widening capacity will be devoted to expanding the agricultural base and improving urban living conditions. All of it will not go into magnifying this machinery capacity which would act, I think, as a retarding influence on their over-all industrial capacity.

MR. BLACKMAN: Could I add one comment here. I think the statement that Russia is running into problems of worsening ores, worsening quality of deposits, and depletion of resources is a good one. In part this is mirrored by table 3 on rates of growth, which shows declining projected tempos in most of the key products. The projections to some extent take account of the troubles that are ahead in various of these sectors.

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QUESTION: You indicated three possible major bottlenecks--transportation, aluminum, and petroleum. I wonder if you could elaborate a little bit on those bottlenecks with a view to telling us how we might possibly exploit them.

MR. BLACKMAN: I think that one of their difficulties in petroleum, which is perhaps the most severe of these items, is the vulnerability of their deposits which are centered in two areas--the Baku area which came under German control in World War II, and now the substantial Emba basin in the Urals. Both of these are concentrated and highly vulnerable, it seems to me, to attack. Their refining and cracking equipment is very inadequate, such that the Soviet scientists and engineers themselves have consciously chosen to continue the production of obsolete transport equipment, locomotives of steam types where Diesels would be preferable, simply because of the short petroleum supply. They say, "We would like to have introduced in greater numbers these petroleum-using locomotives; we can't because of the shortage of petroleum; therefore, we will build the best steam types that we can." Later they may feel the pinch less, which is both a resource pinch and a refinery pinch.

In addition their pipeline capacity is very small. Their pipeline net is tiny as compared with ours, and the steel just isn't being made available for its extension because steel is needed more for other construction.

I can't really do justice to your questions regarding each point. I would like to say in regard to the transport problem however that the traffic densities of the Soviet Union exceed ours by perhaps four times, that is, in ton-kilometers of traffic per mile of line. This to my layman's knowledge, presents an inviting target. But more important than this traffic concentration, it seems to me, is the concentration of the locomotive and rolling equipment factories. These are small in output relative to their needs and they are highly vulnerable.

QUESTION: Russia apparently was quite backward in the early thirties but now is highly industrialized if we can believe reports on jet production and so forth. I am interested in human resources. The Russians must have had a huge program in training to get people to produce these things. Can you say something about that?

MR. BLACKMAN: To begin with the Russians had only ignorant peasant recruits to man these factories, and productivity was extremely low and casualties were many. To correct this they built up a nationwide vocational engineering school system for both formal and on the job training. There remains, I should say, a shortage of skilled personnel, but they have really worked wonders through their technical education program and by borrowing western technicians and "know-how." They are now turning out more engineers and technical people than we do each year. Moreover, they have the power to direct their youth into the

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needed and sensitive occupations. If a man is qualified, he goes to the school the government wants him to attend and, in the particular discipline, that is believed to be crucial. So they have central direction of their labor force in allocating it among factories and in schooling it. They have remained behind in productivity, but remember they started with an uneducated peasant mass, and now they have at least a considerable number of engineers and capable mechanics.

COLONEL RINDLAUB: I am sorry there isn't time for more questions. Mr. Blackman is going to be here this afternoon for discussion with Committees A and B.

Mr. Blackman, on behalf of the faculty and student body, I thank you for this wealth of information you have given us this morning.

(6 July 1953--750)S/en

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