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ECONOMIC INTELLIGENCE REPORT   1ϛ2

LONG-RUN SOVIET ECONOMIC GROWTH

CIA/RR 53

23 December 1954

CENTRAL INTELLIGENCE AGENCY
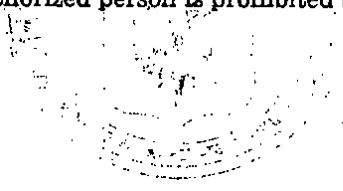
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ECONOMIC INTELLIGENCE REPORT

LONG-RUN SOVIET ECONOMIC GROWTH

CIA/RR 53

(ORR Project 10.406)

CENTRAL INTELLIGENCE AGENCY

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FOREWORD

The primary purpose of this report is to estimate the growth of the Soviet economy over the next 20 years. The report is designed to enable the intelligence community to ascertain the contribution of future Soviet economic strength to the over-all capabilities of the USSR and the economic limitations on probable Soviet courses of action and to serve as a guide in assessing the long-run intentions of the USSR. The results of the report are highly tentative, although they are based upon careful study and research and a wealth of relevant intelligence and statistical data, already developed within ORR. The report is to be considered an early progress report on a subject which is of continuing interest to the intelligence community.

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LONG-RUN SOVIET ECONOMIC GROWTH*

Conclusions

Soviet economic growth is defined as the increase in the ability
of the USSR to produce goods and services and may be measured in terms
of the increase in Soviet gross national product. It is determined by
the quantities of the factors of production available -- land, labor,
and capital -- and by the efficiency with which they are used --
technology, management, the scale of production, and other elements
which can be treated only qualitatively.

It is unlikely that the gross national product of the USSR will
grow at an annual average rate of 5 percent or more over the period
to 1975. The most probable average annual rate of growth will be
between 4.2 and 4.8 percent, depending on the Soviet policy decisions
concerning the allocation of the Soviet gross national product among
various consuming sectors, primarily investment, consumption, and
defense. The chief deterrents to a higher rate are the problems
involved in increasing the output of the agricultural sector above
that projected in this report. This difficulty is illustrated by
the differences in the projected levels of nonagricultural and
agricultural production for 1975: whereas nonagricultural output is
expected to be 170 to 260 percent greater than in 1953, agricultural
output is expected to be only 60 to 80 percent greater than in 1953.

The limits of this range are set by making assumptions as to the
largest and smallest probable growth in consumption and in agricultural
production. Two methods are used in projecting gross national product
in this report.

The above estimates are based, not upon a sample projection of
the gross national product, but upon projections of the principal
factors determining production. To obtain nonagricultural output,
the quantity and quality of labor, the stock of capital, and the
net effect of all other factors (technology, management, and so on)

* The estimates and conclusions contained in this report represent
the best judgment of the responsible analyst as of 13 December 1954.

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are projected. In the case of the agricultural sector, an assumed
level of output serves as a basis for estimating labor and capital
requirements.

A rough comparison of the projected gross national product of
the USSR and that of the US is helpful in assessing the meaning of
estimates developed in this study. This comparison cannot be precise,
because it involves not only all the inaccuracies of projecting both
the USSR and US data but also the inaccuracies of international com-
parison.

The best estimate is that the Soviet gross national product
will increase from $103 billion in 1953 to $290 billion (4.8 percent
per year), assuming low consumption, and $250 billion (4.2 percent
per year), assuming high consumption, in 1975. It is estimated that
the US gross national product will increase from $350 billion in
1953 to $735 billion (3.4 percent per year in 1975). The gap
(in absolute terms) between the US and Soviet gross national product
is expected to increase, even though the Soviet gross national
product is expected to become a larger percentage of the corresponding
US value by 1975.

A basic assumption of this report is that international trade will
increase only slightly and will not contribute to the growth of the
USSR substantially more than it currently does. If, however, the
Soviet policy makers decide to supplement the agricultural output of
the USSR by imports to a significant extent, the rate of growth of
the Soviet gross national product could be higher.

Another basic assumption of this report is that expenditures for
defense will be geared to a continuation of the cold war. If, how-
ever, defense expenditures are less than projected, it is possible
that total production in 1975 would be higher than estimated.

It also should be pointed out that the contributions to the
growth of the USSR made by the Satellites have not been explicitly
considered. These effects have, however, been considered implicitly
to the extent that they have affected Soviet growth in the past.

This report necessarily assumes there will be no basic changes
in the Soviet political system.

Finally, it should be noted that the projections of Soviet out-
put in 1975 are limited to the extent that all economic projections

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over a long period of time are limited. They are based on what is
known about the past developments and present conditions and what
can be deduced from this information and reasonable assumptions about
the future. They are limited to the extent that currently unknown
future events affect the quantities which this report attempts to
estimate.

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I. Introduction.

A. General Point of View.

An economy at any point in time may be regarded as an area having given resources, culture, political and ideological complexion, and international orientation. These conditions have emerged from its past historical development and in turn influence its future development. The problem, then, is to form judgments on the implications of these given conditions with reference to future growth.

It involves the writing of a plausible economic history for the future on the assumption that the future is a logical outgrowth of the past and of clearly identifiable policies as to the future. Its purpose is to reveal basic and persistent trends in the Soviet economy.

It must be emphasized that the data developed here are not to be viewed as a forecast of what will happen to the Soviet economy in the year 1975. On the contrary, these data represent the most likely level to which the Soviet economy can develop on the basis of the past history of the long-run forces and the best current estimates of how these forces may be modified in the future.

Future economic development is primarily concerned with basic cultural phenomena -- for example, population growth, education, producer incentives, consumer demands, and national objectives and ideologies. Although these may change over time, they are likely to be essentially stable or to change along fairly regular trends. Barring war or social cataclysm, the projection of future economic development for a period so short as 20 years is at least not completely hopeless or useless. Indeed, if we knew enough about the basic cultural factors, fairly reliable estimates might be made. The shortcomings of the present report are due primarily to imperfect, incomplete knowledge rather than to the ultimate impracticability of the task.

One qualification, however, is necessary. A feature of the totalitarian state is that social changes can sometimes be imposed by the leadership to a degree not possible in a nontotalitarian state. This is true only when the leadership holds unchallenged authority and then only to a limited degree. Nevertheless, the role of leadership may be such that cultural change may be more rapid or more erratic than in a nontotalitarian regime. But there are limits to cultural change even in a totalitarian country -- as suggested by the experience of the USSR in agriculture.

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B. Definition of Economic Growth.

The economic growth or development of an economy may be defined as the change over time in its ability to generate gross national product (measured in terms of constant prices). This definition refers to productive ability, not necessarily to actual production. It does not refer to the amount of production that the economy actually does or will achieve -- since this amount depends partly on the state of the business cycle or on other temporary, organizational factors. Rather, it refers to the amount of production attainable at reasonable levels of "full employment." The purpose is to estimate attainable productive ability, not actual production. The question is: how much could the USSR (or the US or any of the other relevant areas) produce, at various times in the future, if its economy were operating at practicable full employment?*

C. Factors Determining the Rate of Economic Development.

Growth in the ability of an economy to produce is determined by the quantity and quality of its productive resources -- labor, capital and natural resources -- and the efficiency with which they are used. A more detailed examination of the factors to be considered follows.

1. Supply of Labor.

The supply of labor depends on the size of the population, the proportion of the population in the labor force, and the number of hours worked during a year. The proportion of the population in the labor force in turn depends on the age and sex composition of the population, the number of persons in schools, practices with respect to retirement, and the employment of women and children. The quality of the labor force also affects the supply of labor: an increase in skills through education or training will increase the effectiveness of a given number of workers.

2. Supply of Capital.

The supply of capital depends on the amount of investment and on the current size of, the rate of retirement from, and the

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* In estimating future productive ability, one cannot wholly disregard the business cycle in Western countries or temporary periods of disorganization or structural imbalance in the Russian orbit, because these will affect the rate of capital accumulation.

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composition of the capital stock.

3. Supply of Natural Resources.

The supply of natural resources depends on the quantity and characteristics of the land and available natural materials (that is, known and technically exploitable resources).

4. Efficiency.

The efficiency with which these resources are utilized depends on (a) the technology used and the speed with which new techniques are developed and incorporated into the production process; (b) the skill of management to operate individual plants at minimum costs consistent with given levels of output; (c) the ability to take advantage of specialization and division of labor consistent with given levels of national output; (d) the ability to take advantage of international specialization and division of labor through international trade; and (e) the degree to which production is coordinated with demand or plan and to which priorities are assigned so that urgently needed goods are produced ahead of less urgently needed goods and so that bottlenecks, gluts, and unemployment are avoided.

To account for past growth or to estimate future growth requires the measurement of past or prospective changes in these factors, but only a few of them are directly measurable. The rest are qualitative in nature, and the best that can be done with respect to them is to attempt to measure their effects on production.

D. Methods of Approach.

It is clear that these factors do not affect the development of the different sectors of the economy to the same degree. Ideally, their effects upon each of the principal sectors should be studied separately: the results of these studies should then be checked for consistency and finally combined. For the purpose of this study, the economy is subdivided into two sectors, the agricultural and the nonagricultural.

Two methods are employed to estimate the gross national product of the USSR in 1975: the "labor force productivity method" and the "factor inputs method."

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1. Labor Force Productivity Method.

The labor force productivity method involves a study of
the past and a projection of the future size of the Soviet labor force
in the agricultural and the nonagricultural sectors. Changes in out-
put per man-year in the agricultural and nonagricultural sectors are
calculated for past years and projected. The projections of the labor
force and of output per unit of labor are then combined to obtain agri-
cultural and nonagricultural output. The sum of the agricultural and
nonagricultural projections for 1975 is the gross national product
estimate for the USSR for that year. In this method the only factor
which is explicitly measured and projected is the size of the labor
force. The net effects of the remaining factors are considered as a
whole as they affect the output per unit of labor.

2. Factor Inputs Method.

The factor inputs method treats the agricultural and non-
agricultural sectors separately and both labor and capital explicitly.
The labor and capital requirements in agriculture are projected to per-
mit a reasonable growth in agricultural output. This growth is con-
sistent with the projected growth in consumption and with the past
history and present situation of agriculture in the USSR. Nonagricul-
tural output is based on the projections of labor and capital and the
efficiency with which they are combined. Labor and capital are the
only basic inputs which can conveniently be measured. The projection
of efficiency is an attempt to measure the net effect of the multitude
of all the other forces described above. The combining of these three
projection yields an estimate of nonagricultural output. In projecting
the labor force by this method, adjustments are made to account for the
changes in the quality of labor due to increases in skills and educa-
tion. Actually, two estimates of both nonagricultural and agricultural
output are made for 1975 -- one based on a low consumption-high in-
vestment policy of the government, the other on a high consumption-low
investment policy. High and low estimates of the gross national pro-
duct of the USSR in 1975 are obtained by combining the projections for
the two sectors.

E. Assumptions.

A study of future economic growth necessarily rests upon
assumptions regarding the conditions -- especially political con-
ditions -- likely to obtain during the period under consideration.
The following assumptions underlie this study:

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1. That there will be no changes in international boundaries.

2. That there will be no large-scale war but that psychological, political, and economic conflicts will continue at present levels of intensity.

3. That there will be no basic changes in the internal political and economic system.

4. That the national objectives of the USSR will remain unchanged throughout the period.

5. That the foreign trade of the USSR will increase only slightly and will not contribute to the growth of the USSR substantially more than it currently does.

All the conclusions of this study are strictly relative to these assumptions.

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II. Labor Force Productivity Method.

The first of the two basic methods, the labor force productivity method, is the one most often used to project the growth of an economy. This method involves the following steps: (1) study of the past production of an economy; (2) analysis of the historical development of the labor force and a projection of the labor force based on this analysis and on reasonable assumptions as to how the forces influencing the development of this factor will operate in the future; (3) similar historical analysis and projection of the productivity of labor; and (4) combining of the projections of the size of the labor force and labor productivity to obtain the projection of gross national product of the USSR in 1975.

A. Past Production Trends.

The past growth of production in the USSR can be illustrated most vividly by means of data on the actual physical output of important commodities. Figures 1 and 2* present a variety of data on the production of specific agricultural and industrial commodities and services in the USSR** over the period from 1900 to 1953. Table 1*** and Figure 3**** present summary data (in 1951 rubles) on value added***** in the agricultural and nonagricultural sectors and on gross national product.

The data clearly indicate the sharply divergent movements of nonagricultural and agricultural production in the USSR. Nonagricultural production has increased persistently and, since the late 1920's, dramatically. Agricultural production, on the other hand, has floundered and the trend has been much less clearly defined.

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* Following p. 12. Tables on which these figures are based are in Appendix A.
** Part of the period covered by this study antedates the Russian Revolution. The term USSR, when applied to data prior to 1917, refers to the Tsarist Empire.
*** Table 1 follows on p. 12.
**** Following p. 12.
***** Throughout this report the estimates of and references to output or product for the entire economy or any sector of it should be taken to mean value added and not gross production.

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Table 1

Production (Value Added) in the USSR, by Sector a/
Selected Years, 1902-53

Billion 1951 Rubles

Year	Gross National Product	Agricultural Sector	Nonagricultural Sector
1902	281	210	71
1913	363	245	118
1928	414	296	118
1938 b/	668	307	361
1947	634	257	377
1948	701	255	446
1949	757	258	499
1950	851	287	564
1951	904	275	629
1952	1,003	309	694
1953	1,031	289	742

a. Data in this table are based on Appendix A.
b. Data for 1938 have been adjusted for boundary changes resulting
from World War II.

The average percentage annual changes in nonagricultural pro-
duction, agricultural production, and gross national product between
selected years are shown in Table 2.*

The past production data are difficult to interpret because
of the extremely varied conditions in the USSR during the period
under study. There were 2 major wars and 1 minor war, a revolution,
changes in boundaries, and changes in economic organizations and
economic objectives. In addition, agricultural production was affec-
ted by violent changes in weather and other crop conditions. Since
the end of World War II the Soviet economy has grown at the very high
rate of 8.4 percent per year. This rate reflects to a great extent
the process of reconstruction, as evidenced by a decrease in the rate

* Table 2 follows on p. 13.

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INDEXES OF PRODUCTION OF
SELECTED AGRICULTURAL COMMODITIES
SELECTED YEARS, 1900-1953
(1946=100)
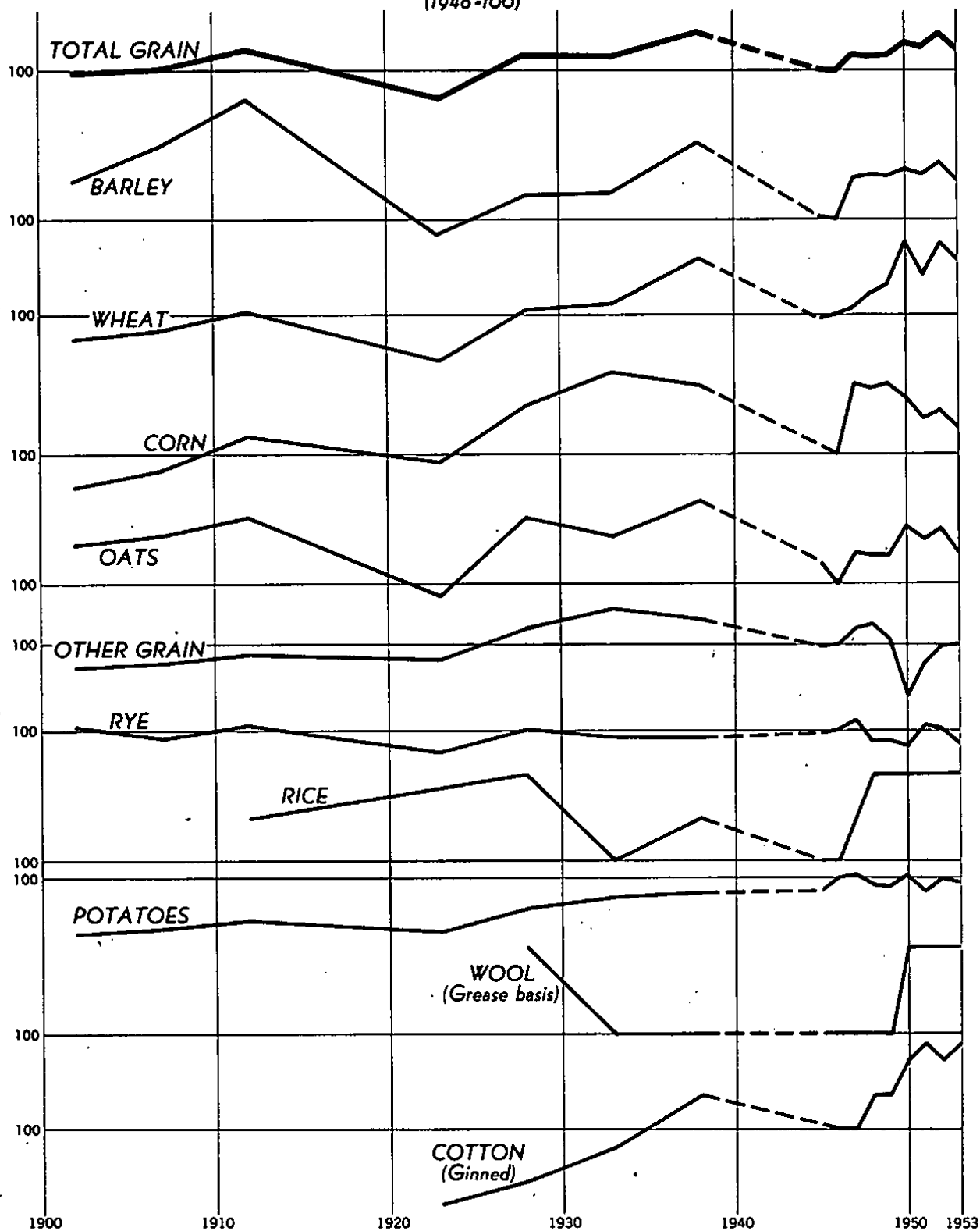
TOTAL GRAIN

BARLEY

WHEAT

CORN

OATS

OTHER GRAIN

RYE

RICE

POTATOES

WOOL
(Grease basis)

COTTON
(Ginned)

1900   1910   1920   1930   1940   1950   1953

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INDEXES OF PRODUCTION OF
SELECTED INDUSTRIAL COMMODITIES
SELECTED YEARS, 1900-1953
(1948 = 100)

REFINED SUGAR

COTTON YARN

LEATHER AND
RUBBER SHOES

PRIMARY COPPER

UNGLAZED BRICKS

CRUDE PETROLEUM

TOTAL COAL PRODUCTION

RAW STEEL

RAILWAY FREIGHT

ELECTRIC POWER

OVER 10 YEARS 10.0%
7.5%
5.0%
2.5%
0

Slope of line represents
rate of increase per year.

1900 1910 1920 1930 1940 1950 1953
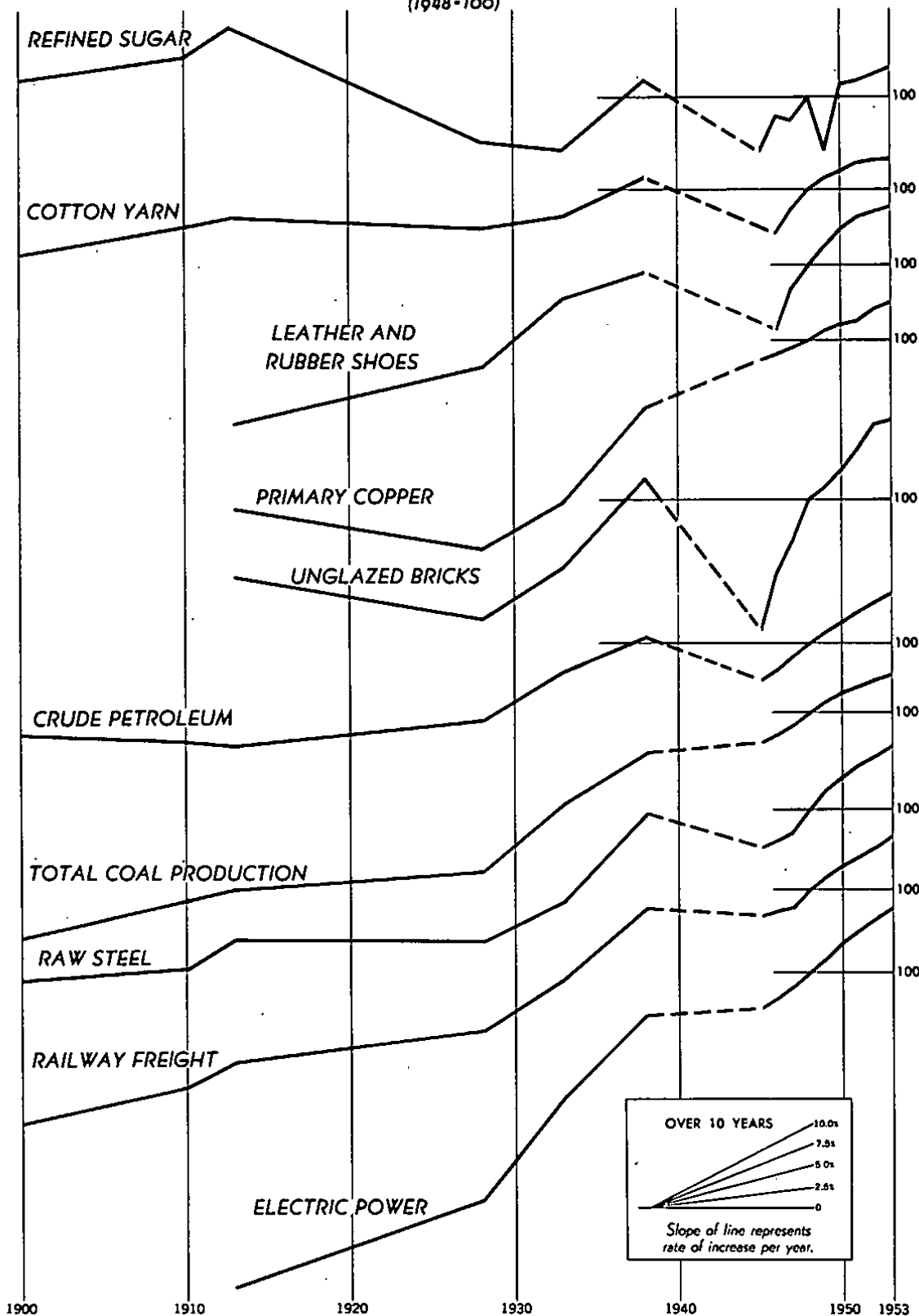
13641 12-54   SECRET   Plotted on semi-logarithmic grid.

Figure 3

USSR
GROSS NATIONAL PRODUCT, BY SECTOR
SELECTED YEARS, 1900-1953
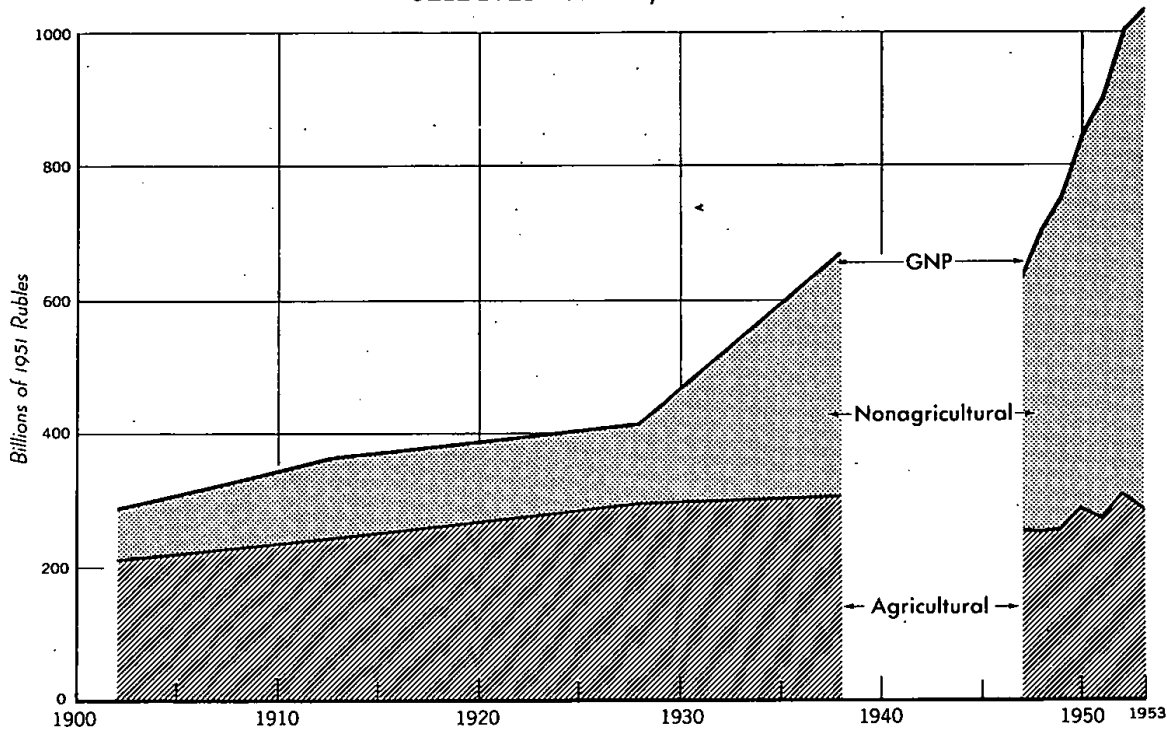
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of growth in the nonagricultural sector from 18.3 percent for 1947-48
to 6.9 percent for 1952-53. The average annual rate of growth in gross
national product in the early postwar period (1947-50) of 10.3 percent
fell to 6.6 percent for the period 1950-53.

Table 2

Average Annual Rates of Growth
in Soviet Gross National Product, by Sector a/
Selected Years, 1902-53

Percent

Period	Gross National Product	Agricultural Sector	Nonagricultural Sector
1902-13	2.4	1.4	4.7
1928-38	4.9	0.4	11.8
1947-50	10.3	3.8	14.4
1950-53	6.6	0.2	9.6
1947-53	8.4	2.0	12.0
1902-53	2.6	0.6	4.7

a. Data in this table are based on data in Table 1.

B. Labor Force: Trends and Projection.

The labor productivity method requires a projection of the
Soviet labor force to 1975, in total and broken down between the agri-
cultural and nonagricultural sectors. Studies of the past and esti-
mated future size of the following are considered in the projection
of the Soviet labor force (see Appendix B): (1) population by age-sex
group; (2) participation of each age-sex group in the labor force;
(3) labor requirements in agriculture, leaving the nonagricultural
labor force to be computed as a residual; and (4) average hours worked
per year by Soviet labor.

Table 3* shows the estimated and projected population of the
USSR in selected past years and in 1975 and also its average rate of

* Table 3 follows on p. 14.

growth between these years. The growth in population has been erratic, particularly during the Soviet era of war, revolution, boundary changes, and economic dislocation. On the assumption of more stable conditions, the 1975 population is estimated by the US Bureau of the Census to be 301.7 million. This estimate involves a projected growth rate for the period 1950-75 of approximately 1.65 percent per year and an over-all increase of about 50 percent.

Table 3

Estimated and Projected Population of the USSR a/
Selected Years, 1860-1975

Year	Population (Millions)	Average Annual Rate of Growth b/ (Percent)
1860	74.1	
1902	136.0	1.5
1913 c/	161.7	1.2
1928	148.0	-0.6
1938 d/	191.0 e/	2.6 e/
1950	200.0	0.4
1953	210.8	1.8
1975	301.7	1.6

a. Data in this table are based on Table 19, p. 72, below.
b. The change represented is that from the previous year shown.
c. Territory in 1913 is approximately the same as in the years following World War II.
d. Data for 1938 have been adjusted for boundary changes resulting from World War II.
e. Includes 21 million people acquired in new territories. The average growth rate, 1928-38, in terms of constant territory would be 1.4 percent.

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Table 4* shows the estimated and projected labor force of the USSR in numbers of persons and as a percent of the population. It indicates that the labor force has increased absolutely but has been a declining percentage of the population since 1928. This relative decline has been due in part to the transfer of population from the country to the cities, with a resulting fall in the participation of women.**

The ratio of the Soviet labor force to population is expected to continue to decline from 1950 to 1975. The principal reasons to expect this decline are the following:

1. Almost all persons less than 15 years of age will be enrolled in school, and the proportion of these persons in the labor force will decline to 2 percent by 1975.***

2. The participation of males in the 15-59 age group will gradually fall to 89 percent as school enrollments of those 15 years of age and over increase.

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 * Table 4 follows on p. 16.
 ** The 1950 ratio of labor force to population is still slightly higher in the USSR than in most industrialized Western countries, as the following tabulation shows:

Country	Year	Population Economically Active (Percent of Total)
Czechoslovakia	1947	48.1
Denmark	1952	49.9
Finland	1950	49.2
France	1946	51.5
Italy	1951	43.1
Japan	1950	43.7
Netherlands	1947	40.2
Norway	1950	42.6
Sweden	1950	44.3
UK	1951	46.2
US	1950	39.9
USSR	1950	50.0
West Germany	1950	46.3

*** For a discussion of educational enrollments, see Appendix B.

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Table 4

Estimated and Projected Labor Force of the USSR a/
Selected Years, 1902-75

Year	Number (Millions)	As a Proportion of Population (Percent)
1902	80.0	59
1913	95.0	59
1928	81.6	55
1938 b/	90.3	47
1950	100.4	50
1953	104.6	50
1955	109.4	50
1975	132.6	44

a. Data in this table are based on Table 6, p. 20,
below.
b. Data for 1938 have been adjusted for boundary
changes resulting from World War II.

3. The participation of females in the 15-59 age group will
gradually fall until it reaches 50 percent in 1975. This decline is
expected for several reasons:

a. There will be some easing of demand for labor as com-
pared with the recent period of postwar reconstruction.

b. Increasing urbanization may tend to reduce the number
of women in the labor force, or at least the number of women counted
in the labor force.

c. The surplus of females over males in the 15-59 age
group was 13.3 million in 1953. This surplus will decline to 3.6 mil-

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lion by 1975, and the decline should reduce the number of unmarried women as well as the participation of women in the labor force.*

4. The average age of retirement of older workers will drift downward, and the proportion of persons 60 years and over in the labor force will decline.

All these changes would result in a lower participation of the population in the labor force (as shown in Table 5**) and in a labor force in 1975 of about 44 percent of the total population (compared with about 40 percent for the US in 1950).***

The projected increase in the total labor force between 1950 and 1975 from 100.4 millions to 132.6 millions (or by about one-third) is equal to an increase of about 1.1 percent per year (compounded). Since the increase will be made up primarily of males in the prime ages between 15 and 59, its effect on productivity may be relatively greater than the numerical increase would suggest.

In dividing the projected labor force between agriculture and nonagriculture, the agricultural labor force was projected separately, and the nonagricultural labor force was computed as a residual.

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* A different view of the participation of women is held by W. W. Eason, who says: "...The percentage of females 16-59 in the labor force, 67.0 in 1949, is assumed to be 70.0 in the projection. This is by way of acknowledging that the postwar decrease in the ratio of males to females in the population generally has probably created an extra incentive for females to be in the labor force; and the tendency is assumed to be maintained through 1970." 1/

50X1
50X1

Mr. Eason does not take into account the strong likelihood that the present imbalance between the sexes will be largely corrected over the next 20 years.

** Table 5 follows on p. 18.

*** Another factor determining extent of participation in the labor force is the degree of urgency of demand for production. Particularly in time of war or national emergency, the labor force will be larger than in peacetime. In this study, urgency of demand is assumed to be constant throughout the period 1953-75. This assumption is implicit in the general assumption of no change in the intensity of the cold war.

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Table 5

Participation of the Population in the
Labor Force of the USSR
1950 and 1975

Age Group	Percent of the Corresponding Age Group	
	1950 a/	1975 b/
Male		
0-14	6	2
15-59	94	89
60 and over	60	32
Total	59	56
Female		
0-14	7	2
15-59	61	50
60 and over	33	32
Total	42	32
Male and female		
0-14	7	2
15-59	75	69
60 and over	44	32
Total	50	44

a. Current estimate.
b. Based on Table 20 and assumptions stated
in the text.

The agricultural labor force declined as a percent of the
total labor force from over 80 percent in 1928 to about 50 percent in
1950. It declined in absolute terms as well during the 1930's, then
recovered slightly during the postwar period.

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The future division of the labor force between the agricultural and nonagricultural sectors will be determined primarily by the agricultural policy of the USSR. To feed and clothe a growing population, even at present levels of per capita consumption, will require continuously expanding agricultural production. If efforts should be made to raise per capita consumption, even greater expansion of agricultural output would be needed. The question then is: how many farm workers will be needed to meet the agricultural objectives?

It is here assumed that the agricultural labor force will rise slightly to 1955 and then remain constant at the 1955 level of about 55 millions. This assumption is based on the following considerations: (1) the regime will probably continue to encourage the movement of people from the country to the cities in order to expand industrial production, and thus the growth of rural population will be drained off to the cities; (2) the marginal product of agricultural labor is still very low, and it is unlikely that substantial increases in agricultural production would result from increasing the number of workers; (3) while the recent trend of the agricultural labor force has been gradually downward, the demand for farm products arising from the increasing number of mouths to feed will probably prevent further substantial reductions in the rural labor supply.

This projection of the agricultural labor force seems to be consistent with any reasonable projection of agricultural output. (For a further discussion of the agricultural problem, see III, B, below.)

Given the total labor force and the agricultural labor force, the nonagricultural labor force is computed as a residual. All three are shown in Table 6* and Figure 4.**

A further step in estimating the effective labor supply is to adjust the number of workers to account for changes in average annual hours. Such an adjustment is made only for the nonagricultural labor force, the concept of average hours being indefinite in agriculture, where much work is seasonal and where leisure and working hours cannot be clearly separated. In the nonagricultural sector, average working hours declined steadily from 1897 to 1938, and then rose under the impact of war and reconstruction needs. They are

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* Table 6 follows on p. 20.
** Following p. 20.

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projected as remaining constant after 1953. (See Appendix B for details.) The adjusted nonagricultural labor force is shown in Table 6.

Table 6

Total, Agricultural, and Nonagricultural Labor Force a/
of the USSR 2/
Selected Years, 1902-75

Million Persons or Man-years

Year	Total Labor Force	Agricultural Labor Force b/	Nonagricultural Labor Force c/	Adjusted Nonagricultural Labor Force d/
1902	80.0	69.0 e/	11.0 e/	12.0
1913	95.0	80.0 e/	15.0 e/	15.6
1928	81.6	67.8	13.8	13.2
1938 f/	90.3	53.3	37.0	30.3
1950	100.4	51.8	48.6	48.6
1953	104.6	52.7	51.9	50.9
1955	109.4	55.0	54.4	53.3
1975	132.6	55.0	77.6	76.0

a. Average for stated year, 1928-55. Beginning of year 1902, 1913, and 1975.
b. Includes collective and individual farmers and state agricultural workers.
c. Includes workers and employees (excluding state agricultural workers), military personnel, forced labor, and artisans..
d. Adjusted for changes in the average work year according to the following indexes: 1902 = 108, 1913 = 104, 1928 = 96, 1938 = 82, 1950 = 100, 1953 = 98, 1955 = 98, 1975 = 98.
e. Based on the estimated distribution of the population between rural and urban.
f. Data for 1938 have been adjusted for boundary changes resulting from World War II. Adjustment of 1938 figure for contemporary boundaries to account for labor acquired from new territories: 7 million agricultural and 3.5 million nonagricultural workers added.

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Figure 4

POPULATION AND LABOR FORCE
SELECTED YEARS, 1900-1953 and 1975

301.7

Legend:
- Persons not in the Labor Force
- Nonagricultural Labor Force
- Agricultural Labor Force

Millions of Persons
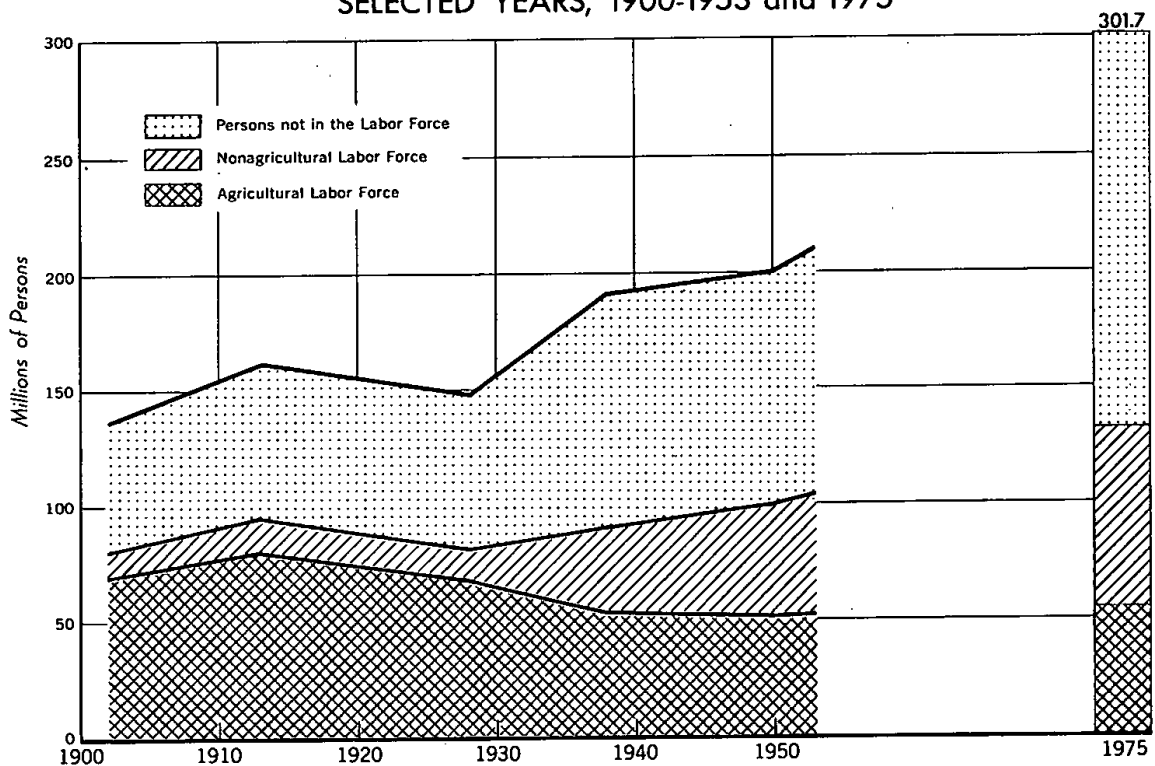
13643 12-54

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The projection of the total labor force for 1975 shows an increase of one-third over 1950. The unadjusted nonagricultural labor force shows an increase of over 60 percent, while the adjusted non-agricultural labor force involves a somewhat smaller increase because of the small drop in the number of hours worked per worker from 1950 to 1953.

C. Labor Productivity: Trends and Projection.

The materials required for projecting Soviet labor productivity are now assembled. Output per man-year is computed as the ratio of output (Table 1) to labor force (Table 6). Table 7* presents data on output per man-year for the agricultural and nonagricultural sectors in selected past years and in 1975. The average annual percentage increases in output per man-year, computed from Table 7, are as follows:

Period	Agricultural Sector	Nonagricultural Sector
1902-13	0.3	2.3
1928-38	2.8	2.9
1950-53	0	8.0
1902-53	1.2	1.8
1928-53	0.9	2.0
1938-53	-0.4	1.4

An examination of average annual percentage changes in output per man-year shows quite clearly the broad developments within the Soviet economy during the period under question. Before World War I, output per man-year was growing slowly in agriculture and somewhat more rapidly in the nonagricultural sector. During the period 1928-38, when millions of surplus workers were being transferred from the farms to the cities, man-year productivity increased at about the same rate in both sectors. After World War II, however, the rise in nonagricultural output per man-year was spectacular, whereas the increase in the agricultural sector was small.

In interpreting the data on output per man-year in agriculture, it must be recognized that a major factor explaining past increases was the transfer of surplus, unproductive labor from farms to the cities. This reduction in farm labor supply did not substantially

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*   Table 7 follows on p. 23.

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affect total agricultural output, and output per man-year, therefore,
increased. There still may be some surplus labor power on the farms.
Under the assumptions of this report, however, the agricultural labor
force will be maintained at the 1955 level, and the remaining surplus
labor on the farms will be absorbed in the effort to meet the growing
needs of the USSR for food and fibre. Future increases in output per
man-year, on this basis, will be achieved only by increasing total
output, not by reducing the number of workers.

In view of these considerations, it is apparent that the
average annual increase in agricultural output per man-year of 2.8 per-
cent during the period 1928-38 was higher than can be maintained in the
future. Since World War II, agricultural production has been adversely
affected by generally unfavorable weather conditions. A rate of in-
crease of about 2 percent* per year 3/ is reasonable on the basis of
past experience. Such a rate would raise the agricultural output per
man-year from 5,500 rubles in 1953 to 8,700 rubles in 1975.

In the nonagricultural sector the increase in output per man-
year has been extremely erratic, partly because of the effects of
World Wars I and II. During the 1928-38 period the growth of the
economy was stimulated by forces which are not expected to exist, or
at least to be so strong, in the future. As the USSR industrialized
rapidly, a great many activities which had previously been performed
within the household entered the "market" (or rather "socialized")
sector of the economy and were consequently registered in the national
product. In addition, the very backwardness of the USSR at the begin-
ning of the period tended to strengthen the effect of the introduction
of foreign technology. The postwar rise in nonagricultural output has
probably been a temporary spurt due to a conjunction of circumstances:
(1) recovery from a low initial level of man-year productivity after
World War II; (2) a sudden harvesting of the results of the extensive
preparatory activities during the 1930's in the form of education,
capital investment, technological advance, improved organization, and
so on; and (3) widespread industrial experience acquired during World
War II. It seems unrealistic to expect indefinite continuation of
rates of increase such as those of recent years. In fact, the rate
of increase has been declining since 1947. From 1947 to 1950, it was
about 12 percent; from 1950 to 1952, 8 percent; and from 1952 to 1953
about 5 percent, although output in 1953 was probably depressed by

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* This rate is substantially higher than that attained over the
period 1902-53.

the necessity for adjusting to a new economic policy. In the absence of such a policy shift, output per man-year in the nonagricultural sector would probably have increased at the 1952 rate of 6 percent.

It is estimated, therefore, that an annual rate of increase of perhaps 3 percent in the nonagricultural sector might be maintained over a long period. (The US figure is about 2.5 percent.) With these benchmarks, it seems reasonable to assume a progressive decline in the annual rate of growth of nonagricultural output per man-year from 5 or 6 percent in 1953-54 to 3 percent by 1965 and thereafter. On this basis, the output per man-year in the nonagricultural sector would rise from 14,600 rubles to approximately 32,600 rubles over the period from 1953 to 1975 (an average annual rate of growth of approximately 3.7 percent).

Table 7

Output per Man-Year in the USSR, by Sector a/
Selected Years, 1902-75

	Thousand 1951 Rubles	
Year	Agricultural Sector	Nonagricultural Sector b/
1902	3.0	5.9
1913	3.1	7.6
1928	4.4	8.9
1938	5.8	11.9
1950	5.5	11.6
1953	5.5	14.6
1975	8.7 c/	32.6 d/

a. Calculations for 1902-53 based on man-year data in Table 6 and output data in Table 1.
b. Based on adjusted data in Table 6.
c. Projected on an assumed 2 percent annual rate of growth.
d. Projected at decreasing rate, from 5.5 percent in 1954 to 3 percent in 1965, and at a 3 percent fixed rate from 1965 to 1975.

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D. Projection of Gross National Product, Labor Force-Productivity
Method.

Given projections of the labor force in man-years and of output
per man-year, for the agricultural and nonagricultural sectors (shown
in Figure 5*), it is possible to compute total output within each sector,
and by adding these, to derive total gross national product. The re-
sulting estimates for 1975 are, for the agricultural sector: 478 billion
1951 rubles; for the nonagricultural sector: 2,478 billion 1951 rubles,
and for the total (gross national product): 2,956 billion 1951 rubles.
These estimates imply an average annual rate of growth between 1953 and
1975 of about 4.8 percent in gross national product, 5.7 percent in non-
agricultural production and 2.0 percent in agricultural production.

* Following p. 24.

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PRODUCT, MAN-YEARS OF LABOR, AND
PRODUCT PER MAN-YEAR
SELECTED YEARS, 1900-1953 and 1975
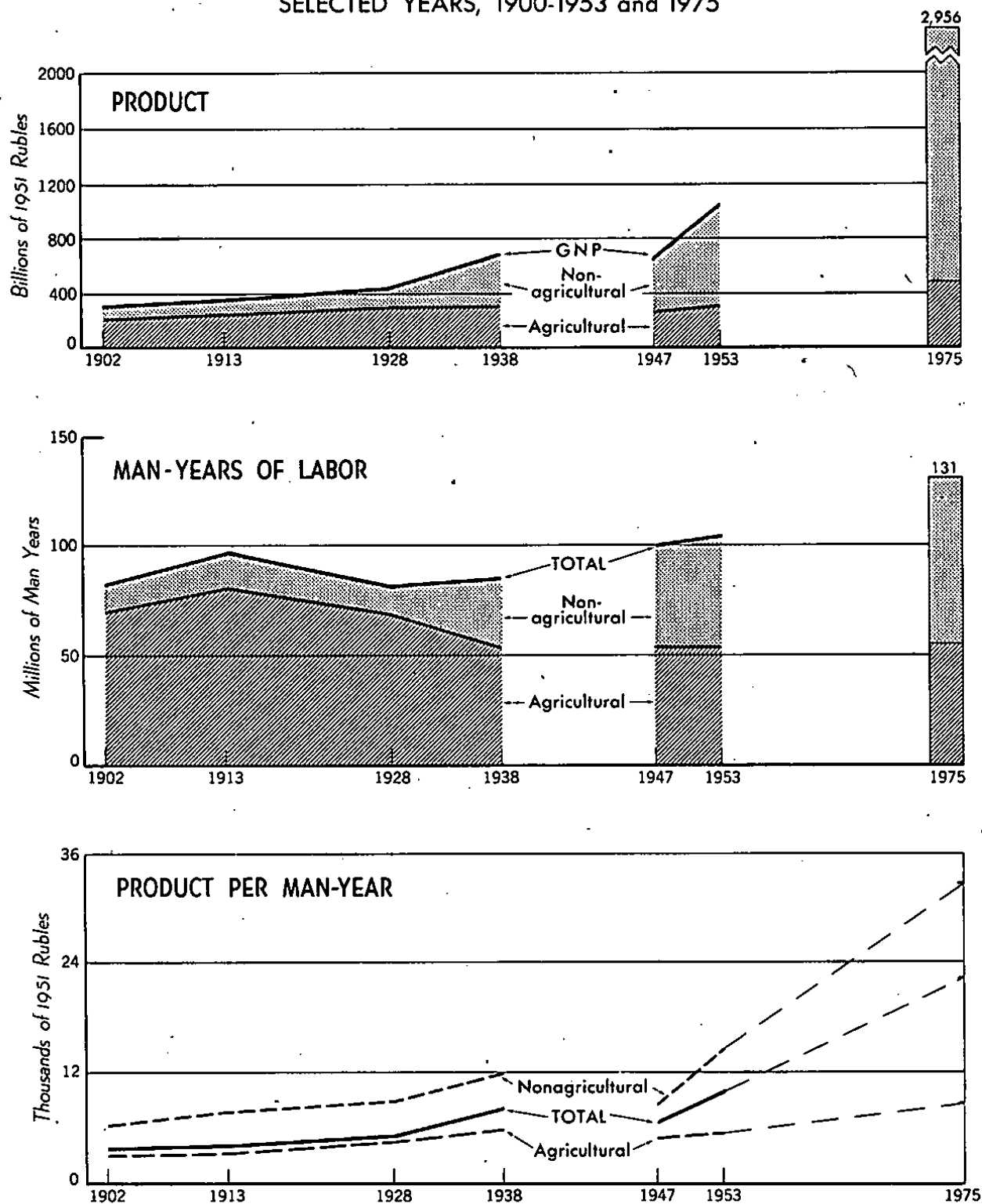
III. Factor Inputs Method.

    A. General Methodology.

        As was explained in Section I, the factor inputs method of estimating the Soviet gross national product for 1975 consists of projecting not only the size of the labor force but also several of the elements which influence labor productivity. The most important of these are the quality of labor and the stock of capital. The effects of changing technology, management, foreign trade, and scale of production also are considered. The nature of the relationship between the factors of production (inputs) and outputs varies substantially between one type of economic activity and another. The most significant difference, however, is between agriculture and the rest of the economy.

        Agriculture faces the problem of the scarcity of arable land. In fact, many students of the subject regard this factor as being substantially fixed. This means that increases in agricultural production are likely to require increasing amounts of inputs (labor, capital, or both) per unit of output. The tendency toward diminishing returns in agriculture is believed to be serious enough to warrant separate consideration.

        In the nonagricultural sector, on the other hand, land is of relatively little importance, while capital and labor can be substituted for each other with comparative ease in the long run. In addition, improvements in technology and management appear to be easier to effect in this sector than in agriculture. Nonagricultural output for 1975 is estimated by projecting the supply of labor and capital and the net effect of all the other forces. In making this estimate, it is necessary to estimate the future allocation of gross national product by end use -- consumption, defense, investment, and administration. Two assumptions are made as to this allocation. Assumption A represents a low consumption-high investment policy, and assumption B represents a high consumption-low investment policy. The final projection, therefore, is in the form of a range whose limits are determined by assumptions A and B.

        In the agricultural sector, levels of production are assumed which are broadly consistent with the assumptions as to the future level of total consumption. This assumption is necessary because most of the agricultural production takes the form of consumer goods

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in the final product. The labor and capital requirements of these two assumed levels of production are then determined.

The rest of this section is concerned with the projections of gross national product in the USSR for 1975 by the factor inputs method. First, the agricultural estimates are made; then the non-agricultural projections are developed; and, finally, the projections of the two sectors are combined.

B. Agricultural Production and Factor Requirements: Trends and Projections.

1. General Statement of the Agricultural Problems and Historical Summary.

The USSR has had great difficulty expanding agricultural production. This problem is rooted in an essential fact -- the relative scarcity of arable land and the low productivity of much of the arable land as a result of climatic conditions.* This situation is aggravated by institutional inefficiencies and by the lack of incentives to agricultural workers, which stem from collectivization and from past emphasis on industrial growth.

Agricultural production increased by only 4 percent in the 1930's** (primarily in industrial crops). The rapid mechanization of agriculture during this period, although it succeeded in increasing labor productivity and freeing agricultural labor for other uses, had little effect on yields per acre. In addition, Soviet agriculture was hit very hard by peasant resistance to the collectivization program during the early and mid-1930's and by the destruction which took place in World War II. In the course of these events, livestock herds were decimated. As a result, the level of meat consumption per capita in 1938 was only three-quarters of the 1927-28 level, and it

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* "About 30 % of the Soviet territory is completely barred from agricultural use by climatic conditions. In the vast forest zone, the expansion of agriculture is limited by both climate and soil factors. On the other hand, in the forest-steppe and steppe zones, the crop area is expanded to its limits, and there is no more free land for occupation in these zones. Land used for agriculture occupies less than one sixth of the entire territory of the USSR, and, if the poor pastures are excluded, less than one eighth of the territory." 4/
** See Table 17, p. 61, below.

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has not risen since then. There was also a rapid drop in the number of draft animals, which was a partial offset to the increase in the number of tractors and combines. The improvement in grains and industrial crops during the late 1930's was partly a result of exceptionally favorable weather conditions.

Recovery from World War II has been spotty but rapid. Eighteen percent of gross investment was in agriculture during the 1948-53 period. 5/ The fixed capital stock in agriculture probably nearly reached the prewar level in 1950 and had substantially exceeded it by 1953. The bulk of this new capital, however, was in the form of machinery and vehicles; there is still a serious shortage of buildings to house vehicles and livestock. In spite of all these efforts, crop yields in 1950-53 were probably not above the 1913 level, and food consumption per capita was below the 1927-28 level.

2. Present Agricultural Problem.

Given the recent increased emphasis on consumption in the USSR and the fact that rapid economic growth in the future may entail substantial increases in total per capita consumption, it is reasonable to expect even greater Soviet efforts to increase agricultural production than in the past. Several serious problems present themselves, however.

Increased production requires increases in yields per acre or in acreage or in both. It is difficult to increase either, for the areas receiving adequate rainfall are also, in general, areas of poor soil and short growing seasons, while areas having the best soil often have uncertain or deficient rainfall. Not many opportunities remain for irrigation, except in areas far removed from the water supply, and then at very high cost.

In the northern regions there is adequate rainfall, but there are also short growing seasons. It is believed to be difficult to increase productivity per acre on dry land with known techniques. Fertilizer, for example, has not been in general effective where water is lacking.

In addition to the technical and resource problem, there is an institutional and human problem. Many authorities believe that the present institutional organization of agriculture, the lack of incentives to farmers, and the scarcity of skilled workers and trained managers exercise a strong depressive effect on production.

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There are many possibilities for increasing labor productivity in agriculture through greater investment and improved techniques. In spite of the rapid mechanization of Soviet agriculture, there are still three times as many agricultural workers per acre in the USSR as in the US. The problem is to increase yield per acre. Many improvements are certainly possible. Techniques of livestock management, feeding, and breeding can be substantially improved. The increased use of fertilizer can greatly raise crop yields in areas of adequate rainfall. Improved practices of cultivation and harvesting are possible, and new types of seeds requiring less moisture and warmth may be developed. Increased building space will increase the productivity of livestock, grain acreage, and machines. Moreover, it is possible that changes in agricultural institutions, increased incentives for farmers through price and tax concessions, and a flow of more highly trained and educated personnel to the rural areas will have important effects. The average level of education of farm workers may rise as much as 50 percent between 1950 and 1957 (see C, 2, below).

3. Projection of Agricultural Output and of Factor Requirements in Agriculture.

In order to estimate the volume of agricultural output in 1975 and to determine the factors required for this output, reasonable assumptions must be made as to Soviet policy decisions regarding the future allocation of resources to the various consuming sectors of the economy. Two sets of assumptions concerning this allocation are made. Assumption A corresponds to a low consumption policy; assumption B, to a high consumption policy. The counterparts of these policy assumptions in the nonagricultural sector are discussed in C, 5, below.

Assumption A projects an increase in per capita consumption of agricultural commodities of 1.6 percent per year and of 2.2 percent in total agricultural output between 1953 and 1975 -- a total increase of about 60 percent. According to assumption B, there will be a substantial increase in agricultural production per capita from 1953 to 1957 such that (a) caloric intake per capita will increase by about 10 percent; (b) per capita consumption (in calories) of meats, dairy products, vegetables, fruits, and so on will increase by 50 percent; and (c) per capita consumption of grains and potatoes will decrease by about 10 percent, leaving total caloric intake at a level 10 percent higher. Under

.assumption B total agricultural production would increase by about
82 percent over the period 1953-75, or at 2.8 percent annually
(1.2 percent per capita). It is necessary to estimate input re-
quirements for each of these two output projections.

The agricultural labor force is assumed to rise to
55 million in 1955 and to remain at that level. This is the same
projection that is made in connection with the labor force pro-
ductivity method. The principal reasons for it are given in
Section II, above. It will be noted that many opportunities remain
to replace men by machines. On the other hand, increased output
in certain sectors of agriculture may require more manpower. This
projection of the agricultural labor force does not explicitly take
into account the increased quality of labor as a result of education
or training. Improvements in the quality of agricultural labor may
well be required, however, to make efficient use of increased capi-
tal and new techniques and are, therefore, implicit in the projection
of agricultural output.

The fixed capital stock in agriculture is assumed to
rise from 156 billion rubles in 1950 to 462 billion rubles in 1975
under assumption A and to 777 billion rubles under assumption B.
Thus the capital stock would rise 3-1/2 times as much as output
under assumption A and 5 times as much under assumption B. The
effect of land scarcity is reflected in rapidly increasing capital
requirements. Capital requirements are derived from historical
relationships between output and inputs (labor, land, capital, and
technology) in agriculture. The method of computation is shown in
Appendix C.

The above projections are based on the assumption that
most of the problems discussed earlier can be overcome at a reasonable
cost. It may be too optimistic, although many difficulties which
limit production in the short run may not do so over a period of
over 20 years. If the difficulties prove insurmountable, the USSR
will have the choice either of moving toward a lower consumption
policy or of importing foodstuffs from abroad.

C. Nonagricultural Production: Trends and Projections.

    1. General Methodology.

Nonagricultural output is determined by the quantities
of the inputs available to the USSR and by the efficiency with which

they are combined. The growth elements described in Section I, above, can be classified into three categories: labor, capital, and efficiency. Labor and capital, however, are the only basic inputs which can conveniently be measured, the nature of the elements determining efficiency (technology, management, and so on) being such that only general qualitative judgments can be made as to their future impact on output. Ideally, labor and capital should be measured in units of constant quality. Efficiency would then represent only those growth elements which can properly be attributed to neither labor nor capital separately but rather to combinations of these two factors. Accordingly, an attempt is made to take into account the change in the quality of labor as measured by educational attainment. To some extent, also, improvements in the quality of capital are implicit in the valuation of capital in constant rubles. Because the measures of labor and capital are certainly not perfect, however, efficiency here includes not only the effect of the "unmeasurable" factors (management and so on) but also the effect of errors in the measures of capital and labor on output.

For a given past year (1953), the entire nonagricultural output is imputed to labor and capital by examining the apparent shares of labor and capital in total factor payments. This year is used as a base for quantity indexes of labor and capital. A combined index of labor and capital is then computed by weighting the labor and capital indexes by the share of these factors in nonagricultural output during 1953. Any divergence between the combined index of these two factors and the index of output in any other year is assumed to result from changes in efficiency.

It is possible to project independently the supply of labor and also certain determinants of the capital stock and of efficiency, relying on judgment to eliminate obvious inconsistencies. The major determinant of the capital stock, however, is investment, and investment clearly depends on gross national product. The capital stock and gross national product, therefore, are mutually determined after all other determinants of gross national product have been projected. The rationale of this method is shown formally in Appendix C. In practice, consistent projections of gross national product, capital stock, labor, and efficiency are obtained by a trial-and-error process. They are shown in the last part of this section. In 2, 3, and 4, below, the basic growth elements are projected: the

supply of labor, the determinants of capital (other than gross national product), and the determinants of efficiency,* respectively.

2. Supply of Labor.

The first step of the factor inputs method of projecting nonagricultural output is to project the supply of labor.

The Soviet labor force, expressed in man-years, is estimated in Section II, above, and shown in Table 6.** The quality of labor, however, does not remain the same. It usually increases through time with the acquisition by labor of additional skill through education and specialized training and with improvements in its health and energy. In this section, an attempt is made to measure the increase in the quality of the Soviet labor force in past years and to project this increase in quality to 1975. It will then be possible to project the labor force in terms of units of approximately equal average quality.

The following discussion relates to (a) the concept of labor "skill" and the manner in which skill may be attained; (b) past and projected developments in Soviet efforts to increase labor skill through education and other types of training; (c) the measurement of changes in the skill of the total and nonagricultural labor force; (d) conclusions as to historical and projected future changes in the Soviet labor supply; and (e) the role of health and energy of the labor force in economic development.

A more detailed discussion of the above problems is given in Appendix B.

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* This relation between inputs and output may be expressed as a production function of the form:

$$\left[\frac{L_p}{L_o} \cdot X + \frac{K_p}{K_o} (1-X) \right] E = 0$$

(Where L_o and K_o, L_p and K_p are indexes of capital and labor in the base year and the projected year and X is the share of labor in total product during the base year.)
** P. 20, above.

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a. Concept of Skill.

It is particularly important to consider degree of
skill, in measuring the USSR's labor supply, because rapid develop-
ment of labor skills has bulked large in explaining past economic
growth and is likely to be of continuing importance in the future.

The term skill, as used here, refers to the produc-
tive capability of workers. The skill of a worker is increased if
he learns how to increase output in a given job or if he learns how
to produce goods or services of higher value. The degree of skill
within a whole society is the weighted average of the skills of all
its workers.

Skill, in this sense, may be acquired through formal
schooling. Much formal education is specifically designed to impart
occupational skills; even general education (reading, writing, arith-
metic, science, and the like) is a prerequisite or aid to the ac-
quisition of many skills. Skills can also be acquired or augmented
through on-the-job training and experience and through improvements
in the health and energy of workers.

b. Education and Training in the USSR.

The USSR has made a determined effort over the past
30 years to increase labor skills. To this end, a rapid extension
of formal education -- much of it oriented toward occupational train-
ing -- and a very large program of on-the-job training have been
instituted.

The educational reforms of the USSR, past and planned,
are impressive. In a generation, illiteracy has been almost com-
pletely overcome. Over the period from 1922-23 to 1950-51, the number
of children in elementary and secondary schools increased from about
8.7 million to 32.5 million, or from 17 percent to 47 percent of the
population less than 15 years old, and the number in higher education
from 0.2 million to more than 0.9 million. Education through grade 4
(ages 7-10) became compulsory in 1934, and virtually universal
coverage was achieved a few years later. Education through grade VII
(age 14) was made compulsory in 1950, and in that year about 90 per-
cent of the children between the ages of 11 and 14 were enrolled in
the higher grades (or as retarded pupils in the primary grades). At
present, efforts are being made to establish compulsory education

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through grade 10 (to age 17), and it is probable that this goal will be achieved between 1956 and 1960. While this great increase in formal education was taking place, a very large effort was also being expended upon adult education and upon on-the-job training of workers. Educational developments have unquestionably been a major factor underlying Soviet economic growth. Their effects are also cumulative as the educational process is carried on from one generation to the next. In the long run, education transforms the culture, the way of life, and the mode of thought of the people. It is the prime requisite for transforming an agrarian society into a modern industrial society. By 1975, nearly 50 percent of the adults, ages 15-59, in the USSR are expected to have completed high school, a proportion only slightly less than that in the US in 1950.*

     c. Measurement of Labor Quality.

The data on educational enrollments and on educational attainment include all available information on full-time technical courses. They exclude part-time courses, on-the-job training, and all other methods of acquiring skills.

The effect of this education and training, and of the resulting increases in occupational skills on the quality of labor, cannot be measured precisely. It is the best available indicator of changes in labor skills, however, and the only one which can be projected with any degree of reliability.** Measurement at least can be approximated by converting available man-years of labor to quality units so that man-years with greater skill can be counted more heavily than man-years with less skill. For the present purposes, therefore, the distribution of the working population by educational attainment is taken as an approximation of the distribution of that population by degree of skill. Each level of educational

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  * Past and probable future changes in Soviet educational levels are shown in Table 22, p. 78, below.
  ** Another indication of changes in the quality of the Soviet labor force is contained in data on the composition of the labor force by occupational group. (See Table 26, p. 89, below.) These data are neither ideally suited to the present purpose nor very reliable, yet they show the effect of the movement of the labor force from the farms to more productive jobs in the city and the large increases in the engineering-professional-technical group and in skilled labor.

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attainment is translated into a corresponding degree of skill. (See Table 25.*)

A reasonably adequate indicator of the relative degree of skill of each class of Soviet labor is the wage paid to that class. The wage data used for this purpose approximate the basic wage expectation in 1950 of persons having attained these various degrees of education.

Given the distribution of the labor force by educational level and the corresponding structure of wages in the USSR, it is possible to estimate the change in the quality of labor from 1950 to 1975.

An attempt also is made to estimate the growth of education among nonagricultural workers.** Table 8,*** which presents indexes of the quality of Soviet labor on a 1950 base, projects for 1975 an increase of 50 percent in the quality of the average unit of Soviet nonagricultural labor.

d. Supply of Soviet Labor.

The product of the index of labor quality and of the available number of man-years is the measure of the Soviet labor force in quality units -- that is, in man-years of the average quality of a Soviet worker in 1950. Table 9*** shows the past and projected Soviet labor force expressed in quality units, in total and for the nonagricultural and agricultural sectors.

Over the period from 1902 to 1950 the increase in total man-years was about 25 percent, whereas the increase in labor supply measured in quality units was over 100 percent. Over the period 1950-75 the increase in man-years is expected to be one-third; and in quality units of labor, to be double. Thus it is evident that education and training produce highly significant additions to the effective labor supply. This measurement of the increase in

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* P. 87, below.
** It was necessary to use very crude rules of thumb for this purpose. The method followed is explained in Appendix B. The estimated distribution of the nonagricultural labor force by educational level is shown in Table 23, below.
*** Tables 8 and 9 follow on p. 35.

Table 8

Indexes of Growth in the Quality a/ of the Labor Force of the USSR
Selected Years, 1902-75

1950 = 100

	Total b/	Agricultural c/	Nonagricultural c/
1902	60	61	58
1931	64	64	64
1928	72	72	73
1938	83	86	79
1950	100	100	100
1953	106	102	110
1975	150	150	150

a. As measured by the growth in the average level of education
attained in the USSR.
b. Based on Table 26, average educational attainment of the pop-
ulation ages 15-59 is assumed to be the same as for the labor force.
c. Derived from the estimated indexes for the total and nonagri-
cultural labor force. The total labor force index is a weighted
average of the agricultural and nonagricultural indexes.

Table 9

Supply of Labor in the USSR in Quality Units a/
Selected Years, 1902-75

Million Units

	Total b/	Agricultural Sector c/	Nonagricultural Sector c/
1902	49.0	42.0	7.0
1913	61.2	51.2	10.0
1928	58.4	48.8	9.6
1938	69.7	45.8	23.9
1950	100.4	51.8	48.6
1953	109.8	53.8	56.0
1975	196.5	82.5	114.0

a. A quality unit is one man-year of a Soviet worker
of average quality (that is, education) in 1950.
b. Total obtained by adding the two sectors.
c. The numbers in this table were obtained by mul-
tiplying the labor force in man-years (Table 24) by
the index of labor quality (Table 26).

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the labor force in quality units probably understates the effect of education and training, in that it is confined to formal education and probably does not allow sufficiently for the skills acquired by on-the-job training and experience. On the other hand, it is possible that the rapid growth of mass education may bring about declines in the quality of that education. It should be emphasized that changes in degree of skill are not susceptible of accurate measurement. The data on labor supply in quality units must be interpreted for what they are -- indicators of the general magnitude and importance of education and training.

    e. Health and Energy.

        Another factor affecting labor skill is the degree of health and energy of the working population. It is not possible to make quantitative estimates of the influence of this factor upon the effective labor supply. There is little doubt, however, that over the period covered by this study substantial improvements in the health and energy of the population have occurred. For example, according to _____, the mortality rate in 1951 was about half that in   50X1-HUM 1940. 6/ It is likely that these health improvements have raised the efficiency of workers by cutting absenteeism and increasing their productivity. Moreover, further improvements in health will likely be achieved over the next 25 years. The progress in health suggests that the measurement of the labor supply in quality units as presented in Table 9 may understate the actual and prospective growth.

    3. Supply of Capital.

        Having arrived at estimates of the supply of labor in quality units in the USSR, the supply of another basic productive resource, capital, must be considered. The first step is to trace the past growth of capital in the USSR. Table 10* presents estimates of the stock of fixed capital** for selected years from 1928 to 1951. This table shows that the stock of fixed capital grew from 291 billion (1951) rubles in 1928 to 1,159 billion rubles in 1951, giving an average rate of increase of more than 6 percent per year (compounded).

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  * Table 10 follows on p. 37.
  ** All capital stock figures used here represent fixed capital only. Investment in fixed capital is assumed to be two-thirds of total gross investment.

Table 10

Fixed Capital Stock in the USSR
Selected Years, 1928-51

Billion 1951 Rubles

Year a/	Total	Agricultural Sector b/	Nonagricultural Sector
1928	291	117	174
1933	433	96	337
1938	793	146	647
1941	999	168	831
1946	847 c/		
1951	1,159	156	1,003

a. As of beginning of the year.
b. Includes livestock.
c. Net of estimated war losses of 222 billion. See
Appendix D for derivation.

In order to project the size of the Soviet stock of fixed
capital in 1975, it is necessary to estimate the additions to it (the
amount of the gross national product that is devoted to investment)
and the deductions from it (retirements). In this section, the amount
of investment through 1975 is estimated by considering the projected
allocation of gross national product by end use. Investments together
with retirements through 1975 and the size of the capital stock in 1951
determine the size of the total fixed capital stock in 1975. The
nonagricultural fixed capital stock in 1975 is obtained by deducting
the agricultural capital projection obtained above.

a. Allocation of Gross National Product by End Use.

The amount of gross investment is set by the conscious
policy of the Soviet regime concerning the allocation of current out-
put. These decisions reflect the relative urgency in their scale of
values of capital formation as compared with the other end uses of
national product, namely, defense, consumption, and administration.

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The problem of projecting future investment is basically that of estimating the future allocations of gross national product among the four end uses. Some guidance concerning this allocation may be obtained from past experience. Table 11*. shows the division of gross national product by end uses for selected years from 1928 to 1953. Future allocations to each of the four end uses will not be considered.

(1) Defense.

One of the basic assumptions of this study is indefinite continuation of the cold war at about present levels of intensity. If this assumption is realized, it is likely that the USSR will make relatively large and stable outlays for defense. A reasonable supposition is that they will maintain their defense establishment at about its present level. To do so, according to estimates of the costs of maintaining technological up-to-dateness, would require increasing expenditures by 2-1/2 to 3 percent per annum. It is assumed that annual increases of 2.75 percent will be made from 1953.

(2) Consumption.

The allocation of national product to consumption raises many difficult questions. On the one hand, there is the record of a steadily decreasing percentage of gross national product devoted to consumption (Table 11) even though the absolute amount has increased. On the other hand, there are the many protestations of the regime and some concrete actions -- pointing to recognition of a need for increased consumption. Moreover, since a large part of consumption is derived from agricultural production, the amount of future consumption will depend partly upon future farm output. Because of the uncertainty about consumption, two alternative assumptions will be made.

Assumption A is that long-term historical trends will continue: that consumption will rise, but at a slower rate than gross national product on the average. In view of the present low level of consumption in the USSR (by Western standards), and in view of the apparent desire of the regime to increase living standards, an

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* Table 11 follows on p. 39.

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:. ... Table 11

Division of Gross National Product of the USSR a/ by End Use
Selected Years, 1928-53

Percent

Year	Consumption b/	Investment c/	Defense d/	Administration e/	Total Gross National Product f/
1928	73.6	21.6	2.4	2.4	100.0
1938	69.6	20.5	7.3	2.6	100.0
1948	65.7	22.2	9.2	2.9	100.0
1950	62.3	25.6	9.4	2.7	100.0
1953	57.8	26.9	12.8	2.5	100.0

a. The percentage distribution of gross national product for 1948, 1950, and 1953 is based on the breakdown for 1951. 7/ Each of the four end use categories is moved by appropriate production indexes to derive the breakdown for the given year. The 1928 and 1938 divisions of gross national product are based on calculations by academic scholars. 8/ In order to achieve consistency between the two sets of estimates, it was necessary to adjust the Hoeffding and Bergson breakdown according to conventions adopted for the later year derivations. One-half of the turnover tax was assumed to represent factor cost and was therefore redistributed as expenditures among the four end uses allocated. This adjustment signifies a somewhat larger allocation to consumption than originally calculated by Hoeffding and Bergson, who did not consider the turnover tax an element in factor cost.
b. Consumption includes purchases of goods and services by individuals and institutions in state and cooperative retail outlets and in collective farm markets, consumption of farm income in kind, military subsistence, rental and computed outlays for housing, trade union dues, and communal consumption in the form of health and educational outlays in the state budgets.
c. Investment covers all outlays for fixed capital, inventory accretion, capital repairs, and increments to the gold stock.
d. Defense includes both the budgetary appropriations to the Ministry of Defense for procurement, operations, and maintenance, and minor outlays considered as military expenditures under US budgetary procedure, but not under Soviet accounting.
e. Administration covers outlays for the police, judiciary, and higher executive organs of government.
f. The derivation of the ruble gross national product figures is described in Appendix C.

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increase in consumption of 3 percent a year (about 1.3 percent per capita compared to 2.2 percent from 1950 to 1953) seems to be a reasonable lower limit. It is further assumed that consumption will be no less than 45 percent of gross national product. In 1953 it was about 57 percent; in 1928, about 73 percent of gross national product. It should be noted that consumption did not fall below 50 percent of gross national product in the USSR during 1944 or in the US and the UK during the most stringent war years.

Assumption B is that the recent policy of increasing consumption rapidly will continue and will not be reversed: that consumption will rise at the rate of 5 percent per year (3.3 percent per capita) but will remain below 60 percent of gross national product. This is to be compared with a rate of increase of about 2.5 percent in per capita consumption per year in the US. It does not seem at all likely, after present difficulties are overcome, that the USSR would raise per capita consumption at a substantially greater rate than in the US.

Per capita consumption increased by about 6 percent between 1929 and 1938. This increase, however, is undoubtedly inflated by the effects of urbanization and cannot serve, therefore, as a basis for projection. Available statistics in the USSR and many other countries do not take full account of food and textile products produced and manufactured on the farm from locally grown crops. Any drastic shift of population from farms to cities therefore overestimates changes in the production of consumer goods, especially in view of the fact that increasing urbanization of the population compels the consumption of services unneeded in rural environments such as transportation and municipal services.

(3) Administration.

Administration refers to the executive, judicial, and police functions of all governmental units. It is assumed that the allocation to administration remains constant at 2.5 percent of gross national product, as in 1953.

b. Determination of Capital Stock.

For any given gross national product, gross investment can be obtained as a residual after deducting expenditures on defense, consumption, and administration. These projections of

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investment provide the basis for estimating the future growth of the
fixed capital stock. Starting with the estimated capital stock in
1950, the future stock is estimated by adding each year's investment
in fixed capital and deducting each year's retirements.* Investment,
capital, and gross national product are, of course, mutually determined. (The final results are shown in Table 12.**) Given the
estimates of agricultural capital, nonagricultural capital is computed as a residual from total fixed capital determined above.

4. Efficiency.

Changes in production cannot be explained entirely by
changes in the inputs of labor and capital; changes in the efficiency
with which these inputs are used also affect output. The forces
included in efficiency -- technology, mineral resources, articulation
of the total economy, enterprise management, scale of production,
foreign trade, and worker morale -- may all affect production, but
they are not readily susceptible to measurement. The best that can
be accomplished is to attempt to measure the changes in the net
effect of all these forces working at one time. The analysis of
future efficiency is, therefore, qualitative, based upon the informal
opinions and judgments of students of these subjects.

a. Technology.

There can be no doubt that technological progress
in the USSR has been swift during the past 30 years. This progress
was largely in the form of rapid borrowing from the West of readymade
technology rather than in the form of the relatively slow accumulation
of new technical knowledge. It is frequently asserted that the

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* Retirement as used here means the removal of capital from productive use. It is assumed that capital items are maintained in serviceable condition until they are retired. The value of the capital stock,
therefore, is not reduced by accounting book-depreciation of existing
capital. The assumptions used for calculating retirements are that
no new capital is retired during the first 2 or 3 years of its life
and that retirements from this capital are at the yearly rate of 3.5
percent of its original value thereafter. The method of estimating
retirements is described in Appendix D.
** P. 49, below. The methodology is described in C, 5, below, and
Appendix C.

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borrowing phase is approaching an end and that the rate of technological change in the USSR will progressively slow down to the rate at which new methods and products are being currently developed. On the other hand, it is frequently asserted that there is substantial room for further continuation of the past rate of technological progress. A clear distinction must be made between technology as knowledge and technology as actual productive method. There is no doubt that the USSR is rapidly catching up with the West in technical knowledge and that progressively less of such knowledge remains to be borrowed from the West. It is not so certain, however, that Soviet productive methods actually correspond to Soviet knowledge. To utilize new technology, the necessary capital must be produced and the necessary workers trained. This process takes time. There probably is still room for much modernization in many sectors of Soviet industry and agriculture. Within the period to 1975 there may be some slowing down of technological advance, but the effect is not expected to be pronounced. In support of this view, it should be added that Soviet encouragement of education and scientific research is likely to bear increasing fruit in the form of indigenous technological advance.

      b.   Mineral Resources.

      It is sometimes assumed that mineral resources are fixed in supply, that economic growth inevitably results in diminishing returns to the labor and capital employed in the mineral industries and, therefore, that progress can be achieved only at the cost of lowered economic efficiency. It is true that the physical supply of mineral resources is fixed at any given time. Changes in the effective supply, however, can and do occur, the rate of change depending upon rate of exploitation, rate of discovery and development, rate of utilization of foreign resources, discovery of new uses for natural resources, discovery of methods of reducing ores not previously workable or of increasing the recovery from given ores, and changes in the structure of the final demands. For this reason, it is not legitimate to take for granted that economic growth will be associated with diminishing returns from mineral resources.

      It is probable that the USSR can produce or obtain enough of any and all minerals (or reasonable substitutes) required for any feasible rate of economic growth in the next 20 years, provided it is willing to make the necessary allocations of manpower and capital to the purpose.

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The rate of technological advance in the USSR is rapid, and active measures are being taken toward the discovery and development of new mineral resources. It is probable, therefore, that diminishing returns, if experienced at all within the next 20 years, will be mild. But even if the USSR should face severe diminishing returns in the mineral industries, the effect on over-all economic growth would be small because the mineral industries, in any case, employ only a small fraction of the total labor and capital.*

c. Articulation.

In the past the growth of Soviet output has frequently been reduced as a result of failure to coordinate production with demand. The result has been lack of urgently needed goods, bottlenecks, gluts, and unemployment. These failures of coordination have been due partly to lack of knowledge and experience on the part of the planners, partly to lack of skill on the part of plant managers, partly to doctrinaire rigidities in policy, and partly to rapidly changing demand conditions arising from war and political factors.

The planners can be expected to become progressively more efficient in coordinating the economy through additional experience.

By this time the Russians have made enough trials and experienced enough errors so that their future planning efforts should be increasingly efficient, assuming adequate flexibility in policy.

On the assumption of generally stable conditions over the period to 1975 (one of the fundamental postulates of this report), unexpected changes in demand are likely to be fewer than those the planners have had to cope with in the past. This also should help them guide the economy more efficiently.

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* If the purpose of this report were to find shortages of strategic materials, in order to guide economic warfare, such offhand treatment of the mineral industries would not be appropriate. The purpose here is to measure long-run growth, given plenty of time for overcoming shortages or finding substitutes.

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d. Management.

By management, in this context, is meant the supervision
of production in individual plants. It involves the physical layout
of production, the organization of personnel, the procurement of
materials, the control of product quality, the disposition of product,
the hiring and firing of labor, the obtaining of capital, negotiation
with government, and the like.

The art of enterprise management in the USSR appears
to be developing, but there is probably much to be learned or to be
put into practice before Soviet management approaches the skill and
efficiency of US management. Further important increases in pro-
ductivity by means of improved management are possible and likely.

e. Factor Proportions and Scale of Output.

The productive efficiency of a country is strongly
affected by the proportions of factors used in output and by the
scale of its total output. As production increases, two opposing
tendencies are experienced -- diminishing returns and increasing
returns.

Diminishing returns will occur if some factors of
production (usually land and other natural resources) cannot be in-
creased in proportion to the increase in other factors. The effort
to squeeze more product out of the slower-growing factor results in
diminishing returns to the faster-growing factors and increasing
costs per unit of output. In this report the possible effect of
diminishing returns has been considered in the discussion on agri-
culture and mineral resources. It also may be of great importance
when there is a major shift in the proportions of capital and labor
used in production. From 1928 to 1953 the Soviet labor force (in
quality units) rose almost as fast as the capital stock in the non-
agricultural sector, as a result of a rapid influx of labor from the
farm to the factory. The proportions of labor and capital used in
nonagricultural output, did not, therefore, change substantially.
during this period. In the future the rate of urbanization will be
less, and the nonagricultural capital stock is likely to increase at
a substantially greater rate than the nonagricultural labor force.

Increasing returns will occur when an increase in
production makes possible (1) a fuller utilization of given fixed

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productive agents (that is, a thinner spreading of overhead costs),
(2) a more economic use of machine methods, or (3) a greater use of
advantageous specialization and division of labor. This is to say,
roughly, that increasing returns are possible when there are advan-
tages in mass production.

As the Soviet economy has grown, one industry after
another has been transformed into a large-scale industry, with
corresponding benefits in the form of lowered costs from mass pro-
duction. The Soviet practice of limiting the number of models and
of changing models only infrequently makes for the ready achievement
of mass production.

In the future a stepping up of the production of
consumer goods would almost surely result in lowered costs of these
goods and therefore in greater economic efficiency.

f. Foreign Trade.

Foreign trade permits specialization in the production
of those goods for which the country has a comparative advantage and
permits it to leave to others the production of those goods for which
it has a comparative disadvantage. Thus through foreign trade total
efficiency can be increased.

In the past the USSR has pursued a persistent policy
of national self-sufficiency. Thus, since trade is already at a very
low level, one can expect no significant future reduction in efficiency
resulting from curtailment of trade. The only significant possibilities
are no change or an improvement.

There is no reason to suppose that the fundamental
aim of national autarky has been abandoned. Yet there is a strong
probability of increasing trade with other Soviet Bloc countries and
also some chance of at least small increases in East-West trade,
particularly since such trade increases might serve the long-run
political interests of the USSR. But more important, if the USSR is
unable to increase agricultural production in proportion to the in-
crease in population, it may be forced to seek food and fiber from
abroad. For it to do so would be a major change in Soviet policy.
Minor increases in efficiency in the agricultural sector may result
from the probable expansion of intra-Bloc trade and perhaps from
small increases in East-West trade.

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g. Worker Incentives and Morale.

By worker morale is meant all those attitudes, values, and culture patterns of the working population which, in the context of existing conditions in the society at large and in the place of work, affect speed and quality of work, regularity of work, organizational cooperation, and willingness to develop personal productivity. Worker morale is affected by objective conditions in the socioeconomic system and by the degree of adjustment to or acceptance of these conditions. For example, morale is affected by the general level and distribution of consumption, housing, and social services; by the political system and the obligations of people under that system; and by the general pattern of social life (religion, family life, recreation, art, and the like). Similarly, worker morale is affected by objective conditions in the place of work and the degree of adjustment to and acceptance of these conditions. Among these conditions, for example, are human relations on the job; physical conditions of work and of travel to work; the system of rewards, penalties, and other incentives; and appropriateness of work to individual aptitudes and interests.

Without question, all of these factors are highly significant in determining the productivity of a country. And there can be no doubt that some of the fluctuations in Soviet output and some of the failures of Soviet planning have been due to problems of worker morale. In spite of their importance, no attempt is made in the present report to examine worker morale in detail. This is simply too vast a problem for a report of this limited scope.

It is a generally accepted view that negative incentives in the USSR, based on fear of punishment, have been carried so far that little extra productivity could be expected from an extension of incentives of this type. Also, it is widely believed that the wage system (including nonmonetary prerequisites) provides very strong positive incentives and that little more could be achieved by changes along this line. It is believed, however, that morale might be enhanced through increasing the quantity and availability of consumer goods. This view rests on three arguments: (1) that if more consumer goods could be purchased, workers would be more interested in earning additional income; (2) that, with more consumer goods, people would have a more positive and cooperative attitude toward the entire social system; and (3) that increasing supplies of consumer goods would tend to enhance the health and strength of the population.

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These are persuasive arguments. On the other hand, it should be pointed out that increased availability of consumer goods might tend to reduce incentives. With higher real incomes, the value of the marginal ruble to the worker might become less, and his incentives might therefore be reduced. Enough has been said to indicate that the subject of worker morale is a highly subtle one about which little can be said in the present state of knowledge.

h. Conclusions as to Efficiency.

Although the complexity of the many elements affecting efficiency makes any generalization highly tentative and uncertain, the following conclusions appear to be justified:

(1) Under the basic assumptions of this report, a reduction in efficiency could result only from a great increase in the scarcity of certain factors of production relative to others. Although there are, in the long run, a great many possibilities for substituting one factor of production for another, substitution between such basic factors as land, labor, and capital is necessarily limited. The seriousness of this problem in agriculture, with regard to the scarcity of arable land, is discussed in B, above. The possibility also has been discussed that mineral resources would become scarcer. It is likewise possible that, if the capital stock increases much faster than the supply of labor, part of it will have to be put to less valuable uses than before -- its marginal productivity will decline.

Of course, the introduction of capital-intensive production techniques would tend to offset this effect by increasing the volume of output per unit of capital used, and there are many sectors of the Soviet economy where even known techniques are largely unexploited. Nevertheless, since the Soviet authorities have much more control over the growth of the capital stock than over the growth of the labor supply or even of the growth of technological knowledge, they have an incentive to rely heavily on capital in attempting to raise output. Diminishing returns to capital would become more likely the more rapid the growth of capital during the period, the other factors being relatively fixed.

(2) All the other factors which have been discussed in this section are likely to raise efficiency or to leave it unchanged. This is true of technology, "articulation," management, and so on.

(3) Factors making for rising efficiency seem stronger than those making for declining efficiency in the nonagricultural sector so long as the change in the relative quantities of capital and labor used is moderate.

(4) The probable increase in efficiency is likely to be small. In the 1928-53 period, no upward trend in efficiency was apparent, as will be seen in the next section. Nearly all of the increase in output can be accounted for by increases in the quantities of labor and capital. In addition, most of the qualitative factors are highly correlated with the quantity of capital and the skill of labor. Technological advance, for example, often creates a demand for more engineers and skilled workers. In projecting an increased supply of these engineers and skilled workers, some of the effects of new technology have been accounted for. Adding the effects of all these "efficiency" factors to those of the supply of labor and capital involves, therefore, some double counting.

It is tentatively assumed that efficiency will rise slightly, so that by 1975 the combination of labor and capital inputs will give an output 10 percent greater than the same amounts of these factors could have given in 1953.

5. Nonagricultural Production: Trends and Projections.

The nonagricultural labor force in quality units, the principal determinants of the capital stock (except output), and the general movement of efficiency have been projected. In arriving at the final results, it is necessary to combine the indexes of labor, capital and efficiency. Labor and capital are computed as relatives of the shares of nonagricultural output which these factors had in 1953. The shares of labor and capital were approximately 75 percent and 25 percent, respectively.9/; these shares are based on an examination of Soviet factor payments in 1951.* These indexes are then added

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* In extensive studies of production functions in the US and in British Commonwealth countries, Paul H. Douglas and others found that about 55 to 75 percent of manufacturing output is attributable to labor and 25 to 45 percent attributable to capital, 10/ and that the relative shares have remained remarkably constant over time. The figure for the US, 1889-1922, was 63 percent to labor and 34 percent to capital. Professor Simon Kuznets reported that in the US, in 1919-38, employee compensation constituted about 63 percent of national income, and other forms of income (entrepreneurial withdrawals, rent,

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together to obtain an index of combined inputs. In order to get mean-
ingful estimates, it is necessary that the estimates of capital and
output be consistent; these can best be determined by trial and error.
The final indexes of capital and labor and the combined inputs index
under both assumptions A and B are shown in Table 12.

Table 12

Determination of the Nonagricultural Production of the USSR
Factor Inputs Method
Selected Years, 1928-75

Indexes, 1953 = 100

Year	Labor a/	Capital b/		Combined Index		Efficiency c/	Nonagricultural Production	
1928	17	15		17		96	16	
1938	43	55		46		106	49	
1950	87	80		85		89	76	
1953	100	100		100		100	100	
		A	B	A	B		A	B
1975	203	704	374	328	245	110	360	270

a. Labor series based on quality units. Refers to estimated labor sup-
ply at the middle of stated years.
b. Capital stock was measured in 1951 rubles. Refers to the beginning
of the stated year.
c. Efficiency is defined as the ratio between output and the combined
index of inputs.

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dividends, interest, corporate savings, and so on) accounted for 37
percent. 11/ Similarly, the Department of Commerce series of US
national income by distributive shares indicated that about 69 percent
of the national income (excluding income of farm proprietors) is in
the form of compensation of employees. 12/ Since wages and salaries
are not the only source of labor income (income in kind, and a sub-
stantial portion of the income of unincorporated enterprises must be
included in labor income), and since land is a small factor in non-
agricultural output, the US proportions for this output are likely to
be close to 75-25.

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For the years 1928, 1938, and 1950, efficiency can be determined as the ratio between the nonagricultural output and combined inputs indexes. Labor and capital both grew rapidly, the growth of capital being slightly greater than the growth of labor. It is notable that the growth of combined inputs very closely approximated the growth of output. No clear trend in efficiency was apparent, although there were fluctuations in the index. From 1928 to 1938, the rapid inclusion in the national product of goods and services formerly produced in households may have inflated the measure of output relative to inputs, and thus may have occasioned the apparent increase in efficiency. The decline in efficiency from 1938 to 1950 and its rise from 1950 to 1953 may have resulted from the effects of World War II and of subsequent recovery.

Considering the many possible errors involved in measuring labor and capital, and the very small number of years for which data are available, it is apparent that no clear conclusion as to the future trend of efficiency can be derived from historical relationships. Moreover, the examination of the qualitative growth factors made in the preceding section gave some reason to expect an improvement in efficiency. Accordingly, the efficiency index is projected as rising by 10 percent from 1953 to 1975.

The projection of the labor supply is the same under assumptions A and B -- the labor force in quality units is expected to double. The entire difference between the A and B projections of output, therefore, is reflected in the capital stock projections. The capital stock increases less than 3 times under assumption B and more than 6 times under assumption A.

Nonagricultural output is projected as rising by 260 percent under assumption A, and by 170 percent under assumption B.

The projection under assumption A may be considered to be an upper limit. It is most unlikely that Soviet consumption would be allowed to fall below 45 percent of gross national product, except under stringent wartime conditions. Moreover, the required increase in the capital stock labor supply ratio is so large (almost 3 times 1953) that some decline in the marginal productivity of capital would almost certainly occur because of the difficulty of substituting capital for labor on too large a scale. As is explained in Appendix C, an assumption that the marginal productivities of labor and capital do not change is implicit in the method used to

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combine these factors. The A projection, therefore, has an upward bias, and possibly a strong one. In fact, efficiency under assumption A might well not increase or even decline substantially.*

There is also an upward bias in the B projection, but a much smaller one because assumption B involves only a moderate shift in the proportions of capital and labor used in output.

Our conclusions as to the growth of nonagricultural output during the 1953-75 period are the following:

(a) Soviet nonagricultural output may grow at an average yearly rate of between 4 and 6 percent per year from 1953 to 1975.

(b) It is extremely unlikely, under the basic conditions assumed in this study (no war, and so on) that the rate of growth would be above or below this range.

(c) The chances that the rate of growth will be between 4.5 and 5.5 percent are very high.

Estimates of the Soviet labor force, fixed capital stock, and production in the nonagricultural sector are shown in Table 13,** and the results are presented graphically in Figure 6.***

D. Final Projection: Factor-Inputs Method.

The projections of agricultural output and of nonagricultural output can now be combined and a final projection of gross national product can be made. The results are shown in Table 14.**** Gross national product rises from 1953 to 1975 at the average yearly rate of 5.2 percent under assumption A and of 4.2 percent under assumption B.

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* The fixed capital-output ratio increases from 1.6 to 3.1 under assumption A, and to 2.2 under assumption B. The ratio for the US was about 2.0 in 1929 and 1.8 in 1947.
** Table 13 follows on p. 52.
*** Following p. 52.
**** Table 14 follows on p. 53.

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Table 13

Labor Force, Capital Stock, and Production
in the Nonagricultural Sector of the USSR
Selected Years, 1928-75

Year	Labor Force a/ (Million)	Labor Supply b/ (Million 1950 Quality Units)	Fixed Capital Stock c/ (Billion 1951 Rubles)		Production (Billion 1951 Rubles)	
1928	13.8	9.6	174		118	
1938	37.0	23.9	647		361	
1950	48.6	48.6	942		564	
1953	51.9	56.0	1,184		742	
1975	77.6	114.0	A 8,335	B 4,428	A 2,671	B 2,003

a. Middle of year.
b. Millions of workers of average quality in 1950.
c. Beginning of year.

Which of the two assumptions is the more reasonable? In the
past the USSR has strongly emphasized economic growth at the expense
of consumption. Although consumption has risen rapidly in recent
years, it is impossible to be sure that this implies a major change
in policy and is not just a temporary bonus to consumers. On the other
hand, a high consumption policy, once started, would be difficult to
reverse.

It is believed that the assumptions A and B represent reasonable
limits as to possible Soviet policies governing the allocation of cur-
rent income -- consumption is almost unlikely to be less than 45 per-
cent or more than 60 percent of the gross national product in 1975.
However, any guess as to the most probable allocation of current income
over a period of over 20 years would be foolhardy in the extreme.

In projecting agricultural output, it is assumed that the
many serious difficulties which appear to have limited agricultural
output in recent years can be overcome. If some of these difficulties

Figure 6

USSR

PRODUCT AND FIXED CAPITAL STOCK
IN THE NONAGRICULTURAL SECTOR
SELECTED YEARS, 1928-53 and 1975
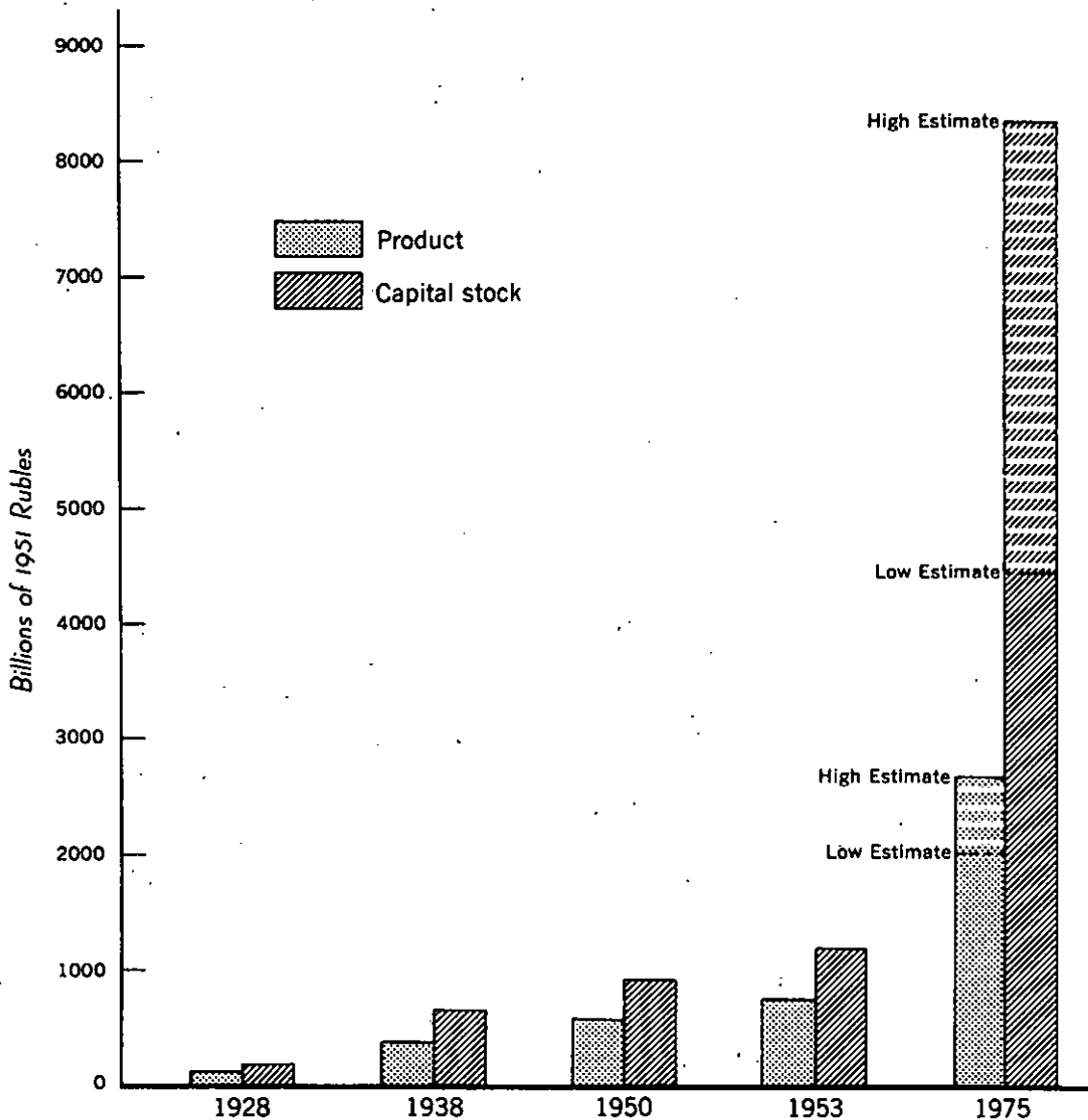
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were not overcome, agricultural output would rise less, and the Soviet government would be faced with the alternatives of either slowing down the increase in consumption or importing agricultural products from abroad.

In the nonagricultural sector, the projections under assumption A and, to a lesser degree, under assumption B are probably too high, as is pointed out above and explained in Appendix C.

It may be concluded, therefore, that the chances that Soviet gross national product will grow at a rate greater than 5 percent per year are very small and that a growth rate of 4.2 to 4.8 percent a year is probable.

Table 14

Projection of the Gross National Product of the USSR
Factor Inputs Method
Selected Years, 1928-75

Billion 1951 Rubles

Year	Agricultural Output		Nonagricultural Output		Gross National Product	
1928	296		118		414	
1938	307		361		668	
1950	287		564		851	
1953	289		742		1,031	
	A	B	A	B	A	B
	463	527	2,671	2,003	3,134	2,530

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IV. Conclusions.

A. Comparison of Gross National Product Projections.

In the preceding sections of this report, two methods have been used to develop three projections of the Soviet gross national product for 1975. Under the first, the labor productivity method, it is estimated that the gross national product would grow from a little over 1 trillion rubles in 1953 to a little under 3 trillion in 1975. The second, the factor input method, results in two estimates based on two different assumptions concerning Soviet policy decisions as to the portion of the gross national product which will be allocated to consumption over the period under consideration. Assumption A, based on a very low level of consumption, yields a growth of gross national product from a little over 1 trillion rubles in 1953 to over 3.1 trillion in 1975. Assumption B, based on a level of consumption consistent with the recent emphasis on consumption, yields a gross national product of only 2.5 trillion rubles in 1975. The average annual rates of growth involved in these three projections are 4.8 percent for the labor productivity method and 5.2 percent (assumption A) and 4.2 percent (assumption B) for the factor inputs method.

It is probable that the factor input method yields more reliable results than the labor productivity method because the latter method permits a far more detailed consideration of not only the primary factors of production, labor and capital, and their qualitative changes but also the many qualitative influences on production which have been grouped under "efficiency." Although the factor input method is considered better, it nevertheless involves assumptions as to the substitutability of factors which tend toward an overstatement of the final results. Because of this overstatement and because of the extremely low consumption postulates of assumption A, the most probable projections for gross national product in 1975 are 2.9 trillion rubles (an annual rate of growth of 4.8 percent) on the low consumption basis and 2.5 trillion rubles (on annual rate of growth of 4.2 percent) on the more liberal consumption policy. These data are summarized in Table 15.*

B. Implications for Intelligence.

It is unlikely that the gross national product of the USSR will grow at an annual average rate of 5 percent or more over the

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* Table 15 follows on p. 56.

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Table 15

Gross National Product of the USSR
1953 and 1975

Year	Method	Gross National Product (Billion 1951 Rubles)	Average Annual Rate of Growth (Percent)
1953		1,031	
1975	Labor productivity	2,960	4.8
	Factor inputs		
	Low consumption	3,130	5.2
	High consumption	2,530	4.2
	Factor inputs (most probable)		
	Low consumption	2,900	4.8
	High consumption	2,500	4.2

period to 1975. The most probable average annual rate of growth will be
between 4.2 percent and 4.8 percent, depending on the Soviet policy de-
cisions concerning the allocation of the Soviet gross national product
among various consuming sectors -- primarily, among alternative uses of
investment and consumption. The chief deterrents to a higher rate are
the problems involved in increasing the output of the agricultural sector
above that projected in this report. This difficulty is illustrated by
the differences in the projected levels of agricultural and nonagri-
cultural production. Whereas the nonagricultural sector is expected to
increase by from 1.7 to 2.6 times, agricultural output is estimated to
increase only from 60 percent to 80 percent over the 1953 estimates.

A basic assumption of this report is that international trade
will increase only slightly and will not contribute to the growth of
the USSR any more than it currently does. If, however, the Soviet policy
makers decide to supplement the agricultural output of the USSR by im-
ports to a significant extent, it is possible that the rate of growth
of the Soviet gross national product could be considerably higher. The
level to which it would grow depends on the extent of the imports and
on the terms of trade involved. It is, however, important that the
intelligence community be alert to significant increases in Soviet im-
ports, especially of agricultural commodities.

Another basic assumption of this report (that the cold war will continue at about the present level of intensity) is translated into the proposition that expenditures for defense will increase during this period at the rate of 2.75 percent per year. These expenditures would be primarily for the maintenance of the current military strength in an up-to-date condition. If, however, defense expenditures are kept at the current level or reduced, it is possible that total production in 1975 would be higher than estimated. How much higher would depend on the extent of the cut in defense expenditures.

It should also be pointed out that the contributions to the growth of the USSR made by the Satellites have not been explicitly considered. These effects have, however, been considered implicitly to the extent that they have affected Soviet growth in the past.

Finally, it should be noted that the projections of Soviet output in 1975 are limited to the extent that all economic projections over a long period of time are limited. They are based on what is known about the past developments and present conditions and what can be deduced from this information and reasonable assumptions about the future. They are limited to the extent that currently unknown future events affect the quantities which this study attempts to estimate.

A rough comparison of the projected gross national product of the USSR with that of the US is helpful in assessing the meaning of estimates developed in this study. This comparison cannot be precise, because it involves not only all the inaccuracies of projecting both the Soviet and the US data but also the inaccuracies of international comparison. The factor inputs projections of Soviet gross national product and an estimate of US gross national product are compared in Table 16* and Figure 7.** While the US estimate grows from $350 billion in 1953 to $735 billion (3.4 percent per year), the best estimate for Soviet gross national product grows from $103 billion in 1953 to $290 billion (4.8 percent per year), assuming low consumption, and $250 billion (4.2 percent per year), assuming high consumption, for 1975. The difference between the two gross national products grows from $247 billion in 1953 to $422 billion (low consumption) and to $482 billion (high consumption), while the Soviet gross national product expressed as a percentage of the US increases from 29 percent in 1953 to 39 percent, assuming low consumption, and 34 percent, assuming high consumption, in

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* Table 16 follows on p. 58.
** Following p. 58.

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1975. It is also interesting to note that during this period the average annual increase in the difference between the US and Soviet gross national products is growing much faster (between 2.7 percent and 3.1 percent) than the percentage relationship between the two (between 0.7 percent and 1.3 percent). In summary, the gap (in absolute terms) between the US and Soviet gross national products is expected to increase, even though the Soviet gross national product is expected to become a larger percentage of the corresponding US value by 1975.

Table 16

Comparison of the Gross National Products of the USSR and the US
1953 and 1975

Year	USSR (Billion 1951 Dollars) a/	US (Billion 1951 Dollars)	Difference (Billion 1951 Dollars)	USSR as Proportion of US (Percent)
1953	103	350	247	29
1975 b/				
USSR, low consumption	313	735	422	43
USSR, high consumption	253	735	482	34
USSR, low consumption, most probable	290	735	445	39
USSR, high consumption, most probable	250	735	485	34

a. Dollar values for the gross national product of the USSR are derived on the basis of 10 rubles equal one dollar.
b. USSR estimates for 1975 are factor inputs estimates. US estimate for 1975 is based on discussion in Appendix E.

SECRET   Figure 7

COMPARISON BETWEEN GROSS
NATIONAL PRODUCTS OF THE USSR AND THE US
1929, 1953, and 1975

Billions of 1951 US Dollars (10 Billions of 1951 Rubles)

	US	USSR
1929		
	1928	
1953		
1975		

Best Estimate

High Estimate

Low Estimate
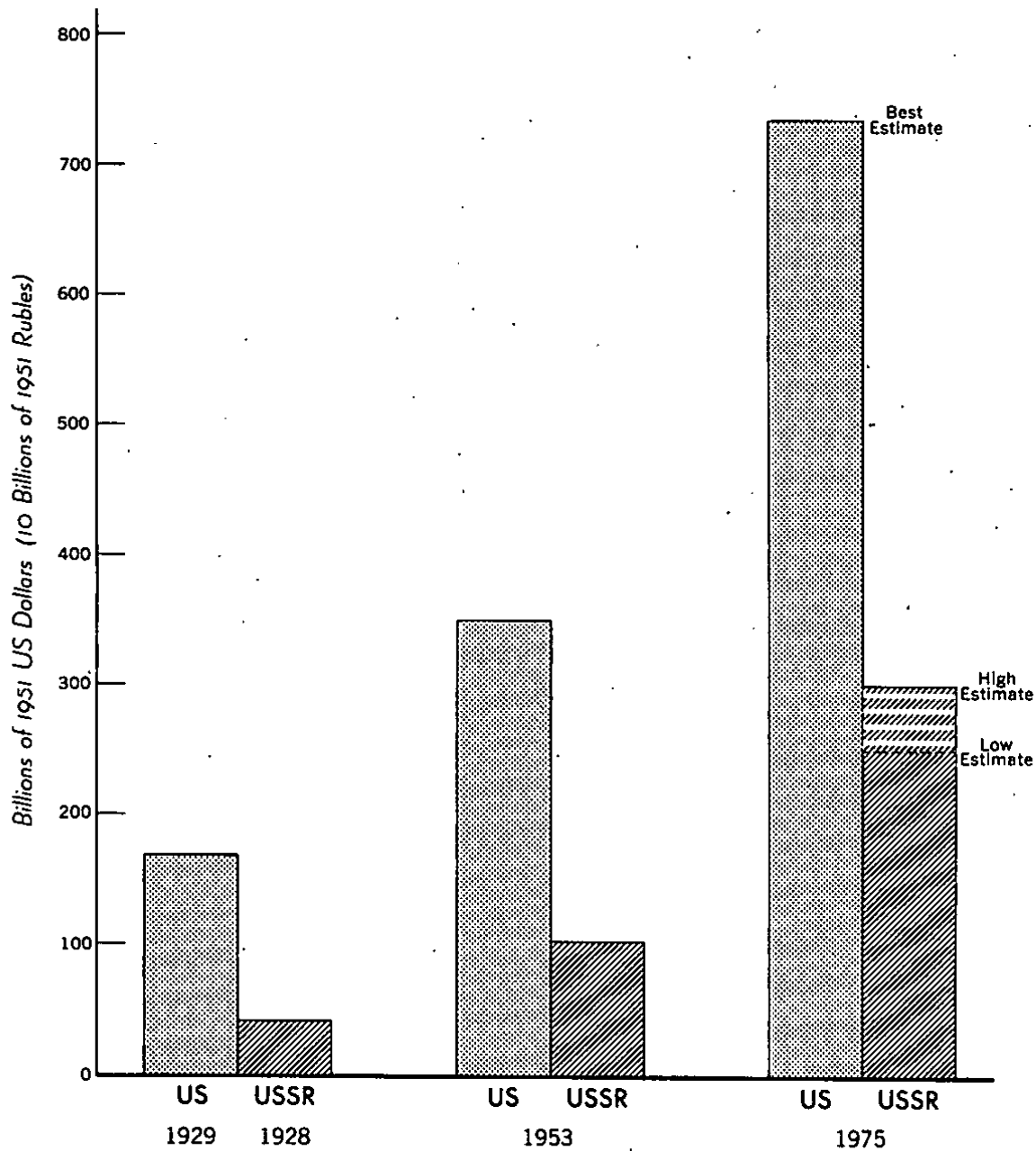
13646 12-54   *SECRET*

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APPENDIX A

METHODOLOGY FOR COMPUTATION OF PRODUCTION STATISTICS

The value-added figures in Table 1* in the text are based on
physical production indexes developed separately for the agricultural
and nonagricultural sectors. The indexes are converted to ruble terms
by valuing the two sectors of gross national product in terms of 1951
rubles. Gross national product is calculated as the sum of the two
sectors in 1951 rubles.

1. Agricultural Index.

For the period 1902-13 the sector index has been moved by a grain
production index. Ideally, an agricultural index should also include
livestock and industrial crops, but data are not available for these
groups in the early period. Their omission may involve some slight
understatement of the growth of agriculture as a whole, if the excluded
sections exhibited a more rapid growth rate than did grain production
in these years, as they have done in later years.

The index for 1913-28 incorporates both grain and livestock products.
It applies to the 1928 boundaries of the USSR. The price weights for
these years, as well as for the entire period 1902-38, are the 1926-27
prices for the respective products. Although 1926-27 prices had become
anachronistic by the late 1930's, they are reflective of comparative
cost conditions throughout most of the post-World War I period. Given
the absence of prices for the pre-World War I years, 1926-27 prices
have been used as weights in the belief that they do not significantly
distort actual price relationships. The physical production figures
for grain crops are found in Table 17.** The livestock product com-
ponent of the agricultural product index is based on official esti-
mates 16/ as to the value of livestock product output in 1913 and 1929.
The 1929 value estimate has been moved back to 1928 on the basis of the
behavior of the livestock product component of the comprehensive 1928-38
agricultural production index described below.

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* P. 12, above.
** Table 17 follows on p. 61.

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Table 17

Production of Selected Agricultural Commodities
in the USSR 15/
Selected Years, 1900-1953

Million Metric Tons

Year a/*	Wheat	Rye	Oats	Barley	Corn	Other Grain b/	Total Grain	Rice	Potatoes	Cotton (Ginned)	Flax (Scutched Basis)	Hemp Fiber	Wool (Grease Basis)
1900-04	14.9	22.9	12.6	6.6	1.2	4.2	62.4		25.6				
1905-09	17.4	19.9	13.6	8.5	1.6	4.5	65.5		29.2				
1910-13	22.1	23.5	15.5	11.0	2.4	5.1	79.6	.3	35.6				
1921-25	10.1	16.4	7.5	3.8	1.8	4.7	44.3	N.A.	27.6	.07			
1926-30	22.5	22.2	15.4	5.9	3.1	6.8	75.9	.4	46.8	.2	.4	.3	.2
1931-35	23.5	20.2	13.5	6.0	3.9	8.0	75.1	.2	55.9	.4	.6	.2	.1
1936-40	35.1	20.1	17.1	8.7	3.6	7.4	92.0	.3	58.4	.7	.6	.1	.1
1945-49	24.0	21.2	11.0	6.0	3.0	6.3	71.5	.3	65.8	.5	.4	.1	.1
1950-53	36.0	20.5	13.4	7.1	2.9	4.5	84.4	.4	67.0	.9	.5	.2	.2
1945	20.1	21.3	11.1	4.8	2.2	5.6	65.1	.2	59.6		.4	.07	.1
1946	21.2	21.8	8.7	4.6	2.0	5.7	64.0	.2	70.0	.5	.4	.07	.1
1947	23.1	24.2	11.9	6.8	3.6	6.8	76.4	.3	71.6	.5	.4	.09	.1
1948	26.8	19.1	11.6	7.0	3.5	7.1	75.1	.4	65.0	.7	.4	.1	.1
1949	28.7	19.3	11.6	6.9	3.6	6.1	76.2	.4	63.0	.7	.5	.2	.1
1950	39.2	18.0	14.5	7.3	3.3	2.3	84.6	.4	72.2	.9	.5	.2	.2
1951	31.3	23.3	13.1	7.0	2.8	4.5	82.0	.4	59.5	1.0	.5	.2	.2
1952	38.8	22.1	14.3	7.6	3.0	5.6	91.4	.4	69.7	.9	.5	.2	.2
1953	34.7	18.7	11.9	6.7	2.6	5.7	80.3	.4	66.4	1.0	.5	.2	.2

* Footnotes for Table 17 follow on p. 63.

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Table 17

Production of Selected Agricultural Commodities
in the USSR 15/
Selected Years, 1900-1953
(Continued)

a. 1900-1906 - Data are for 72 oblasts. Areas not included are the Transcaucasus, Turkmen, and Eastern Siberia.
   1907-1910 - Data are for 90 oblasts.
   1911-1913 - Data are for 87 oblasts.
   1921-1922 - [   ] data are for all of the USSR, probably 1922 boundaries.
   1923-1927 - Data are for the USSR, probably 1927 boundaries.
   1928-1934 - Data are based on present boundaries except for the territories acquired from Poland, Germany, Czechoslovakia, and Rumania
               at the end of World War II.
   1935-1953 - Data are based on present boundaries.
b. Other grain includes buckwheat, millet, spelt, peas, beans, and lentils.

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In the 1928-38 comparison a comprehensive list of products, covering perhaps 90 percent of total agricultural output, comprises the basis of the index. The territorial coverage is the post-World War II USSR. The physical estimates of grain products entering into the index have been adjusted to exclude the proportions of total output used as animal feed and seed. As noted above, 1926-27 prices have been used as weights.

The index for 1938-53 17/ is intended to be a comprehensive index of agricultural production, incorporating grain, livestock products, and industrial crop output. The weights are 1951 prices synthesized from retail prices by deduction of marketing, processing, and transportation costs. The territory covered is the present day USSR.

2. Nonagricultural Sector.

The ruble series for the years 1902-28 is based on a time series of industrial output developed by Kondratiev for the years before World War I and by official Soviet agencies for the period 1913-28. 18/ It is assumed that industrial growth is representative of nonagricultural growth in this period. The validity of the index is confirmed by inspection of selected output data in Table 18.* Geographically, the 1902-13 comparison is in terms of current boundaries; the 1913-28 comparison, in terms of 1928 territory.

For the period 1928-38 the index has been derived by aggregation of component sector indexes. The industrial production index is based on CIA estimates. Individual products have been weighted by 1949 prices, and the branches of industry by 1941 value-added proportions. The construction index is obtained from a time series of total investment expenditures deflated by a production goods price index. This procedure assumes that construction remained a constant proportion of investment outlays over the decade. The transportation and communications index is based on CIA estimates of freight and message traffic. The weights used to aggregate this component are average 1949 freight and message rates. The trade sector index is derived from a time series of retail trade deflated by a consumer price index. The services sector index is based on changes in the labor force employed in medical services, education, fine arts, the armed forces, and government administration over the period. The services index has been increased by 2 percent per year to adjust manpower data to account for assumed productivity increases.

* Table 18 follows on p. 67.

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Table 18

Production of Selected Industrial Commodities
and Services in the USSR
Selected Years, 1900-1953

Year	Electric Power (Billion Kilowatt-Hours)	Railway Freight (Billion Ton-Kilometers) a/	Raw Steel (Million Metric Tons)	Total Coal Production b/ (Million Metric Tons)	Crude Petroleum (Million Metric Tons)	Unglazed Bricks (Billion Units)	Primary Copper (Thousand Metric Tons)	Cotton Yarn (Thousand Metric Tons)	Leather and Rubber Shoes (Million Pairs)	Refined Sugar (Thousand Metric Tons)
1900		33.3 c/	2.8	16.7	10.4			239.1		2,205
1910		50.9 c/	3.2	25.4	9.6			330.8		2,859
1913	1.9	67.0 c/	4.2	29.1	9.2	2.9	30	371.8	35.9	4,062
1928	5.0	94.2 c/	4.3	35.5 d/	12.3	1.8	19.1	324.0	65.9	1,107
1933	16.4	172.9 c/	6.9	76.3	21.5	3.3	32.7	367.3	142.5	1,017
1938	39.6	384.4	18.0	132.9	30.2	8.7	95.5	558.9	189.5	2,160
1945	43.4	347.6	12.3	149.3	19.4	1.6	160.0			981
1946	47.7	368.0	13.4	164.2	21.7	3.0	170.0	299.1	99.3	1,449
1947	55.0	377.8	14.6	183.9	25.8	4.4	185.0	397.8	161.4	1,386
1948	64.1	468.2	18.7	209.7	29.2	6.9	200.0	493.2	205.5	1,800
1949	75.6	540.8	23.4	236.1	33.4	8.0	225.0	562.3	254.9	1,000
1950	90.2	612.0	27.1	262.0	37.8	9.6	240.0	607.1	310.6	2,070
1951	102.8	690.0 c/	31.2	282.4	42.1	12.3	250.0	667.0	356.9	2,160
1952	117.0	755.0 c/	34.3	301.3	47.0	16.0	287.5	686.0	373.9	2,340
1953	133.0	859.0 c/	38.0	320.0	52.7	17.0	310.0	691.0	395.0	2,520

a. Operating ton-kilometers.
b. Includes lignite d/.
c. Estimated as 2 percent greater than tariff ton-kilometers.
d. For the period 1 October 1927 through 30 September 1928.

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The task of aggregating the separate sector indexes into one representing total nonagricultural activity posed a problem of weighting, as these years saw considerable change in the Soviet economic structure. If the sector indexes are combined according to 1928 sector weights, an average annual growth of 11.6 percent is obtained for the entire non-agricultural sector; use of 1938 weights yields a growth of 12.3 percent. As a best estimate, an arithmetic average of 11.95 percent is used to project nonagricultural expansion in this decade.

The industrial index component is derived from comprehensive time series of physical production. Individual products are weighted by 1950 prices and branch indexes aggregated into a sector index by use of 1951 value-added weights. The transportation and communication index components are similarly constructed. The construction, trade, and services index components are obtained in the same manner as described for the 1928-38 period. The territorial coverage is the present-day USSR.

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APPENDIX B

SUPPLY OF LABOR

1. Population and Labor Force.

    a. Population.

        The projection of the population of the USSR is based on a recent estimate made in the US Census Bureau. Past and projected population estimates are shown in Table 19.* Table 20** shows the past and projected distribution of the population by age and sex.

    b. Labor Force.

        The rationale for the projection of the Soviet labor force is explained in the text. It should be noted that there is considerable disagreement as to the effect of continued urbanization and also the effects of higher incomes on the participation of women in the labor force.

        Another difficulty related to part-time work. Labor participation ratios have been reduced in the younger age groups to account for the greatly increased number of children and youths expected to be in school by 1975. Many of these, however, will work on the farm during vacations.

    c. Working Hours.

        Information on working hours is extremely sketchy. Estimates of average hours worked per week by nonagricultural workers are shown in Table 21.*** It is assumed that hours for these workers will remain constant at 48 per week during the period from 1955 to 1975. This estimate may be supported on the following grounds: (1) only small gains in efficiency per man-hour are likely to result from further****

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    * Table 19 follows on p. 72.
  ** Table 20 follows on p. 73.
 *** Table 21 follows on p. 74.
**** Continued on p. 75.

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Table 19

Estimated Total Population
of the USSR 19/
Selected Years, 1815-1975

		Millions
Year	Population, Contemporary Territory	Population, Present Territory a/
1815	42.5	
1825	52.3	
1835	60.2	
1860	74.1	
1897	125.6	118.5
1900	131.7	124.2
1902	136.0	129.0
1913	161.7	153.5
1926	147.0	164.3
1939	170.5	190.5
1940		193.0
1945	186.4	186.4
1947	191.1	191.1
1950	200.0	200.0
1952	207.3	207.3
1953	210.8	210.8
1955	217.8	217.8
1956	221.7	221.7
1957	225.6	225.6
1958	229.7	229.7
1959	233.8	233.8
1960	238.1	238.1
1965	260.6	260.6
1970	282.3	282.3
1975	301.7	301.7

a.   Data for 1897-1939 adjusted to present terri-
tory on the assumption that the percentage growth
in population of present territory is equal to
that in contemporary territory for periods of no
change in latter.

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Table 20

Distribution of the Population of the USSR by Age and Sex
Selected Years, 1897-1975 [20]

.Millions

	1897	1926	1939	1947	1950	1955	1960	1965	1970	1975
Male										
0-14	23.9	27.5	30.2	34.5	34.5	36.5	40.6	46.0	49.1	49.7
15-59	34.3	39.0	46.9	47.9	52.0	58.7	64.7	70.0	77.3	85.7
60 and over	4.2	4.5	4.6	5.5	5.5	6.2	7.0	8.3	9.6	11.0
Total	62.5	71.0	81.7	87.9	92.0	101.5	112.3	124.3	135.9	146.5
Female										
0-14	23.8	27.2	30.1	33.4	34.0	35.7	39.3	44.1	47.0	47.5
15-59	34.9	43.1	52.4	61.8	66.3	71.6	75.9	79.2	83.9	89.3
60 and over	4.4	5.7	6.3	7.9	7.7	9.0	10.6	12.9	15.5	18.4
Total	63.2	76.0	88.8	103.2	108.0	116.3	125.8	136.3	146.3	155.2
Male and Female										
0-14	47.7	54.7	60.3	67.9	68.5	72.3	79.9	90.1	96.0	97.3
15-59	69.2	82.2	99.3	109.7	118.3	130.3	140.6	149.3	161.2	175.0
60 and over	8.6	10.2	10.9	13.4	13.2	15.2	17.6	21.2	25.1	29.4
Total	125.6	147.0	170.5	191.1	200.0	217.8	238.1	260.6	282.3	301.7
Males as percent of total population	49.8	48.3	47.9	46.0	46.0	46.6	47.2	47.7	48.1	48.6
Persons aged 15-59 as percent of total population	55.1	55.9	58.2	57.4	59.2	59.8	59.1	57.3	57.1	58.0

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Table 21

Estimated Average Annual Hours Worked
by Nonagricultural Workers in the USSR a/
Selected Years, 1897-1975

Year	Average Hours per Day	Average Days per Week	Average Hours per Week	Average Hours per Year of 50 Weeks
1897	9.0	6	54	2,700
1902	8.8	6	53	2,650
1907	8.7	6	52	2,600
1912	8.5	6	51	2,550
1913	8.5	6	51	2,550
1917	8.0	6	48	2,400
1926	8.0	6	48	2,400
1927	8.0	6	48	2,400
1928	7.8	6	47	2,350
1931	7.3	5 2/3	41	2,050
1933	7.0	5 2/3	40	2,000
1935	7.0	5 2/3	40	2,000
1938	7.0	5 2/3	40	2,000
1939	7.3	5 2/3	41	2,050
1940	8.0	6	48	2,400
1944	9.8	6	59	2,950
1947	8.9	6	53	2,650
1950	8.1	6	49	2,450
1952	8.1	6	49	2,450
1953	8.0	6	48	2,400
1955	8.0	6	48	2,400
1960	8.0	6	48	2,400
1965	8.0	6	48	2,400
1970	8.0	6	48	2,400
1975	8.0	6	48	2,400

a. These data are extremely rough estimates. They are based
upon varied bits of information. 21/ It is assumed that the
48-hour week will be in force during the period 1955-75.

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shortening hours; (2) gains in leisure could be more readily obtained by increasing the availability of consumer goods and by reducing extra-curricular obligation than by reducing working hours; and (3) the total demand for goods for consumption, investment, and defense will continue strong.

2. Education and Training.

    a. Past Trends.

When the Communist government came to power in the USSR, a substantial part of the adult population (probably about 60 percent) was illiterate; over 85 percent lived in rural areas and were engaged in work requiring little formal education and training. Less than 15 percent of the population had completed primary school, and only 1-1/2 percent had a secondary education or higher.

No substantial progress appears to have been made during the early 1920's, except in reducing adult illiteracy, expanding university enrollment to make room for deserving Communists -- often graduated from special high schools (workers' faculties) -- and creating technical high schools (technicums) for the training of specialists.

The start of the First Five Year Plan was the signal for an extremely rapid expansion of all schools, both general and specialized. Labor had to be trained for industrial jobs concurrently with the growth of the capital plant. Four-year primary education became compulsory in 1934; and 7-year (intermediate) education, by 1950. Ten-year (complete secondary) education, although interrupted by World War II and still little developed as late as 1949-50, is to become compulsory by 1960. Technicums graduated 100,000 to 200,000 persons a year, and higher educational institutions are currently turning out engineers, teachers, doctors, and other professionals at the rate of nearly 250,000 a year.

In order to meet current industrial needs more rapidly, the government founded factory schools (FZU) in which the basic elements of an elementary education could be obtained in addition to technical

training. Numerous evening courses and on-the-job training courses,
on which there is unfortunately little statistical information, were
also given. Illiteracy was reduced to below 20 percent by 1939.

World War II caused a fall in enrollments of nearly all
schools, but its pressing industrial needs gave rise to a draft of
children into the labor reserve (FZO), an organization which is still
in existence and has graduated between 300,000 and 1 million skilled
workers a year. The labor reserve differed from the factory schools
in that it was centralized and generally took in students who had
completed at least 4 years of school.

Between 1927 and 1939, full-time enrollments in Russian
schools increased from 11.5 million to 34 million (about the same
number as in recent years). Excluding elementary and 7-year schools,
enrollments went from 750,000 in 1927 to 3.8 million in 1939 to 7.6
million in 1953.

b. Projections.

In 1975, there are expected to be 63 million Russians in
school on a full-time basis, of whom about 17 million will be 14 years
old or over. Detailed information on estimated graduations and at-
tendance in Russian schools since 1875 with projections to 1975 is
presented in Table 28.* The percentage of graduations to the esti-
mated number of children of graduating age is also shown in Table 28.
Projections of educational enrollments and graduations were made on
the basis of the following assumptions: (1) the percentage of children
of the appropriate age (11 and 14 years) graduating from primary and
7-year schools will rise slowly to a limit of 95 percent and 80 per-
cent, respectively; (2) the percentage of children (age 17) graduating
from 10-year schools will rise very rapidly in line with recent trends
and, given the official Soviet goals of making 10-year education com-
pulsory by 1960, to 80 percent in 1975; (3) the labor reserve will
continue at a reduced level of activity to 1960; (4) technicums will
decline slowly until they have been absorbed completely by the 10-year
schools by 1975; and (5) graduations from higher educational insti-
tutions will rise at a sharply decreasing rate and will reach about
315,000 a year by 1975.

* Table 28 follows on p. 94.

It will be noted that the tremendous expected growth of 10-year schools is comparable to the past growth of 4-year schools and (later) 7-year schools, except for the interruption of World War II. The percentage of adult Soviet citizens having graduated from 10-year schools is expected to rise from 25 in 1950 to 44 in 1975. Seven-year school attainment has grown from 7 percent in 1939 to about 28 percent today, and 4-year school attainment went from 26 percent in 1926 to 56 percent in 1950. There is, however, likely to be a substantial change in the nature and function of 10-year schools. In the past, their primary purpose was to prepare for higher education with a resulting emphasis on pure science, literature, history, and other academic subjects on an intellectual level comparable perhaps to West European secondary schools. Nonscholarship students had to pay tuition. In the future, standards in 10-year schools are likely to decline as the schools become media of mass education. At the same time, at least part of the more specialized training now obtained in technicums, or even on the job, will probably be encompassed by the regular school system, although it is not now known to what degree the 10-year schools themselves will change their curricula or, alternatively, to what degree additional specialized training will follow graduation. In any event, 10-year schools in the future will prepare Soviet youth not only for professional and white-collar jobs but also for the bulk of skilled and even semiskilled workers' jobs in industry and agriculture.

c. Educational Attainment of the Soviet Population.

Table 22* shows the number of Russians (aged 15-59) having graduated from the principal types of schools during selected past years and every 5 years to 1975.

The method of computation is as follows: (1) the years during which each 5-year age group of the population in given years is of age to graduate from 4-, 7-, and 10-year schools are determined; (2) the percentages of the population of these ages actually graduating for appropriate 5-year periods are averaged out; (3) actual population for each 5-year age group is multiplied by these percentages, giving the

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* Table 22 follows on p. 78.

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Table 22

Educational Attainment of the Soviet Population: Number and Percentage of Persons
Between 15 and 59 Years of Age by Highest Educational Level Reached
Selected Years, 1897-1975

Millions

	1897	1913	1926	1939	1950	1955	1960	1965	1970	1975
Higher education	0.1	0.3	0.4	1.0	1.5	2.4	3.3	4.6	5.5	6.6
Technicums				1.0	2.6	3.6	4.7	5.2	5.3	5.2
10-year schools				0.2	2.3	4.4	13.7	31.9	56.2	83.7
7-year schools	0.6	1.1	1.1	6.9	21.1	34.7	42.0	40.6	37.1	31.4
Labor reserve					5.7	8.0	9.1	9.0	8.9	8.6
4-year schools	6.9	13.6	22.0	32.7	37.7	34.3	30.5	26.7	23.8	22.1
Factory schools				2.0	2.1	2.1	2.0	1.7	0.8	0.2
Literate	9.7	20.6	24.2	40.6	40.6	36.9	32.5	26.6	20.4	13.7
Illiterate	51.9	53.3	34.5	14.9	4.7	3.9	2.8	3.0	3.2	3.5
Population 15-59	69.2	88.9	82.2	99.3	118.3	130.3	140.6	149.3	161.2	175.0

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Table 22

Educational Attainment of the Soviet Population: Number and Percentage of Persons
Between 15 and 59 Years of Age by Highest Educational Level Reached
Selected Years, 1897-1975
(Continued)

Percent

	1897	1913	1926	1939	1950	1955	1960	1965	1970	1975
Higher education	0.1	0.3	0.5	1.0	1.3	1.8	2.3	3.1	3.4	3.8
Technicums				1.0	2.2	2.8	3.3	3.5	3.3	3.0
10-year schools				0.2	1.9	3.4	9.7	21.4	34.9	47.8
7-year schools and labor reserve	0.9	1.2	1.3	6.9	22.6	32.8	36.3	33.2	28.5	22.9
4-year schools and factory reserve	10.0	15.3	26.8	34.9	33.6	27.9	23.1	19.0	15.3	12.7
Literate	14.0	23.2	29.4	40.9	34.2	28.3	23.1	17.8	12.6	7.8
Illiterate	75.0	60.0	42.0	15.0	4.0	3.0	2.0	2.0	2.0	2.0
Population 15-59	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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number of graduates alive in the given year; (4) to obtain the highest
educational level reached, graduations from higher schools are sub-
tracted from graduations from lower schools in the following manner:
higher education, all graduates; technicums, all graduates minus 5
percent assumed to have later graduated from higher educational
institutions; 10-year schools and workers' faculties, all graduates
minus higher education graduates (after adjustment for 5 percent of
technicum graduates); 7-year schools, all graduates minus 10-year
school graduates and technicum graduates; labor reserve, all grad-
uates; 4-year schools, all graduates minus 7-year school graduates
and labor reserve graduates; factory school, all graduates; and
literate, but without further formal education, residual: total
population 15-69 minus illiterates, minus all graduates of above schools.

Although part of the labor reserve graduates did complete
7-year school, it is believed that the large majority completed only
4-year school. Factory schools are believed to have been parallel
to 4-year schools and to have recruited few 4-year graduates.

The estimates of Soviet educational attainment are probably
fairly reliable because they are based on a substantial amount of
data and because the effects of errors in estimates of graduations
for particular years are very small. The projections could be thrown
off substantially only by a major change in educational policy.
Certain types of training such as on-the-job training, evening courses,
and the like, are excluded for lack of adequate time series.

Although such training is to some degree necessary for any
new employee and is used widely in the USSR for the purpose of up-
grading existing workers, its omission is not likely to bias greatly
the measure of educational attainment except perhaps during the 1930's
when longer on-the-job training was designed to compensate for de-
ficiencies in formal education.

Educational attainment in the Soviet labor force may be some-
what greater than in the total adult population and may have increased
more rapidly. Compared to the educational attainment of the 15-59 age
group, however, differences are probably rather small, particularly in
view of the large growth in the education of women.

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d. Educational Attainment in the Nonagricultural Sector.

There is no statistical information available on educational
attainment in Russian agriculture, or in nonagricultural occupations,
except for data on literacy in 1897 and on the employment of graduates
from higher educational institutions.

An approximation of educational attainment outside agriculture
may be obtained by assuming. (1) that nearly all (90 percent) the
graduates from higher educational institutions, technicums, 10-year
schools, labor reserve, and factory schools were employed outside
agriculture from 1897 to 1955; (2) that illiteracy was much more prev-
alent in rural than in urban areas up to 1939 and that virtually none
of the nonagricultural labor force was illiterate after 1939; and
(3) that a high, but diminishing, percentage of 7-year school graduates
were employed in industry up to 1955 (the percentage falling from 90
percent to 75 percent).

The proportion of 4-year school graduates to the nonagricultural
labor force is assumed to be the same as their proportion to the total
population aged 15-59.

The results of these computations are shown in Table 23.*
They are decidedly less reliable than those pertaining to the total
population aged 15-59. They may understate the growth in the educa-
tional attainment of the nonagricultural labor force, but not to a sub-
stantial degree.

It is not possible to project these series beyond 1955. It is
likely, however, that the rapid spread of 7-year school attainment in
recent years and the future growth in 10-year school attainment will
cause educational standards to rise at least as quickly on the farm
as in the factory, although they will almost certainly not catch up
by 1975.

In view of the present relative educational backwardness of the
agricultural labor force, the greater emphasis in agriculture expected
to take place in the future, and the rapid projected expansion in total
school enrollments, an assumption that agricultural and nonagricultural
education levels will rise at the same rate from 1950 to 1975 is prob-
ably not unrealistic.

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*   Table 23 follows on p. 82.

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Table 23

Educational Attainment of the Nonagricultural Labor Force
in the USSR by Highest Educational Level Reached
Selected Years, 1897-1955

Millions

	1897	1913	1926	1939	1950	1955
Higher education	0.1	0.3	0.5	0.9	1.3	2.2
Technicum				0.9	2.3	3.4
10-year schools				0.2	2.1	4.0
7-year schools	0.6	1.0	1.0	5.2	10.4	16.7
4-year schools	0.7	2.3	3.7	14.9	15.5	14.2
Labor reserve					5.1	7.2
Factory schools				1.9	2.0	2.0
Literate	4.1	8.5	7.4	18.8	7.3	1.3
Illiterate	4.5	3.0	1.4	0	0	0
Total nonagricultural labor force	10.0	15.0	14.0	42.8	46.0	51.0

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Table 23

Educational Attainment of the Nonagricultural Labor Force
in the USSR by Highest Educational Level Reached
Selected Years, 1897-1955
(Continued)

						Percent
	1897	1913	1926	1939	1950	1955
Higher education	1.0	2.0	3.6	2.1	2.8	4.3
Technicum				2.1	5.0	6.7
10-year schools				0.5	4.6	7.9
7-year schools	6.0	6.7	7.1	12.2	22.6	32.8
4-year schools	7.0	15.3	26.4	34.8	33.7	27.8
Labor reserve					11.1	14.1
Factory schools				4.4	4.3	3.9
Literate	41.0	56.0	52.9	43.9	15.9	2.5
Illiterate	45.0	20.0	10.0	0	0	0
Total nonagricultural labor force	100.0	100.0	100.0	100.0	100.0	100.0

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3. Occupational Skill.

Independently of educational attainment, an attempt was made to measure the change in the economic functions of the Soviet labor force. Table 24* shows the percentage distribution of the Soviet labor force by occupational group. Apart from the broad division of labor between the agricultural and nonagricultural sectors, the data in this table are highly conjectural. In addition, some of the categories are so broad that changes in skills within them may outweigh changes in skills requirements between the categories them-. selves.

4. Measurement of the Quality of the Labor Force.

The effect of education and training and of changes in occupational skills cannot be measured precisely. The problem, however, can at least be approached by converting available man-years of labor to quality units adjusted for changes in the composition of labor with respect to education and occupational skill. To convert man-years into quality units, it is necessary to weight man-years within each educational level and within each occupational class. The appropriate weights in each case would be, theoretically, the marginal value product of the given class of labor. An approximation to this is the relative wage (or product per worker) of each of the several classes of workers in the USSR.

Data are available on Soviet wages and salaries by occupational skill. Because there are no data for the USSR on relative wages, or product per worker by educational level, educational levels were equated to categories of occupational skills and weighted by the wage pertaining to the appropriate skill category. The weights used for both the educational and the occupational classifications are shown in Table 25.**

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* Table 24 follows on p. 85.
** Table 25 follows on p. 87.

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Table 24

Estimated Percentage Distribution of the Labor Force
in the USSR by Occupational Group 22/
Selected Years, 1902-53

Percent

	Agricultural Labor Force			Nonagricultural Labor Force					
Year	State Agricultural	Other Agricultural	Total Agricultural	Engineering, Professional, and Technical	Skilled Labor	Other Workers and Employees	All Other Nonagricultural	Total Nonagricultural	Total Labor Force
1902			86.5	0.4	0.6	12.5		13.5	100
1913			84.2	0.7	1.2	13.9		15.8	100
1928	2.5	80.6	83.1	1.0	1.7	9.1	5.1	16.9	100
1938	2.2	56.8	59.0	1.7	3.1	27.7	8.5	41.0	100
1950	2.6	49.0	51.6	4.2	7.1	24.1	13.0	48.4	100
1953	2.9	47.5	50.4	4.9	8.2	25.1	11.4	49.6	100

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Table 25

Earnings in the USSR by Level of Education and Occupation
1950

Rubles

Education Completed a/	Average Basic Monthly Wage
Higher education	1,500
Technicum	1,000
10-year general	620
7-year general or labor reserve	500
4-year general or factory school	350
Literacy (no formal education)	250
Illiterate	200

Occupational Group b/	Average Basic Monthly Wage
Engineering, professional, and technical	1,240
Skilled labor	620
Other nonagricultural workers and employees	372
Other nonagricultural labor force	250
State agriculture	496
Other agriculture	186

a. Educational Classification: Wages and salaries represent es-
timates of the average wage or salary expectancy of persons with
different amounts of education and formal training. Basic wage
rates by grade of worker and salary ranges for professional or
technical persons obtained from the above sources were arrayed, and
a median wage selected for appropriate grades. On the basis of
evidence as to grades obtained by persons with different types of
training and education upon entering on the job, the educational
background of persons in certain grades, and judgments on the qual-
ifications gained from various types of training and education, the
following relationships are assumed: literate (no formal educa-
tion), Grade I; 4-year or factory school, Grade IV; 7-year or

Table 25

Earnings in the USSR by Level of Education and Occupation
1950
(Continued)

labor reserve school, Grades V-VI; 10-year school, Grade VII;
technicum, average of technicians' salaries; and higher education,
average of professional and management salaries. It was further
assumed that wages of illiterate labor would be 25 percent below
Grade I.

b. Occupational Classification. The same basic wage scales are
used as for the educational classification: engineering, profes-
sional, and technical, average of salaries of persons in these
positions -- skilled labor, Grade VII; other nonagricultural
workers and employees, Grades IV-V; other nonagricultural labor
force, Grade I; state agriculture, Grades V-VI; and other agri-
culture, half of the wage of Grades IV-V. All above wage rates
are basic rates. They are substantially lower than actual aver-
age wages because they exclude in-grade raises, incentive pay-
ments, bonuses, and other extras.

Indexes of average educational attainment or of average degree of
skill required by the types of occupations extant have been obtained
by weighting each percentage category, for the years shown, by the ap-
propriate wage from Table 25. These indexes (Table 26*) are considered
to be indicators of the change in the quality of labor.

The next step is to adjust the supply of labor, expressed in man-
years to account for the change in labor quality. This has been done
by multiplying the labor force each year by the quality index for that
year. Table 27** shows the labor force in quality units measured by
both educational attainment and occupation. Since 1950 has been se-
lected as the base year for the labor quality indexes, a quality unit
of labor is equal to one man-year of a worker of average education or
in a job requiring average qualifications in 1950.

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Table 26

Indexes of the Quality of the Labor Force in the USSR
Selected Years, 1902-75

1950 = 100

	As Measured by Educational Attainment			As Measured by Occupational Classification		
Year	Total Labor Force	Nonagricultural Labor Force	Agricultural Labor Force	Total Labor Force	Nonagricultural Labor Force	Agricultural Labor Force
1902	60	58	61	65	78	92
1913	64	64	64	68	86	92
1928	72	73	72	72	91	97
1938	83	79	86	87	89	98
1950	100	100	100	100	100	100
1953	106	110	102	104	104	101
1975	150	150	150			

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Table 27

Indexes of the Supply of Labor in the USSR in Quality Units
Selected Years, 1902-75

1950 = 100

Year	As Measured by Educational Attainment			As Measured by Occupational Classification			In Man-Years Unadjusted for Changes in Quality		
	Total Labor Force	Nonagricultural Labor Force	Agricultural Labor Force	Total Labor Force	Nonagricultural Labor Force	Agricultural Labor Force	Total Labor Force	Nonagricultural Labor Force	Agricultural Labor Force
1902	48	14	81	52	19	122	80	25	133
1913	61	20	99	65	27	142	95	32	154
1928	58	20	94	59	25	127	82	27	131
1938	69	49	88	78	55	101	90	62	103
1950	100	100	100	100	100	100	100	100	100
1953	109	115	104	109	109	103	105	105	102
1975	196	234	159				133	156	106

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It will be noted that the increase in the quantity of the total Soviet labor force in quality units is slightly greater as measured by educational attainment than as measured by occupational skill. This probably would not be the case if occupational skill were broken down in more detail. The difference between the two measures is much greater when the agricultural and nonagricultural labor force are measured separately. This discrepancy is due to the fact that the difference between agricultural and nonagricultural wages is an important element in the skill classification but does not explicitly enter the classification by educational attainment. The effect of a movement of labor from agriculture to nonagriculture, therefore, is not reflected in the efficiency of labor as measured by occupational skill within the two sectors taken separately. The index of the labor force in quality units as measured by educational attainment probably reflects more accurately the improved quality of both the agricultural and nonagricultural labor force, although it may overstate agricultural and understate nonagricultural educational attainment in the peak years.

Within the agricultural and nonagricultural categories the skill breakdown could only be projected by means of arbitrary assumptions. Unless a drastic rise in the percent of skilled workers and professionals is assumed, labor quality would be projected as increasing very slowly in view of the very slow expected shift from agriculture to industry. This does not appear at all consistent with the rapid expected rise in educational levels, which must certainly have a substantial effect on labor productivity.

The rate of increase in the quality of the total labor force (as measured by educational attainment) has shown a gradual upward trend to 1950. This is not the case for the nonagricultural labor force, whose quality rose slowly from 1926 to 1939 and extremely rapidly from 1939 to 1950. Although this could result from the arbitrariness of the assumptions allocating educational attainment to the nonagricultural labor force, it does not appear that any reasonable allocation would give a smoother trend. The reason for the much slower rise in nonagricultural attainment in 1926-39 than in 1940-50 appears to be that the large movement of labor from agriculture in the first period tended to slow down the rise in educational levels while no such movement took place in the latter period.

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Table 28

Russian Education
Selected Years, 1875-1975

Thousand Persons

				Enrollments a/*				
Year	Grades I-IV	Grades V-VII	Grades VIII-X	Technicums (VIII-XI)	Workers' Faculties	Factory Schools	Labor Reserve	Higher Education
1875	1,090	100						10
1880	1,425	160						15
1885	1,724	160						16
1890	2,325	160						15
1895	2,619	165						16
1900	4,213	260						27
1905	5,200	350						50
1910	6,620	500						80
1914	7,236	565				219		112
1919	(6,000) b/							105
1920	(7,500)							163
1921	(7,000)							207
1922	(7,500)	(500)		123				224
1923	(8,000)	(600)		133				213
1924	(8,500)	(700)		154		(50)		205
1925	(9,000)	(800)		164		(60)		165
1926	(9,500)	(900)		180	47	(75)		160
1927	(10,000)	(1,000)		180	(48)	(150)		163
1928	10,350	1,437	165	188	49	178		160

* Footnotes for Table 28 follow on p. 95.

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Thousand Persons

	Enrollments a/ (Continued)							
Year	Grades I-IV	Grades V-VII	Grades VIII-X	Technicums (VIII-XI)	Workers' Faculties	Factory Schools	Labor Reserve	Higher Education
1929	11,583	1,615	190	208	57	(250)		167
1930	15,385	1,976	66	236	(150)	(400)		191
1931	17,732	2,814	1	594	232	585		272
1932	17,674	3,518	67	748	319	975		391
1933	17,749	4,084	139	724	353	959		492
1934	18,280	4,848	286	602	271	(600)		417
1935	19,077	5,852	491	636	267	(400)		470
1936	20,078	6,717	723	698	276	288		516
1937	20,755	7,677	1,013	739	(200)	(250)		542
1938	21,202	8,780	1,404	850	(150)	(250)		547
1939	20,471	9,715	1,870	952	108	244		590
1940				945 c/	50	(275)	(1,100)	617
1941	20,903	12,551	2,808	975		333 d/	(850)	505
1942						300 e/	(800)	313
1943						300 e/	(750)	227
1944				500		200 e/	(732)	321
1945				700		100 e/	(1,176)	439
1946				947		50 e/	(1,796)	562

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Thousand Persons

					Enrollments a/ (Continued)			
Year	Grades I-IV	Grades V-VII	Grades VIII-X	Technicums (VIII-XI)	Workers' Faculties	Factory Schools	Labor Reserve	Higher Education
1947				1,084			(1,723)	632
1948				1,120			(1,271)	670
1949		30,866	1,144	1,084			(859)	734
1950	21,920	11,080		1,308			(691)	774
1951	17,020	12,210	2,270	1,000 e/			(626)	841
1952	13,020	12,710	3,270	1,000 e/			(900)	910
1953		24,423	4,577	1,000 e/			(1,100)	916
1954								
1955	16,800 e/	11,200 e/	5,200 e/	610 e/			(500)	1,000 e/
1957								
1960	20,000 e/	12,000 e/	9,300 e/	380 e/				1,000
1965	23,600 e/	14,200 e/	11,500 e/	230 e/				1,150 e/
1970	24,800 e/	15,700 e/	13,500 e/	60 e/				1,200 e/
1975	28,000 e/	18,300 e/	15,700 e/	0 e/				1,250 e/

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Thousand Persons

				Graduations e/				
Year	Grade IV f/	Grade VII f/	Grade X f/	Technicum	Workers' Faculties g/	Factory School	Labor Reserve	Higher Education
1875	218	20						2
1880	285	32						3
1885	345	32						3
1890	425	32						3
1895	524	33						3
1900	843	52						5
1905	1,040	70						10
1910	1,324	100						16
1914	1,400							
1919	1,100							
1920	1,000							
1921	1,100							
1922	1,200							
1923	1,300							
1924	1,400						Negligible	
1925	1,500	Negligible					20	
1926	1,600	50		Negligible	Negligible		24	

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Thousand Persons

					Graduations e/ (Continued)			
Year	Grade IV f/	Grade VII f/	Grade X f/	Technicum	Workers' Faculties g/	Factory School	Labor Reserve	Higher Education
1927	1,700	100		Negligible	12	30		
1928	1,800	150		29	12	60		
1929	1,900	200		(50)	13	71		
1930	2,000	250		(90)	15	100		
1931	2,300	300		(100)	39	100		
1932	2,600	450		108	60	234		
1933	3,000	600	Negligible	133	83	390		
1934	3,300	750	Negligible	97	92	384		
1935	3,400	900	46	114	58	240		
1936	3,500	1,050	109	111	67	160		
1937	3,600	1,200	144	156	71	115		
1938	3,700	1,350	159	201	52	100		101
1939	3,800	1,500	216	204	39	100		102
1940	3,900	1,650	312	208	28	200		106
1941	4,000	1,800	359	191	13	200	650 d/	109
1942	4,000	1,500	280	(70)			450	69

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Thousand Persons

	Graduations e/ (Continued)							
Year	Grade IV f/	Grade VII f/	Grade X f/	Technicum	Workers' Faculties g/	Factory School	Labor Reserve	Higher Education
1943	3,700	1,250	190	(80)			400	28
1944	3,600	1,200	100	(100)			400	36
1945	3,700	1,350	130	100			350	54
1946	3,800	1,500	109	191			382	77
1947	4,100	1,700	150	230			796	103
1948	4,500	1,825	168	252			1,000	136
1949	4,550	2,000	194	246			723	163
1950	4,650	2,300	230	220			494	173
1951	4,700	2,600	280	210			365	181
1952	4,800	3,000	335	205			326	200
1953	4,600	3,100	440	200 e/			300	215
1954	4,400	3,200	755	195			600 e/	230 e/
1955	4,200	3,300 e/	1,110	190			500 e/	240 e/
1957								
1960	4,750 e/	3,600 e/	2,365 e/	135 e/			100 e/	280 e/
1965	5,900 e/	4,200 e/	3,200 e/	90 e/				295 e/
1970	6,200 e/	5,000 e/	4,050 e/	40 e/				305 e/
1975	7,000 e/	5,800 e/	4,900 e/	0 e/				315 e/

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Percent

	Graduations as a Proportion of the Population of Graduating Age							
Year	Grade IV	Grade VII	Grade X	Technicums	Workers' Faculties	Factory Schools	Labor Reserve	Higher Education
1875	11	0.8						0.1
1880	13	1.2						0.2
1885	14	1.3						0.2
1890	16	1.2						0.2
1895	20	1.2						0.2
1900	28	2.0						0.3
1905	33	2.7						0.5
1910	37	3.8						0.6
1914	38	4.0						
1919	30							
1920	28							
1921	30							
1922	31							
1923	32							
1924	33							
1925	33	0				0.7		
1926	35	2		0	0	0.8		

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Percent

	Graduations as a Proportion of the Population of Graduating Age (Continued)							
Year	Grade IV	Grade VII	Grade X	Technicums	Workers' Faculties	Factory School	Labor Reserves	Higher Education
1927	41	3		0	0.2	1.0		
1928	47	4		0.6	0.2	1.9		
1929	53	6		1.0	0.2	2.3		
1930	67	7		1.8	0.3	3.3		
1931	80	9		3.0	1.3	5.3		
1932	83	13		2.1	2.0	7.9		
1933	85	18		3.8	2.9	13.4		
1934	87	22		3.0	3.1	13.1		
1935	88	25	1	3.3	2.0	8.0		
1936	89	28	3	3.2	2.2	5.3		
1937	89	31	4	4	2.4	3.8		
1938	90	34	4	6	1.7	3.2	--	3.4
1939	90	37	6	6	1.3	3.2		3.5
1940	91	40	9	5	0.8	5.9		3.5
1941	91	42	10	6	0.4	5.6	16.7	3.6
1942	85	38	8	2			12.5	2.1

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

Percent

Graduations as a Proportion of the Population of Graduating Age (Continued)

Year	Grade IV	Grade VII	Grade X	Technicums	Workers' Faculties	Factory School	Labor Reserves	Higher Education
1943	80	35	3	2			12.5	0.8
1944	80	35	2.5	2.5			12.9	1.0
1945	82	39	4	3			11.0	1.4
1946	85	43	3	6			11.8	2.0
1947	87	47	4	6			23.8	2.3
1948	90	51	4	7			29.7	3.2
1949	91	55	5	7			21.0	3.7
1950	92	62	6	6			14.1	3.9
1951	93	67	7	6			10.2	4.5
1952	95	74	8	6			9.0	5.2
1953	95	80	11	6			7.5	5.5
1954	95	82	14	6			13.6	5.8
1955	95	85	26	6			11.1	6.6
1957								
1960	95	87	58	4			2.1	6.4
1965	95	90	71	2				6.9
1970	95	90	76	1				7.0
1975	95	90	80	0				6.1

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Table 28

Russian Education
Selected Years, 1875-1975
(Continued)

a. Projections. Sum of projected graduations for the following 4 years for Grades I-IV and the following 3 years for Grades V-VII and VIII-X. Adjustments for retardation: Grades I-IV, none; Grades V-VII, 10 percent in 1955, 5 percent in 1960-70, none in 1975; Grades VIII-X, 20 percent in 1955, 15 percent in 1960, 10 percent in 1965, and 5 percent in 1970 and 1975.
b. Figures in this table in parentheses are interpolated.
c. Includes correspondence students. Projected enrollments computed as sum of projected graduations during following 4 years adjusted for retardation in the same manner as 10-year schools.
d. 1941 Plan.
e. Projected.
f. On the basis of occasional data on graduations and enrollment series, smooth curves were drawn showing the trend of graduations in past years and projected to 1975. See text for assumptions used in projecting. Prior to 1914, it was assumed that graduations were 20 percent of enrollments each year.
g. Graduations given as 274,000 in 1931-34, and as 58,000 in 1935. Assuming a 1-year lag, these amount to about 25 percent of enrollments. The same percentage is applied to other enrollment figures to obtain graduations 1 year later.

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APPENDIX C

METHODOLOGY FOR FACTOR INPUTS METHOD

1. Nonagricultural Sector.

Independent projections were made of the nonagricultural labor force and efficiency and of the agricultural capital stock and output. The nonagricultural capital stock, however, had to be determined simultaneously with nonagricultural output. The fixed capital stock which the USSR will have in 1975 depends upon the amount of fixed capital stock it now has, the additions to this through investments from now to 1975, and the deductions from this through retirements during this period. Since the investment in any one period depends on the allocation of a part of gross national product to this purpose, investment depends on the size of gross national product and the other deductions from it. The final estimates for fixed capital stock and gross national product in 1975 were actually determined by trial and error so that they were consistent with gross national product and investment estimates during the 1953-75 period. The consistent estimates of gross national product and fixed capital stock in 1975 resulted in the following total fixed investment in billions of 1951 rubles for the period 1953 to 1974:

		Assumption	
		A	B
	Total of gross national products, 1953-74	39,700	35,310
Less:	Total allocation to consumption, 1953-74	18,970	21,130
	Total allocation to defense, 1953-74	3,920	3,920
	Total allocation to administration, 1953-74	990	880
	Total allocation to working capital, 1953-74	5,270	3,130
Equals:	Total allocation to fixed investment, 1953-74	10,550	6,250

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The final fixed nonagricultural capital stock in billions of 1951
rubles at the beginning of 1975 was determined as follows:

		Assumption A.	Assumption B
	Total fixed capital stock, beginning of 1953	1,450	1,450
Plus:	Total allocation to fixed investment, 1953-74	10,550	6,250
	Livestock, beginning of 1975	130	150
Less:	Retirements, 1953-74	3,330	2,640
	Agricultural fixed capital, beginning of 1975	460	780
Equals:	Fixed nonagricultural capital stock, beginning of 1975	8,340	4,430

The 1975 Soviet nonagricultural output can be computed from the
nonagricultural labor supply,* the fixed nonagricultural capital stock,
and the efficiency factor. The formula used in computing nonagricultural
output is as follows:

$$\text{Nonagricultural output} = \overline{\lfloor a} \ L + (1\text{-}a) \ \underline{K \rfloor} \ E$$

where output, L, and K are quantity <u>indexes</u> (1953 base) of nonagri-
cultural output, nonagricultural labor <u>force</u>, and nonagricultural
capital stock; where a and (1-a) are the shares of labor and capital
in the value of output in a base year; and where E is an Efficiency
index.

<u>Nature of the Production Function.</u>

The production function used in this report is only one of many
possible functions that could be used. It has the advantage of being
relatively simple and of showing clearly the quantities of labor and
capital inputs that may be available to the USSR in 1975. On the
other hand, the efficiency factor used is a conglomeration of many
elements, some of which tend to be offsetting in their effects on
output. For some purposes, it is useful to distinguish between the
problem of <u>substitutability between factors</u> and the problem of <u>returns
to scale.</u> To the degree that factors cannot be perfectly substituted
for each other, a change in their proportions under conditions of constant

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* III, C, 2, above.

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technology will tend to reduce output. On the other hand, a proportional increase in both factors tends to increase output. Consequently, a disproportionate increase in the factors tends to increase output less than a proportionate one. In an actual growth situation, technological changes occur and may occasion both changes in factor proportions without loss in efficiency and also greater returns to scale.

The combined inputs index used in this report can be defined as an arithmetic mean of the individual input quantities, weighted by the prices (or marginal productivities) of these inputs in a base year. The formula may be expressed as follows:

$$\text{Nonagricultural output} = \frac{(\alpha L_p + \beta K_p)}{(\alpha L_0 + \beta K_0)} \, E$$

where L and K refer to quantities of labor and capital, where α and β refer to their marginal productivities (which serve as weights), and the subscripts p and o refer to the projected and base years.

The implications of this index are that the relative marginal productivities of labor and capital do not change when the ratio of their quantities changes and that, therefore, the proportions of labor and capital in the value of output do change.

If it is believed that the marginal productivities do change, and if there is a change in the proportion of the quantities of labor and capital, the resulting diminishing returns must be taken into account in the efficiency index.

The production function used by Professor P. Douglas [13] is of a different nature. His combined inputs index can be defined as a geometric mean of the input quantities weighted by the proportions of the value of these inputs to total output in a base year. In terms of the present problem, it may be expressed as follows:

$$\text{Nonagricultural output} = \frac{(L_p)^a}{(L_0)} \cdot \frac{(K_p)^{1-a}}{(K_0)} \cdot E$$

where a is the constant proportion of total output attributable to labor and E is a constant "efficiency" factor. This method of computation (using the geometric mean to compute the combined index) implies,

therefore, that the relative marginal productivities of labor and capital will change in such a way as to offset the effect of changes in their relative quantities on the value of output. The combined inputs index computed by this method, therefore, gives a lower projection than is obtained by using our method, and in order to obtain the same projection of output as with the formula used in this report, the E factor in the Douglas equation would have to rise more.

Which of these assumptions as to the degree of substitutability is most reasonable with regard to the problem at hand?

Over the long run, and in an economy which has many opportunities to introduce capital intensive techniques in heretofore undeveloped sectors, the degree of factor substitutability is probably quite high.

Douglas' formula assumes that the shares of labor and capital in the value of output remain stable in spite of a substantial change in the proportions of labor and capital quantities used. This would imply a compensating change in the relative marginal value products of these factors.

There is, however, no presumption that this assumption is applicable to the USSR. Although there is no evidence of any substantial historical change in the proportions of labor and capital in Soviet nonagricultural output, the projection envisages a much more drastic change in their relative quantities than in the past. It is difficult to believe that the proportion of capital to output will not increase somewhat during the period of the projection. It is likely that the geometric mean (Douglas formula) tends to give too low a projection of the combined inputs index for the USSR and that the arithmetic mean (the one used in this report) probably gives too high a projection. The proper average of labor and capital is probably between these.

2. Agricultural Sector.

In calculating capital required under A and B projections of agricultural output a production relation for 1938 was used. This is the most recent year for which data of even moderate reliability are available.

The following production relation was used:

$$O = A^a B^b C^c D^d E^e$$

The variables are defined as follows:

O, value added plus purchases from nonagriculture = gross output in agriculture.

A, labor.

B, land.

C, capital items defined as a flow (including buildings other than dwellings, machinery, horses, tractors).

D, current purchases from nonagriculture.

E, livestock other than horses (defined as a flow).

The coefficients are defined in a constant return to scale:

$$a + b + c + d + e = 1$$

Under assumption A the following assumptions are made:

a. Labor is held constant.
b. Land input is increased by 10 percent.
c. Livestock is increased by 230 percent.
d. Current inputs are increased at same rate as capital stock.
e. There is no technological change.

Under assumption B the following assumptions are made:

a. Labor is held constant.
b. Land input is increased by 10 percent.
c. Livestock is increased by 230 percent.
d. Current inputs increase at same rate as capital stock.
e. Technological change (k) occurs at a rate of 0.5 percent per year.

In solving the two unknowns (C and D assumed to increase at the same rate), there is an increase of capital requirements of about 300 percent under assumption A and of about 500 percent under assumption B.

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APPENDIX D

CAPITAL STOCK

1. Total Capital Stock.

Capital stock estimates represent only fixed capital and livestock. They exclude inventories, gold stock, and other types of working capital. They are valued at original cost, undepreciated, in terms of 1951 rubles. Gross investment figures exclude investment in working capital, gold stock, and capital repairs. They include changes in livestock numbers.

Table 29* shows the total fixed capital stock, excluding livestock, in the socialized sector of the USSR in 1928, 1932, 1937, 1940, and 1950.

To obtain figures for fixed capital stock including livestock in the entire economy, estimates of nonsocialized agricultural fixed capital (which comprised the bulk of the agricultural capital stock in 1928, a small portion in 1932, and an insignificant one in later years) and of the value of livestock must be added to the figures in Table 29. The derivation of the agricultural capital stock is described below.**

The 1945 capital stock is estimated by deducting war losses from the sum of the 1940 capital stock (adjusted for retirements) and of gross fixed investment during 1941-45.*** 24/

Capital stock figures are obtained for 1955, 1960, 1965, 1970, and 1975 by adding the cumulative gross fixed investment of the preceding 5 years**** to the capital stock at the end of the previous 5 year interval net of retirements.

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* Table 29 follows on p. 112.
** P. 114.
*** Gross investment figures in current rubles for the years 1941-52. These figures were converted to 1951 rubles by means of an index of investment goods prices.
**** The derivation of gross investment in future years has been described in the text. Since the capital figures represent fixed capital only, a portion of projected investment had to be excluded. It was assumed on the basis of historical experience that two-thirds of projected investment represented new fixed capital.

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Table 29

Fixed Capital Stocks in the USSR (Socialized Sector) a/
Selected Years, 1928-50

	1928	1932	1937	1940	1950
Total Socialized Sector	190 b/	390 b/	770 b/	970 b/	1,125 c/

a. The figures are believed to be gross of depreciation. With the
exception of the 1928 figure, which is assumed to reflect stocks at
the beginning of the year, they are assumed to be end-year figures.
b. These figures were given in 1945 prices. 25/ They were inflated
to reflect 1951 price levels with the investment price index. 26/
c. This estimate was derived in the following manner: (1) The Soviet
authorities announced that fixed capital in the national economy of
the USSR was planned to be 8 percent greater at the end of the Fourth
Five Year Plan than in 1940, measured in comparable prices. 27/
(2) The 1940 figure was multiplied by 108 percent to obtain the planned
1950 figure. To this was added 75 billion rubles to reflect the over-
fulfillment of the investment plan during the Fourth Five Year Plan
period. (Planned Centralized investment was 250.3 billion rubles in
1945 prices. The plan was reported to have been overfulfilled by
22 percent. Twenty-two percent of 250.3 billion rubles is about 55
billion rubles, which, converted to 1951 price levels, would amount
to about 75 billion rubles.)

The sum of capital carried over from 1940 to 1950 at assumed normal
rates of retirement and of gross investment from 1940 through 1950 was
computed. The excess of this sum over the value of the 1950 capital
stock was taken to be a measure of war losses.* These represent about
22 percent of the 1940 capital stock. They were allocated proportion-
ately to those portions of the 1940 capital stock that would not have
been completely retired by 1950 at normal retirement rates.

The weighted average retirement rate of increments to the capital
stock was estimated at approximately 2.8 percent a year before 1950,

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* War losses were estimated at two-thirds of the capital stock of the
German occupied areas in 1940. It is likely that 35 to 40 percent of
the capital stock of the USSR was in these areas. 28/

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and at 3.5 percent a year from 1950 to 1975. These retirement rates were applied on a straight line basis to increments of capital created during periods of several years. Since there are assumed to be no retirements of new stock during these periods, the average rates actually used are slightly lower than the above rates in terms of each year's increment.

Capital stock for years between 1913 and 1950 was broken down among several categories, and retirement rates were assigned to each category as follows:

	Percent
Industrial machinery and equipment	4
Industrial buildings and structures	2
Agricultural machinery and equipment	6.7
Agricultural buildings and structures	2
Urban housing	1 1/2
All other (mostly railroads, public utilities, and buildings)	2 1/2

Estimates of the above breakdown of the capital stock are exceedingly rough. They are believed, however, to give a more refined basis for estimating retirements than do the total fixed capital stock figures because they separate to some degree the more from the less durable items.

Retirement rates were based on depreciation rates allowed by the US Treasury Department, Bureau of Internal Revenue, for tax purposes.

In the case of industrial machinery and equipment, a lower rate was used than the 5 to 6 percent indicated in this source because

(a) Highly durable types of machinery and equipment were probably a greater part of industrial capital stock in the USSR than in the US. Capital in consumer goods industries appears to be less durable on the average than capital in investment goods industries.* The latter predominate in the USSR.

(b) The relative scarcity of capital in the USSR, at least through 1950, was probably associated with lower obsolescence rates than in the US.

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* A study of depreciation rates for individual US industries led to this conclusion. 29/

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(c) The US rates themselves may overstate actual retirements.

Retirement rates on housing were also assumed to be lower in the USSR than the 2 percent allowed in the US because of the relative scarcity of housing space in the USSR.

During the period 1950-75, it was judged that obsolescence would tend to rise with diminishing capital scarcity and that the proportion of less durable capital to the total would grow with the expansion of consumer goods production and of more complex manufacturing processes. Consequently, increased retirement rates are assumed (3.5 percent).

2. Agricultural Capital Stock.

Historical series on capital stock in Soviet agriculture were computed by means of á quantity index of agricultural capital and a value figure of agricultural capital in a base year expressed in 1951 prices.

An index of the capital stock in agriculture was derived from time series on quantities of individual capital items. The method of computation was as follows:

An index of power in agriculture was set up from data on numbers of draft animals, tractors, combines, trucks, and other agricultural machinery (Table 30*). Each type of equipment or draft animal was expressed in terms of horsepower equivalents. In line with Soviet practice, draft horses were assumed to have 0.75 percent horsepower, and oxen 0.50 horsepower. 30/

An index was computed for livestock other than draft animals from data compiled on numbers of specific types of livestock. Cattle were given a weight of 4, hogs and sheep a weight of 1.

The above indexes were combined in the ratio of 2 for horsepower and 1 for nondraft cattle.

An adjustment was made for buildings. Arbitrary assumptions had to be made because of lack of data on the value of buildings owned by private persons in the 1928-36 period. After 1936, nearly all farm buildings were probably in the socialized sector. It was assumed

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* Table 30 follows on p. 117.

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that the stock of buildings in agriculture represented about one-third of the agricultural capital stock in 1928 and did not change between 1928 and 1933 and that the stock of buildings declined from one-third to one-quarter of the agricultural capital stock from 1938 to 1950.

Value figures in 1951 rubles were estimated for the 1938 capital stock. Values for other years were then obtained by applying the quantity index described above to the 1938 figures.

Figures on the agricultural capital stock in the socialized sector, excluding livestock, were available for several prewar years expressed in 1933 rubles.

Figures on capital stock in the socialized sector, including live-stock, and broken down by major component for the period 1928-36 are 31/ expressed in 1926-27 rubles.

Figures on numbers of private and socialized livestock were also found in this source.

It was assumed that the average value of private livestock was the same as the average value of socialized livestock of similar types.

The ratio of the value of all livestock to the value of socialized agricultural capital (excluding livestock) in 1936 was assumed to be the same expressed in 1933 rubles and in 1926-27 rubles. As a result of this assumption, the value of livestock in 1933 rubles could be obtained.

It was further assumed on the basis of information on ownership of arable land, crop production, and livestock holdings, that 5 percent of the agricultural capital stock was in private hands in 1936.

The foregoing operations gave a value of total agricultural capital for the year 1936 in 1933 rubles. By means of the quantity index of agricultural capital, a stock value figure was derived for the year 1938, a year for which estimates of the total socialized capital stock (excluding livestock) were available both in 1933 and in 1951 rubles.

It was assumed that the value of total agricultural capital was in the same ratio to the value of the total socialized capital stock (ex-cluding livestock) in 1928 expressed in 1933 or in 1951 rubles.

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Table 30

Derivation of the Index of Agricultural Capital in the USSR
Selected Years, 1928-53

Year	Draft Horses (Million)	(Million Hp)	Oxen (Million)	(Million Hp)	Tractors (Thousand Units)	(Million Hp)	Combines (Thousand Units)	(Million Hp)	Trucks (Thousand Units)	(Million Hp)	Other Agricultural Machinery (Million Hp)	Total Power (Index 1928 = 100)	(Million Hp)	Other Livestock (Index 1928 = 100)	Total Power and Livestock (Index 1928 = 100)	Index of Total Agricultural Capital (Adjusted for Buildings)
1928	24.3	18.2	6.9	3.4	35	0.4						100	22.0	100	100	100
1929					66	0.4										
1930	22.4	16.8	4.9	2.4	72	1.0	2	Negligible	2	Negligible		92	20.2			
1931					125	1.9	6		5							
1932	16.2	12.1	2.6	1.3	148	2.2	14	0.3	12	0.3	(0.5) c/	76	10.7	66	73	82
1933					211	3.2	24		23							
1934	12.9	9.7	2.9	1.4	276	4.5	31	0.9	31	0.8	(1.0) c/	83	18.3			
1935					380	6.5	49		41							
1936	11.4	8.5	3.4	1.7		8.0	93	2.6	72	1.9	(1.5) c/	110	24.2	78	99	
1937						8.4	123		103	2.8						
1938	11.0	8.2	3.8	1.9		9.3	154	4.3	196	5.3	2.5	143	31.5	89	125	125
1940						10.2										
1950	8.2 a/	6.1	3.4 b/	1.7		13.2	196	5.5	248	6.7	3.2 d/	165	36.4	95	142	133
1953	9.9 a/	7.4	3.4 b/	1.7		18.4	317	8.9	409	11.0	4.8 d/	237	52.2	105	193	181

a. 65 percent of all horses.
b. 6 percent of all cattle
c. Extrapolated.
d. Assumed to rise at the same rate as combines from 1938 to 1950 and at a slightly lower rate from 1950 to 1953.

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The value of the 1938 agricultural capital stock was then obtained in 1951 rubles. Values for other years were derived by applying the quantity index.

The validity of the results obtained from the foregoing method depends primarily on the realism of the following assumptions: (a) that the quantity index used is a representative indicator of changes in the total stock of agricultural capital, (b) that livestock prices and prices of other agricultural capital goods moved at the same rate from 1926-27 to 1933, and (c) that prices of agricultural capital and prices of all capital goods moved at the same rate from 1933 to 1951.

Although such items as fertilizer, electric power, irrigation, and the like are not included in the quantity index, they are not believed to have been very important, at least through 1950.

There is insufficient information to judge the realism of assumptions (b) and (c), above. In order to improve the estimates substantially, it would be necessary to obtain a price index not only for capital goods but also for agricultural capital and livestock from 1928 to the post-war period.

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APPENDIX E

PROJECTION OF US GROSS NATIONAL PRODUCT IN 1975

Several long-term projections of US gross national product have been made. 32/ These studies project a 40-percent increase in the US gross national product between 1950 and 1960 (Colm), a 46-percent increase during the same period (Weinberg), and a 100-percent increase from 1950 to 1975 (Paley).

The Paley estimate for 1975 (or rather for some year around 1975) is conservative, projecting a rate of growth in gross national product of only 2.8 percent a year, less than during the 1913-52 or 1929-52 periods. Its projection of the labor force is based on a population estimate below the lower limit of the range shown in the latest Census projection to 1975. An additional reason for the conservative result is the assumed 15-percent drop in average hours per week (resulting in a 35-hour average week by 1975). Colm projects a drop of only 3.5 percent in hours from 1950 to 1960.

All three studies assume an average rate of growth of 2.5 percent in product per man-hour.

The most probable value of and a range for the US gross national product in 1975 are estimated below. The high and low points of the range are determined by various assumptions as to labor force, hours worked, and product per man-hour.

1. Labor force (1953 = 100):

   High (US Census estimate A): 138
   Low (US Census estimate D): 124
   Best estimate (US Census estimate B): 134

2. Average weekly hours:

   High (Paley): 15-percent decline
   Low (hypothetical): 5-percent decline
   Best estimate: 10-percent decline

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3. Product per man-hour (rate of increase per year):

   High: (1947-53 average): 2.7 percent   (1929-52 average,
   Low: (1913-52 average): 1.9 percent   2.6 percent)
   Best estimate: 2.5 percent

4. Gross national product in constant prices (1953 = 100): Billion
                                                     1951
                                                  dollars

   High: 237   830
   Low: 163   570
   Best estimate: 210   735

The only changes made in the Paley projections are for a larger labor force and a smaller decline in hours worked. A projected rise of 110 percent in the US gross national product between 1953 and 1975 (3.4 percent a year) is greater than the 100-percent rise which an extrapolation of the Colm projections would give. It is only slightly lower than an extrapolation of the Weinberg projection.

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