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PROVISIONAL INTELLIGENCE REPORT

SOVIET STRUCTURAL STUDIES

TECHNIQUES AND ANALYSES



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SOVIET STRUCTURAL STUDIES: TECHNIQUES AND ANALYSES

CIA/RR PR-134

(ORR Project 13.429)

NOTICE

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FOREWORD

This report represents an attempt to put into use for intelligence purposes some of the techniques of intersectoral analysis. It is a sequel to earlier studies of the intersectoral accounting structure of the Soviet economy.

In particular, this report is an explication of the precise analytical processes of intersectoral analysis and includes examples of analysis using these techniques. A brief investigation of the implications of an increase in petroleum output, an examination of the investment program of the Soviet electric power industry, and a study of the impact on the domestic economy of Soviet trade with the Western countries have been selected to test the techniques and demonstrate the usefulness of intersectoral analysis in economic intelligence research.

The analytical work undertaken in this report is suggestive rather than definitive. As the basic data improve and as more experience with the techniques of analysis is gained and they become more refined, the intelligence community will be able to analyze accurately and in detail many phenomena of the Soviet economy which now must be treated with qualitative and highly aggregative techniques.

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SOVIET STRUCTURAL STUDIES: TECHNIQUES AND ANALYSES\*

Summary and Conclusions

When presented with concrete problems such as the implications for an economy of an investment program, an increase in production, or the impact of foreign trade upon the economy, economic intelligence has been forced to rely upon scattered aggregative data, qualitative judgments, and intuition. It has frequently not been possible to make use of available data about an economy, because no over-all analytical framework existed.

This report presents the intersectoral accounting system as one possible analytical framework. It is a method of describing and analyzing the Soviet economy in terms of the interrelationships among all the separate sectors. The analytical framework is designed for tracing through the production structure of the economy a postulated change which affects any or all sectors.

After a discussion of the structural description of the Soviet economy (Section I) and the general analytical techniques (Section II), three specific analytical problems are examined. The first problem is to estimate and classify the production of goods and services implied in additional deliveries of a given value (1 million rubles) of petroleum products delivered to final demand. The second problem is to examine the Soviet electric power investment program between 1951 and 1960. The third problem is to determine the nature and characteristics of Soviet trade with the West by comparing the domestic requirements generated by exports and those generated by the replacement of a comparable volume of imports.

The problems discussed in this report are suggestive of the kind of analyses which may be undertaken using these techniques. The absence of necessary corollary information prevents the presentation of definitive conclusions.

\* The estimates and conclusions contained in this report represent the best judgment of ORR as of 15 January 1956.

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The example of increased deliveries to final demand of petroleum products indicates clearly that a given change in final demand will have multiple repercussions throughout the economy, thus demonstrating the extent of the interrelationships in the economy. In addition, the immediacy with which a change in a single sector fans out and is felt in every sector of the economy indicates the strength of these interrelationships.

The requirements of the electric power investment program, traced through the Soviet economy, draw attention to the sectors in which these may be limiting factors. The analysis is a prototype of that which must be applied to the entire investment sector, program by program, in order to point up the sensitive areas within the Soviet economy.

Soviet trade with the West is shown to be labor intensive. This represents a confirmation of an already established judgment. It is further shown, within the framework of this analysis, that the replacement of imports by domestic production would represent a substantially greater sacrifice than the benefits which would be gained by domestic retention of exported items on a per unit basis.

Despite the fact that the conclusions cannot be regarded as final, the analyses undertaken in this report indicate clearly that the techniques employed, while still crude, are those which are capable of providing answers to many of the questions required of the intelligence community.

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I. Structural Description of the Soviet Economy.

The purpose of intersectoral accounting systems is to describe the operations of an economy, to indicate the interrelationships among all sectors of the economy, and to provide the basis for analysis of the economy. Analysis proceeds from the implicit assumption that intersectoral transactions in fact reflect the dependency

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of a given sector upon the other parts of the economy. For example, the production of steel is directly dependent upon the supplies of manpower, iron ore, coal, and other materials and upon electric power made available to the steel sector. Similarly, the output of these products and their supply to the steel sector are dependent, directly or indirectly, upon steel deliveries.

These intersectoral relationships for the Soviet economy employed in this analysis are presented in Figures 1, 2, 3, and 4. Figure 1\* is the basic intersectoral transactions table for the Soviet economy in 1951. Figure 2\* presents a simplified intersectoral transactions table for the Soviet economy in the same year. Figure 3,\* which is derived from Figure 2, presents the direct requirements by a given sector per ruble of deliveries to a consuming industry. Figure 4,\* which is derived from Figure 3, presents the direct and indirect requirements by a given sector per ruble of deliveries to final demand. The conceptual basis of intersectoral accounting and the mathematical formulation of intersectoral analysis are presented in Appendix A.

The intersectoral transactions table (Figure 2) upon which this report is based has been derived from the transactions table (Figure 1) presented in an earlier report. 1/\*\* The differences between these tables are as follows: the current table is smaller (there are fewer processing sectors); imports in the current table are treated as a negative output rather than as an input; the government and defense sectors of the earlier table have been combined, as have the trade and services sectors.

A. Reduction of the Number of Sectors.

The smaller intersectoral transactions table was employed in this research aid to reduce the computational requirements of analysis. Computing the inverse (see Appendix B) of a transactions table requires  $n(n^2 + n)$  individual computations, where  $n$  represents the number of processing sectors. The original table has 61 processing

\* Inside back cover.

\*\* For serially numbered source references, see Appendix C.

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sectors. Thus about a quarter of a million computations would be required to obtain the inverse. The transactions table employed in the current study has 28 processing sectors. Only about 25,000 computations were required to calculate the inverse.\*

The process followed in reducing the size of the transactions table was to combine those sectors whose products were similar. The rows and the columns of those sectors whose products were similar were added. The resulting new row presents the distribution of output of the new combined sector, and the resulting new column presents the distribution of inputs of the combined sector. Intrasectoral transactions, as in the earlier table, have been removed from the diagonal cells and from the totals.

This combining, or aggregation, of sectors is not without its effect upon the usefulness of the intersectoral tables as analytical tools. First, the process of aggregation may obscure important interrelationships among the components of the aggregated sectors. In some instances it is possible that the detailed information sacrificed may be of greater importance than the more general information made available by the process of aggregation.

A second effect of aggregation is upon the numerical results derived from the use of the transactions table as an analytical device. A different grouping or combining of sectors from that employed in this report will yield more or less different numerical results for the problems discussed below. If the "correct solution" to a given problem is known, then by comparing the different shortcut answers with the "correct solution" it is possible to measure the comparative "goodness" of different aggregative classifications. However, because the data, even in their most detailed state, are already aggregated, it is not possible to determine the "correct solution" if it is not given.

Two general characteristics of the process of aggregation are as follows: the more highly aggregated systems, when employed for analytical purposes, tend to overestimate the attainable levels

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\* Even so, large-scale electronic computing machinery was required. Appendix B outlines the computational procedure.

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of production for an economy; similarly, the more highly disaggregated systems tend to underestimate the capabilities of an economic system. These characteristics develop from implicit assumptions regarding the substitutability among both inputs and outputs for a given aggregated sector. The process of aggregation tends implicitly to widen the range of "feasible" substitute inputs and outputs. Conversely, the process of disaggregation tends to narrow the range of "feasible" substitutes.

The implications of these characteristics may be seen from the following example. Assume, for instance, that large quantities of a certain type of electric motor are essential to aircraft construction. These motors might be, and indeed are, grouped with a number of other electrical parts and form only a small portion of the aggregate. If increased aircraft production were attempted, the number of motors needed might exceed the number which could be produced. A large aggregated sector, however, in which motors were only a small part would not reveal such a shortage. On the contrary, it would imply that material inputs and factors of production could be converted from the manufacture of other commodities within the sector to satisfy the requirement. Conversely, aluminum is a "feasible" substitute for copper in the production of electrical equipment. The disaggregation of these two commodities, by narrowing the range of substitutes, will tend to cause an understatement of the ability of the economy to meet its requirements for electrical equipment.

B. Accounting for Foreign Trade.

A comparison of Figure 1\* with Figure 2\* reveals that, in the latter transactions table, imports are treated as though they were negative exports (or negative output), whereas in Figure 1 they are handled as inputs to the import-competing sectors. That is, in Figure 1, imports are channeled through those sectors which produce comparable domestic products rather than being charged directly to the consumer's industry. The effect of this change is that in Figure 2 each sector's total output is expressed as domestic production, whereas in Figure 1 it is expressed as domestic production plus imports.

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This modification is not without its effect upon the input coefficients derived from the transactions table. The effect is to increase the input coefficients for the sectors in which this change takes place. This may be demonstrated as follows. Assume an industry which has the following input pattern:

Inputs of Goods and Services into Industry "i"		
	<u>Rubles</u>	<u>Percent</u>
Industry 1	40	40
Industry 2	30	30
Industry 3	20	20
Imports	10	10
Total	<u>100</u>	<u>100</u>

A shift of imports from inputs to negative exports will display the following input pattern:

Inputs of Goods and Services into Industry "i"		
	<u>Rubles</u>	<u>Percent</u>
Industry 1	40	45
Industry 2	30	33
Industry 3	20	22
Total	<u>90</u>	<u>100</u>

The second input pattern, in which imports do not appear as a cost to the sector which produces similar commodities, furnishes a more accurate basis for computing, for example, the requirements generated by a postulated change in final demand. It also clarifies the treatment of imports, since it leaves the determination of net

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import requirements for each class of commodities to be determined as the algebraic difference between the requirements generated and the domestic production forthcoming under the postulated conditions.

C. Accounting for Government, Defense, Trade, and Services.

The aggregation of government and defense and of trade and services from 4 into 2 sectors was conducted for the purposes of analytical convenience. The combined government and defense sector now includes all purchases of the government (including the purchases of the defense industries) with the exception of outlays for health, education, and retail trade. The latter expenditures are included in the combined services and trade sector. These modifications have no direct impact upon the analytical results derived from the application of intersectoral techniques to a given problem. Furthermore, the loss of detail in the final demand sector does not hamper seriously the interpretation of these results.

II. General Analytical Techniques.

The description of an economic system, ideally, may be conducted in the absence of assumptions regarding the nature or structure of the economy. Most frequently, however, the complexities of modern societies force the use of simplifying assumptions in order to form a frame of reference for the accumulation and processing of information. To the extent that these simplifying assumptions abstract from reality, the description itself abstracts from reality.

In addition, because man is not omniscient, the prediction of economic events always requires two primary sets of assumptions. The first is the postulation of the future activity -- for example, a change in final demand or a technological innovation. The second is the necessary assumptions regarding the interrelationships within the economy over the period involved.

The primary postulate of intersectoral transactions accounting systems is that there exists a relationship between some of the transactions which take place within an economy and the structure of that economy. Therefore, an accounting of these transactions may be employed to make meaningful statements regarding the structure

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and nature of an economy. It was upon the basis of this postulate that an attempt to construct an intersectoral transactions model for the USSR was undertaken.\*

A further limiting condition was imposed in the construction of the basic transactions table to reduce the areas of conjecture and to evolve a useful tool for analysis. This was to restrict the transactions estimated to those on current account. Thus the transactions table employed in this report presents only the intersectoral transactions on current account. The capital account transactions have been accumulated into the investment sector of final demand.

To employ the transactions table for the analysis of particular problems, it is necessary to make an additional postulate. This additional postulate may be stated as follows: the intersectoral transactions in an economy are some function of the output level of the various sectors. For example, it is postulated that the purchase of coal by the iron and steel sector is some function of the output of the iron and steel sector.

Operationally, in the absence of adequate information regarding these transactions (that is, the purchase and sales among processing sectors), it has been necessary to specify arbitrarily the nature of the functional relationships among the sectors of the economy. It is assumed specifically that the purchases a given sector makes from another processing sector are a constant proportion of the level of output of the purchasing sector. Purchases of coal by the iron and steel sector are assumed to be a constant proportion of the value of the output, and thus of the total costs, of the iron and steel sector. In economic terms, it is assumed that all sectors are experiencing constant costs. These assumed characteristics are displayed in Figure 3.\*\* Here the input requirements of each sector are expressed as a constant proportion of the sector's cost. By moving the decimal point two places to the right, these input requirements may be expressed as a percentage of total cost.

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\*. The theoretical structure and the analytical applications of intersectoral accounting are discussed in a previous report. 2/

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Intersectoral analysis has its primary application in the examination of the implications of changes in the economy which influence the levels of output of the various sectors. These may be characterized as (1) changes in final demand; (2) changes in technology; and (3) restrictions imposed upon the economy from outside, such as trade controls and industry destruction as from air war or sabotage. The validity of the results derived from intersectoral analysis of problems of this type rests upon the extent to which the data approximate the conditions in the Soviet economy and the extent to which the assumptions needed for the analysis are a reflection of Soviet economic and industrial experience.

Two general methods may be employed to analyze problems of the type outlined in the preceding paragraph. One is the iterative process, using the sector input coefficients. The other is the application of an algebraic device known as an inverse. (Both represent methods for the solution of the system of equations outlined in Appendix A.) Thus, given a change in the economy, such as an increase in final demand, these methods permit an estimate of the impact of this change upon the individual sectors of the economy.

By way of example, it can be assumed that there is a 1-million-ruble increase in final demand for petroleum products. The goal is to determine the total impact, not only upon this sector of the economy but also upon all sectors of the economy of this increase in demand. The increased demand postulated for petroleum products, if met by increased production, will induce increased purchases by this sector from its suppliers. The amount of these purchases from each supply sector is determined by the input coefficients of the petroleum sector (column 11 of Figure 3\*). This is the initial, or first-round, impact of the postulated change in final demand and is represented in Table 1\*\* by the first column.

The suppliers to the petroleum sector are assumed to meet these increased purchases by increases in output. The increases in the output of the petroleum sector suppliers cause them to increase their purchases from their supplying sectors, the amount of each purchase being determined by the appropriate input coefficient.

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\*\* Table 1 follows on p. 11.

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This is the second-round impact of the change in final demand and is represented sector by sector in Table 1 by columns 2 through 15. This procedure is continued, tracing the increased purchases through the economy until the changes become negligible. The sum of all these increased sales (output) for a given sector is the total effect upon that sector of the increased demand for petroleum products. The final column in Table 1 presents for each sector the total impact upon that sector of the increased demand for petroleum products. In effect, this column presents the direct and indirect requirements needed from each sector to fulfill the increased output of petroleum products.

Fortunately, for some purposes, this laborious procedure may be shortened. Figure 4\* shows the results of a systematic, simultaneous, and complete set of computations of the desired type, carried through by means of a high-speed electronic computer.\*\* Technically, the result of these computations is the derivation of the "inverse" of the input-coefficients table, Figure 3, or the matrix  $(I - A)^{-1}$ \*\*\*

For purposes of exposition, Figure 4 is a transposed inverse: that is, the rows and columns have been interchanged. Each row of Figure 4 shows the output in 1951 required directly and indirectly from each sector to support the delivery to final demand of 1 ruble's worth of product by the sector named at the beginning of the row. For example, in row 1 the delivery of 1 ruble's worth of food crops in 1951 required a total output (exclusive of intra-industry sales) of 1.003794 rubles of food crops (sector 1), 0.5419586 ruble of industrial crops (sector 2), 0.0008144 ruble of coal and coal products (sector 12), and varying amounts from all others.

Each column in Figure 4 shows the gross output required from the sector named at the top directly and indirectly per ruble of deliveries outside the processing system by each of the sectors. The entries in the first column, for example, reflect the dependence of food crops production on the demand for grain, mill, and bakery products; other foods and kindred products; chemicals; and so on.

\* Inside back cover.

\*\* See Appendix B, Computational Note.

\*\*\* See Appendix A, Mathematical Note.





ing Sectors

1950 Rubles

Round	16	17	18	19	20	21	22	23	24	25	26	27	28	Total	Total First, Second, and Third Rounds	Total Direct and Indirect Effects
										1.6			0.7	677.1	1,059.4	1,260
		0.2												352.8	7,183.5	7,720
														1,816.1	1,816.1	2,090
	0.1	1.1								0.3			0.2	158.3	1,129.9	1,240
		0.4								11.0	5.3		1.1	32.9	822.0	870
		0.4								21.8	12.7	1.7	2.0	356.3	1,370.5	1,500
		41.4	1.9	2.9	0.03	1.4	9.4	3.0			7.1	1.7	0.4	466.3	1,639.0	2,270
		2.3	1.0	0.2	0.1	0.05	0.3	0.3			1.5			28.1	97.4	110
6	101.8	37.9	9.9	1.2	0.4	2.1	80.2	5.9		0.9	5.6	1.1	1.8	934.9	7,635.3	8,060
5	120.1	42.1	8.5	1.9	0.3	6.3	75.0	2.0	2.1	12.8	16.0	1.1	1.1	1,345.5	42,353.0	42,770
1	67.3	4.1	2.1	0.5	0.1	0.6	3.9	0.7	23.2	94.5	224.7	226.4	0.7	976.3	3,709.2	4,430
4	22.5	3.7	1.9	0.5	0.1	0.5	3.4	0.5	270.1	1,100.7	4.7	5.1		2,030.4	15,065.9	16,150
	0.9	2.9	4.3	8.9	1.2	0.3	15.1	0.1	1.1	0.3	118.8	1.5	0.2	398.0	1,741.8	1,870
6	21.9	21.7	5.0	2.3	0.1	5.1	33.0	0.4	35.1	4.7	1.4			358.9	4,660.9	4,910
	49.4	317.7	93.6	28.6	13.4	28.3	72.2	38.0		62.2	5.1		0.2	944.9	3,198.2	3,690
5		94.2	31.2	2.6	0.6	10.0	179.2	3.5		18.1	1.3		0.2	531.3	2,924.9	3,210
3	14.1		38.9	15.4	2.7	7.2	108.3	11.5	1.8	14.0	9.7	4.2	1.1	892.7	5,471.5	6,100
2	5.3	25.5		23.5	7.6	8.8	25.9	20.4	3.1	22.1	7.1			216.2	9,645.7	9,800
9	13.3	0.3	0.2						4.8	2.2	135.4		1.5	304.5	5,984.0	6,230
2	38.3		0.05	2.5				1.0		1.2				132.2	191.5	230
		13.6	29.8	0.1	1.9		25.1	7.9		3.0	3.6			85.0	504.3	550
	0.5	17.5	12.8	8.4	0.4	11.8		5.2	43.6	8.6	7.1		17.9	145.7	2,340.8	2,450
5	1.6								0.3	20.7	0.5	137.5		178.0	462.6	510
5	209.5	12.0	5.6	0.8	0.4	1.3	10.1	1.7		52.0		1.7	3.3	1,064.7	50,853.0	51,310
4	104.5	27.7	9.8	3.5	1.1	2.5	16.0	3.5	86.4		32.8	7.6	1.8	1,382.1	10,740.8	11,490
0	14.6	5.3	2.1	0.7	0.2	0.6	6.7	1.0	34.0	37.5		1.3	0.9	440.6	2,766.3	2,990
4	4.0	1.4	0.5	0.2	0.04	0.1	0.8	0.4	89.0	7.0	22.5		0.2	262.5	4,547.1	4,700
9	11.2	5.8	2.8	0.3	0.2	0.8	6.4	0.6	31.0	7.3	26.6	5.9		200.8	14,464.2	14,580
														16,707.1	204,378.8	213,090

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The use of the inverse is most suited to those problems in which one wishes to examine many different changes in final demand. The one inverse can be used an indefinite number of times with variations in final demand. When changes in elements other than final demand, such as changes in the technical structure, are to be subjected to examination, the inverse is not a helpful device. In such instances, the process of iteration, which permits changes in technical coefficients and allows more flexibility in the tracing of indirect effects, is utilized. Iteration also is used where it is desired to introduce time explicitly into the problem, as in analyzing some investment programs.

### III. Use of Analytical Techniques to Explore Specific Problems.

It is the purpose of this section to introduce the methodology and the limitations of intersectoral accounting as they are exhibited in the analyses of three specific economic problems. The first is a hypothetical increase in the output of the petroleum products sector, employed as an illustration in the preceding section. The second is an estimate of the requirements generated by the proposed Soviet investment program for the electric power industry. The third is an evaluation of the impact of alternative trade control programs upon the Soviet economy.

It must be pointed out that the numerical results proceeding from this type of analysis are of relative rather than absolute significance. A complete evaluation of these problems can be made only in the light of additional information (not available in the transactions structure used in this report) regarding the Soviet economy. The role of this additional information and its nature will be noted with regard to the specific problems treated in this section.

#### A. Increased Output of Petroleum Products.

The determination of the demands imposed upon the Soviet economy by an increase in the output of petroleum products is one type of economic problem to which intersectoral accounting techniques may be applied. Postulating a given increase in the output of this sector, it is possible to indicate by means of the iterative process or the inverse the demands which would be levied directly and indirectly upon the economy to meet this increased output goal. The requirements bill resulting

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from this analysis (Table 1,\* last column) reflects only purchases on current account and provides no direct measure of the capital requirements for the increase in output.

The capability of the Soviet economy to produce that bill of goods (requirements on current account) needed to expand the output of petroleum products depends upon three factors: (1) the availability of natural resources including labor, (2) the existence of unused plant capacity, and (3) the position of the petroleum products sector in the schedule of priorities of the Soviet decision-makers. It may be seen that (1) and (2) cover the ability of the Soviet economy to meet the requirements of the higher level of output, without reference to changes in other requirements. The Soviet capability to allocate resources and plant capacity as needed, to meet the desired level of output, also depends, of course, on the extent of higher priority requirements. Thus it may be seen that the data resulting from the computational procedure are of limited use and have real significance only in connection with other information regarding the Soviet economy.

If it is determined that in order to meet the required levels of output, the existing plant of certain sectors, including possibly the petroleum products sector, must be expanded, it is possible then to estimate the requirements of the subsequent capital investment program. This demands the determination of capital coefficients and then of the inputs required to achieve the required increase in plant capacity. Given this input information, it is possible to estimate (again using the iterative process or the inverse) the impact of the capital program upon the output levels of all sectors in the economy. The total impact upon the economy, then, is the sum of the input requirements induced by the expanded output of the petroleum products sector plus the requirements generated by the accompanying capital program.

The petroleum products sector has substantial charges outside the processing sectors. Of the 1-million-ruble expenditure, only about 130,000 rubles are expended in the 28 processing sectors. The first-round column in Table 1 shows how these expenditures are allocated.

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\* P. 11, above.

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Table 1 indicates how each of the first-round effects fans out through the economy as the sectors whose outputs are increased in the first round force their suppliers to expand their output. In the second round, many sectors on which direct demands are not made have their outputs increased.

In the third round, all the sectors are affected, so that by the end of the third round every sector has an expanded output. In fact, at the end of the third round, the output of all sectors is about 58 percent greater than the direct expenditures of the 28 processing sectors. It is interesting to note that more than 15 percent of the direct and indirect effects is represented by output from sectors where there are no direct expenditures.

The relationship between the direct and indirect expenditures as revealed at the end of the third round of transactions and the final conclusion of the iterative process, as shown by the inverse, has some meaning. About 96 percent of the total impact of the initial expenditures has been worked out by the end of the third round. This indicates the strength and extent of the interdependence of the economy and the immediacy with which an impulse in one sector is communicated to all other sectors.

Intersectoral analysis also indicates labor expenditures generated by the increased demand for petroleum products. The direct labor expenditures generated are 202,000 rubles. As has been indicated earlier, however, the increased output has repercussions throughout the economy. Multiplying the direct and indirect demands for all 28 sectors by their respective labor input requirements indicates that the total labor requirement is 271,000 rubles, or about 35 percent more than the direct labor requirements.

It can be seen readily that should the USSR decide upon an expansion of petroleum products, not only must it count upon a considerable expansion of other industries, but also its labor requirements will be substantially more than is indicated by direct costs.

The problem, as described above, has been assumed to be timeless: that is, the response of the economy to changes in the output of the petroleum sector has been assumed to be, in effect, instantaneous. More detailed knowledge of the Soviet economy and its decision-making processes

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would permit a modification of the analytical technique to account for the time period between the initial decision and its fruition. This would require the leading or lagging of particular sectors so that their position in the iterative process would correspond more closely to their position, in time, in the production process. It must be noted here that the use of a single inverse provides an instantaneous, or timeless, solution, and it is not possible to modify the technique to account for the leads and lags of individual sectors in the productive process.

B. Investment in the Electric Power Industry.

The purpose of this section is to analyze the implications of the Soviet electric power development program between 1951 and 1960. The use of intersectoral accounting techniques permits the examination of the investment program which underlies the growth trend of the production of electric power from 90 billion kilowatt-hours (kwh) in 1950 to the proposed goal of 320 kwh in 1960. These techniques indicate those sectors of the economy which will feel not only the direct but also the indirect impact of investment in electric power.

1. Expansion of Installed Capacity.

The Fifth Five Year Plan (1951-55) for the electric power industry was to double electric power capacity, which was 19.2 million kilowatts (kw) at the beginning of 1951, while increasing electric power output by 80 percent. This program would have reduced the high plant factor obtaining at the beginning of the period, almost 4,800 hours per year, to about 4,300 hours per year.\* By the end of 1955 the USSR had increased the output of electric power by more than the planned amount though falling short of the goal established for generating capacity. Electric power production, calculated from Sixth Five Year Plan (1956-60) information, <sup>3/</sup> was 170 billion kwh in 1955, whereas generating capacity is estimated to be 37.0 million kw. This represents no reduction from the plant factor experienced in 1950.

The Sixth Five Year Plan <sup>4/</sup> implies a generating capacity in 1960 of about 2.3 times the 1955 plant, or approximately 84.4 million kw. The planned capacity, in conjunction with the output goal, results in a plant factor of about 3,800 hours per year, a reduction of nearly 1,000 hours per year from the 1955 level. The

\* Using end-of-year output and capacity.

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reduction in plant factor embodied in the Sixth Five Year Plan is twice that planned for the 1951-55 period. This suggests that the electric power investment program in the Sixth Five Year Plan is, in part, an attempt to make up for time lost in the previous program.

The 1950 Soviet electric power plant of 19.2 million kw is estimated to have been composed of 16.2 million kw of thermal capacity and 3.0 million kw of hydroelectric capacity. For the period 1951-55 it is estimated that 14.8 million kw of thermal capacity and 3.0 million kw of hydroelectric capacity were added. The Sixth Five Year Plan calls for a thermal capacity in 1960 of 2.2 times the 1955 level and a hydroelectric capacity of 2.7 times the 1955 level. 5/ This represents an increase of 37.2 million kw in thermal generating capacity and 10.2 million kw in hydroelectric generating capacity.

In addition to generating capacity, it also will be necessary for the USSR to add to its transmission and distribution facilities during 1956-60. It is estimated that transmission and distribution facilities will increase proportionately to increases in generating capacity.\*

## 2. Investment Program in Value Terms.

For use in the intersectoral framework it is necessary to convert the investment program described above into the same units as those used in the analytical device: that is, 1950 rubles. There are not sufficient Soviet data to convert the entire physical program directly into rubles. Hence recourse was taken to technical data for the US, modified wherever possible by Soviet information. Extensive studies have been made in the US on the capital equipment and construction requirements for the addition of electric power capacity. The US capital equipment data are in 1947 US dollars.\*\* It was necessary to adjust these data to 1950 dollars.\*\*\* The dollar data

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\* The procedure employed in this report assumes that approximately 1.00 kilometer (km) of 100 kilovolt (kv) line is constructed per 1,000 kw of added generating capacity. This is in keeping with the Soviet experience of 1.75 km in 1951 and 0.75 km in 1954 as reported by A. Marinov, Director of Chief Urals Power Administration. 6/

\*\* See source 7/ for a collection of US capital studies.

\*\*\* The US data were for 1947. The price indexes used for moving the data to 1950 were from source 8/.

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were then converted to rubles for each category of inputs by means of studies of ruble-dollar ratios for nearly all sectors of the economy. 9/ The same treatment was given construction data. 10/ The difference in the proportion of thermal to hydroelectric power between the US and USSR was taken into account, and Soviet data were used wherever available. All these data were organized into the classification system of Figure 2.\* They are presented in columns 1 and 3 of Table 2.\*\*

The investment program as outlined conforms closely to that which has transpired in the USSR so far.\*\*\* In 1950 rubles the investment program carried out in 1951-53 and planned for 1954 amounted to 47 billion rubles. 11/ Table 2 shows the 1951-55 electric power program to be 64 billion rubles. The ratio of value of capital expenditure to capacity is 3,600 rubles per kw. This figure is somewhat higher than that for the early postwar period, when smaller expenditures could bring partly destroyed plants into production. 12/

### 3. Impact of Investment Program on the Economy.

Using the inverse matrix, Figure 4,\* it is possible to determine the implications of the electric power investment program and its impact upon every sector of the economy. The direct and indirect expenditures of the program are given in columns 2 and 4 of Table 2.

The total investment program, including construction, is spread over 13 of the 28 sectors, with substantial purchases in many of them. Many of these expenditures are such as to give rise to indirect expenditures of considerable magnitude. For the investment program as a whole, the direct and indirect expenditures are one-half again as much as the direct expenditures.

The relationship between the direct expenditures and the direct and indirect expenditures is an indication of the distribution (or composition) of the burden which the economy assumes when

\* Inside back cover.

\*\* Table 2 follows on p. 19.

\*\*\* This conformity is in terms of funds invested rather than in terms of additions to capacity actually put into operation during the period. The difference between the ways of measuring the program would be indicated by the difference in the volume of work under way at the beginning and end of the period.

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Table 2  
Soviet Investment in the Electric Power Industry  
1951-60

Sector	Million 1950 Rubles					Sector Outputs 1951
	Requirements 1951-55		Requirements 1956-60		Direct and Indirect	
	Direct	Indirect	Direct	Indirect		
1. Food crops		227			613	175,198
2. Industrial crops		476			1,284	43,908
3. Agricultural services		139			374	27,171
4. Agriculture, n.e.c. a/		147			394	40,700
5. Grain, mill, and bakery products		46			126	105,678
6. Food and kindred products		119			316	189,252
7. Textiles, apparel, and house furnishings		638			1,718	88,742
8. Leather and leather products		51			136	52,566
9. Logging, lumber, wood, and paper products	3,801	5,781		10,288	15,571	39,166
10. Chemicals		1,993			5,347	57,199
11. Petroleum and petroleum products		1,370		1,280	3,686	18,114
12. Coal and coal products	473	2,089			5,597	33,712
13. Rubber and rubber products	229	550		620	1,474	15,432
14. Nonmetallic minerals and manufactures	4,030	4,985		10,872	13,421	19,078
15. Iron and steel	2,186	5,498		5,878	14,705	27,625
16. Nonferrous metals	3,374	5,888		9,131	15,834	18,015
17. Fabricated metal products	5,505	7,614		14,858	20,478	66,053
18. Industrial equipment	4,037	4,743		10,370	12,247	30,584
19. Automotive equipment and tractors	139	355		376	958	22,652
20. Agricultural, construction, and mining machinery	218	392		545	903	4,620
21. Motors, generators, and transformers	10,095	10,558		27,074	28,295	7,438
22. Communications and electrical equipment	14,693	15,222		39,280	40,702	13,049
23. Transport equipment, n.e.c.		43			112	5,385
24. Electric power		1,394			3,739	17,997
25. Rail transport		2,034			5,456	39,737
26. Road transport		523			1,397	24,882
27. Transport, n.e.c.		276			737	6,923
28. Communications	85	366		231	983	6,839
Processing total	48,865	73,517		130,803	196,603	
Construction labor costs	15,115			40,913		
Total expenditures	63,980			171,716		

a. N.e.c. equals not elsewhere classified.

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undertaking the program. As would be expected, the relationship in the electrical equipment sectors is nearly 1 to 1. This results from the fact that most of the output of these sectors is delivered directly to final demand, especially the investment sector.

Indirect effects are not felt evenly through the economy. The petroleum products, rubber, automotive equipment, and communications sectors experience considerable indirect demands resulting from the investment program. Sector by sector the ratio of direct and indirect to direct expenditures ranges from 1.04 (electrical equipment) to 4.2 (communications). There are even considerable indirect expenditures in sectors where there are no direct expenditures. In the period 1951-55, over 10 billion rubles of expenditures, more than 20 percent of the direct expenditures, are in sectors in which there are no direct expenditures. A similar ratio holds for 1956-60.

#### 4. Soviet Capabilities to Meet the Program.

Any single-sector investment program such as that for electric power, is within the capabilities of the USSR. Only by testing the entire investment, consumption, and military program would it be possible to determine economic feasibility. On the basis of the limited information on investment in electric power and its impact upon the economy, 1951 sector outputs, and the potential growth of all sectors, however, something may be said about the relative impact of the program, and an indication may be given as to the economy's ability to carry the burden.

It is possible to dismiss most of the sectors from consideration because the demands, direct and indirect, of the electric power program are so small. There are, however, a few industries in which the impact is substantial. For instance, in nonmetallic minerals, which includes building materials, the direct and indirect demands for the period 1956-60 are about 70 percent of 1951 output. For nonferrous metals the total demands are almost 90 percent of 1951 output. Iron and steel, fabricated metal products, and industrial equipment also will feel a considerable impact from the electric power investment program. It cannot be said, however, on the basis of evidence here, that the Soviet economy will not be able to absorb these demands, which are spread over a period of 5 years.

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There are two substantial direct requirements, however, which may well impose important choices between investment in the electric power industry and other goals. One is the requirement for turbines, generators, transformers, and electrical equipment (including cable for transmission lines), which amounts to about three-eighths of the direct cost of the program. Since a great deal of this equipment is produced specifically for the electric power industry, the principal competing requirement would appear to be that of defense and defense-related programs. Whatever the reason, the production of turbines and generators during the Fifth Five Year Plan has been below the target set, and this presumably is related to the cutback in investment in the electric power industry. The other major direct requirement of the program is construction labor, which accounts for about one-third of the direct and indirect labor costs, or 14.6 billion out of 42.6 billion rubles in the years 1951-55 and 24.5 billion out of 71.2 billion rubles in the years 1956-60. The direct construction-labor cost alone amounts to about one-quarter of the direct cost, and the cutback in investment in the electric power industry may be related to the failure to meet planned targets for increasing the productivity of construction labor. The greater part of the construction of electric power capacity deferred from the Fifth Five Year Plan seems to consist of two very large hydroelectric projects in the Volga region, which together have a planned capacity of 3.9 million kilowatts.

The 1956-60 electric power investment program, designed to sharply reduce plant utilization, is more than 2.5 times the 1951-55 program. Whatever the reason, the 1951-55 program failed to achieve the original goals whereas over-all investment and electric power output both achieved the proposed levels. It would seem evident that the Fifth Five Year Plan objectives of reducing plant utilization (and of increasing the proportion of hydroelectric capacity) had a lower priority than some of the objectives with which they were in competition.

C. Trade with the West.

This section presents a preliminary evaluation of Soviet trade with the West in 1951. The analysis includes a study of the impact of this trade upon the Soviet domestic economy. Both the exports and imports are examined in order to determine what sectors of the economy are involved and the extent of demand upon these sectors.

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The technique of intersectoral analysis permits an examination of the nature and characteristics of Soviet foreign trade. It has the signal advantage of permitting an estimate of the direct and indirect requirements generated by both exports and domestically produced replacements for imports where imports are reduced or eliminated as a result of non-Soviet action, such as Western trade controls. The technique points out those sectors upon which these demands would impinge, thus indicating some of the forces underlying Soviet trade patterns.

It must be noted that the grouping of all processing activity into 28 sectors of the economy represents a considerable sacrifice of detail. These large categories tend to obscure Soviet trading activity, which is characteristically highly specific. Some restrictions, therefore, must be placed upon the conclusions because of the high degree of aggregation.

1. Valuation.

Presented in Table 3\* are estimates of Soviet trade with the West. Soviet exports to the West are assigned to those sectors of the economy producing the export. Imports from the West are assigned to those sectors of the Soviet economy which produce domestically goods that compete with, or are similar to, the imports. For example, Soviet imports of electric motors, generators, and transformers are assigned to sector 21, which produces those products domestically.

Available estimates of Soviet trade with the West are compiled in dollars on the following basis: Soviet exports c.i.f. Western ports and Soviet imports f.o.b. Western ports. Before converting these estimates to a ruble base, it is necessary to adjust for transportation charges. Available estimates of the cost of shipping goods indicate that transport charges are about 13 percent of the total value of Soviet exports and 10 percent of the total value of Soviet imports. 13/ These percentages, in the absence of other data, were applied across the board to the commodity estimates in dollars for the trade with the West.

\* Table 3 follows on p. 23.

Table 3  
Soviet-Western Trade  
1951

Sector	Soviet Exports (f.o.b. USSR)			Soviet Imports (c.i.f. USSR)		
	Dollar Estimate (Thousand Dollars)	Domestic Retail Prices (Million Rubles)	Adjusted Domestic Prices (Million Rubles)	Dollar Estimate (Thousand Dollars)	Domestic Retail Prices (Million Rubles)	Adjusted Domestic Prices (Million Rubles)
1. Food crops	153,184	2,573.	230	55,890	939	84
2. Industrial crops				1,354	19	2
3. Agricultural services						
4. Agriculture, n.e.c. a/	61,654	857	92	32,804	455	50
5. Grain, mill, and bakery products	1,160	27	14	12	b/	b/
6. Food and kindred products	10,391	195	98	3,079	58	29
7. Textiles, apparel, and house furnishings	5,125	79	40	6,000	92	46
8. Leather and leather products	56,721	391	391	24,905	172	172
9. Logging, lumber, wood, and paper products	9,125	129	129	12,009	169	169
10. Chemicals	3,627	56	28	2	b/	b/
11. Petroleum and petroleum products	9,765	116	116	3	b/	b/
12. Coal and coal products	1	b/	b/	88,361	1,175	1,175
13. Rubber and rubber products	639	6	6	282	2	2
14. Nonmetallic minerals and manufactures	5,360	50	50	10,065	95	95
15. Iron and steel	2,035	32	32	5,965	95	95
16. Nonferrous metals	90	1	1	31,965	285	285
17. Fabricated metal products	382	2	2	41,912	213	213
18. Industrial equipment	773	7	7	866	9	9
19. Automotive equipment and tractors	2	b/	b/	6,755	29	29
20. Agricultural, construction, and mining machinery	31	b/	b/	10,456	51	51
21. Motors, generators and transformers	26	b/	b/	14,189	68	68
22. Communications and electrical equipment	340	1	1	72,236	282	282
23. Transport equipment, n.e.c.						
24. Electric power						
25. Rail transport						
26. Road transport						
27. Transport, n.e.c.						
28. Other, n.e.c.						
Total	24,646	246	246	6,835	68	68
	345,097	4,768	1,483	425,945	4,276	2,924

a. N.e.c. equals not elsewhere classified.  
b. Less than 0.5 million rubles.

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Aside from some scattered statements indicating total trade turnover, available information regarding Soviet foreign trade is presented in currencies other than the ruble. Detailed statistics of Soviet commodity trade with the West are available in dollars. For use in the exercise they must be converted from dollars to rubles. Two ruble estimates of Soviet trade with the West are presented in Table 3.\* The first is the result of employing ruble-dollar ratios based upon Soviet domestic prices. 14/ The second estimate is an attempt to value trade in consumer goods and petroleum products in ruble prices which exclude the turnover tax and trade in agricultural products in ruble prices which are assumed to represent Soviet procurement and contract prices. These are referred to as adjusted domestic prices. The results are summarized (from Table 3) as follows:

	<u>US Prices</u> (Thousand Dollars)	<u>Soviet Domestic</u> <u>Prices</u> (Million Rubles)	<u>Adjusted Soviet</u> <u>Domestic Prices</u> (Million Rubles)
Exports (f.o.b. USSR)	345,097	4,768	1,483
Imports (c.i.f. USSR)	425,945	4,276	2,924
Total	<u>771,042</u>	<u>9,044</u>	<u>4,407</u>

On the basis of Table 3, the USSR, when its trade with the West is valued in dollars, has an import balance which is approximately 10 percent of total trade turnover. When these same traded items are valued in Soviet domestic prices, the USSR has an export balance of slightly more than 5 percent of the total value of trade. Finally, when the traded items are valued in adjusted domestic prices, the USSR has an import balance of almost 33 percent of total trade.

If Soviet commodity trade with the West were in balance in dollars and trade were being conducted rationally, it would be expected that the valuation of this trade in rubles would result in an import

\* P. 23, above.

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balance. This proposition assumes that relative Soviet prices reflect relative costs and scarcities and that the USSR exports those items with relatively low domestic prices while importing those items with relatively high domestic prices. The failure for such a pattern to emerge may be attributed to one or a combination of the following: (a) Soviet trade decisions are dictated by factors which run counter to rational economic motives, and (b) the prices used for the conversion do not reflect relative cost and scarcities as viewed by the Soviet authorities.

The use of unadjusted domestic prices to value Soviet imports and exports, instead of resulting in an import balance, as anticipated from the above, results in an export balance. On the other hand, the use of adjusted domestic prices does result in an import balance of trade as expected. If, therefore, Soviet trade decisions are in accord with rational economic motives, the price base upon which these decisions are made lies between the adjusted and the unadjusted domestic prices.

Additional information in the form of official Soviet statements is in keeping with the above hypotheses and seems to indicate that the price base used is nearer to the adjusted than to the unadjusted prices. Soviet spokesmen have indicated that total trade turnover in 1951 was 18 billion rubles and that trade in 1952 with the rest of the Sino-Soviet Bloc accounted for about 80 percent of the total turnover. Soviet-Western trade, valued in domestic prices, is 50 percent of the announced total, whereas this trade, valued in adjusted domestic prices, is approximately 24 percent of the announced total. The apparent confirmation of the hypotheses stated above should be taken only as suggestive, in view of the extremely roundabout procedure involved in valuing Soviet-Western trade in rubles.

## 2. Direct and Indirect Requirements.

A glance at Soviet trade with the West shows that Soviet exports consist primarily of agricultural and light industry products, whereas Soviet imports consist primarily of industrial products. It would be expected that the requirements levied upon the Soviet economy by exports would fall, for the most part, on the agricultural and light industry sectors. Conversely, it would be expected that

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if imports were cut off, the requirements levied upon the Soviet economy to replace these imports would fall largely upon the industrial sectors.

This conclusion may be demonstrated by studying the direct and indirect impact of trade upon the domestic economy. The methodology employed is to estimate, using the inverse, the direct and indirect requirements levied upon the Soviet economy to produce a bill of goods exported to the West in 1951. Similarly, the direct and indirect requirements also are determined for a bill of goods which represents import replacements: that is, the bill of goods which would have to be produced by the Soviet economy to replace (or substitute for) imports from the West, if these imports were cut off.

The bills of goods which represent exports and import replacements are determined as follows: it is assumed that the West reduces its exports to the USSR and its imports from the USSR by \$100 million. These reductions are distributed proportionally over the 1951 trade bill. The resulting bills of goods are then revalued in unadjusted Soviet domestic prices (including the turnover tax). The use of prices including the turnover tax was necessitated by the nature of the prices employed in the construction of the original model of the Soviet economy.

The hypothetical bills of goods, valued in dollars and rubles, are presented in Table 4\* together with the direct and indirect requirements generated by the production of these bills. The direct and indirect requirements levied upon a given sector include not only the output required to meet its direct export (or import replacement) demands but also the additional output which is consumed by other sectors in meeting their requirements. From Table 4 it may be seen that in order to produce the bill of export goods postulated, output valued at 763 million rubles is required from sector 1, output valued at 38 million rubles is required from sector 2, output valued at 52 million rubles from sector 3, and so on for each of the sectors.

\* Table 4 follows on p. 27.

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Table 4  
Representative Bill of Soviet Export and Import Replacements Based on Soviet-Western Trade  
1951

Sector	Soviet Exports: Representative Bill			Direct and Indirect Requirements Generated			Soviet Import Replacements: Representative Bill			Direct and Indirect Requirements Generated		
	US Prices (Thousand US \$)	Soviet Domestic Prices (Rubles)	Gross Value (Thousand Rubles)	Distribution among Sectors (Percent)	Value per Ruble of the Export Bill (Rubles)	US Prices (Thousand US \$)	Soviet Domestic Prices (Thousand Rubles)	Gross Value (Thousand Rubles)	Distribution among Sectors (Percent)	Value per Ruble of the Import- Replacement Bill (Rubles)		
1. Food crops	44,388	745,718	763,483	41.10	0.582130	13,121	220,433	233,198	14.20	0.235984		
2. Industrial crops			38,182	2.05	0.029112	318	4,420	51,384	3.13	0.051998		
3. Agricultural services			51,822	2.79	0.039712			27,999	1.71	0.028333		
4. Agriculture, n.e.c. g/	17,866	248,337	266,672	14.24	0.201803	7,702	107,058	115,024	7.01	0.116469		
5. Grain, mill, and bakery products			9,044	0.49	0.006896			4,485	0.27	0.004538		
6. Food and kindred products	336	7,862	46,827	2.52	0.035704	3	70	23,999	1.44	0.023971		
7. Textiles, apparel, and house furnishings	3,011	56,607	113,043	6.08	0.086191	723	13,592	130,165	7.93	0.131720		
8. Leather and leather products	1,435	23,018	24,204	1.30	0.018455	1,409	21,840	22,948	1.40	0.023222		
9. Logging, lumber, wood, and paper products	16,436	113,408	151,502	8.15	0.115515	5,847	40,344	74,107	4.51	0.074992		
10. Chemicals	2,644	37,280	77,183	4.15	0.058849	2,819	39,748	107,006	6.52	0.108284		
11. Petroleum and petroleum products	1,651	16,396	41,020	2.21	0.031276	b/		28,741	1.75	0.028084		
12. Coal and coal products	2,830	33,677	54,458	2.93	0.044522	1	12	33,619	2.09	0.034020		
13. Rubber and rubber products	b/	185	12,005	0.65	0.009153	20,745	275,908	283,286	17.26	0.286670		
14. Nonmetallic minerals and manufactures	1,559	14,655	13,699	0.74	0.010445	66	627	15,263	0.93	0.015445		
15. Iron and steel	590	9,381	26,025	1.40	0.019843	2,363	22,212	63,495	3.87	0.064253		
16. Nonferrous metals	26	231	17,173	0.92	0.013094	1,400	22,260	40,985	2.50	0.041474		
17. Fabricated metal products	111	566	47,672	2.57	0.036348	7,504	66,786	104,090	6.34	0.105333		
18. Industrial equipment and tractors	224	2,173	4,111	0.22	0.003134	9,840	50,184	60,190	3.67	0.060909		
19. Automotive equipment and construction, and mining machinery	b/	43	10,890	0.56	0.008273	203	1,969	7,096	0.43	0.007181		
20. Motors, generators, and transformers	8	38	851	0.05	0.000649	1,586	6,820	8,242	0.50	0.008340		
21. Communications and electrical equipment	99	386	1,763	0.10	0.009541	2,455	11,794	28,427	1.73	0.028766		
22. Electric power			3,948	0.21	0.003010	3,331	15,969	21,235	1.29	0.021489		
23. Rail transport			13,924	0.75	0.010624	16,959	66,140	68,557	4.18	0.069376		
24. Road transport			37,382	2.01	0.028502			23,472	1.43	0.023752		
25. Transport, n.e.c.			19,274	1.04	0.014696			39,284	2.39	0.039753		
26. Communications			7,696	0.41	0.005868			12,839	0.78	0.012992		
27. Other, n.e.c. d/			5,501	0.30	0.004194			6,253	0.40	0.006636		
28. Total	92,858	1,311,534	1,858,039	100.00	1.416687	98,395	988,196	1,641,607	100.00	1.661216		
Other, n.e.c. d/	7,142	71,420				1,605	16,050					
Grand total	100,000	1,382,954				100,000	1,004,246					

a. N.e.c. equals not elsewhere classified.  
b. Less than \$500.  
c. Less than 500 rubles.  
d. Dollar values for which no commodity detail is available.

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To facilitate the comparison of exports with import replacements, the direct and indirect requirements levied upon each sector also are presented (in Table 4\*) as rubles per ruble of export bill or import-replacement bill. Thus to produce 1 ruble's worth of export bill (distributed proportionally) requires an output of 0.582130 ruble by sector 1, 0.029112 ruble by sector 2, 0.39512 ruble by sector 3, and so on. The total requirements -- the sum of the sector requirements -- is 1.416687 rubles per ruble of export (distributed proportionally). A similar measure computed for the import-replacement bill indicates that the total of the sector requirements per ruble of import replacements (distributed proportionally) is 1.661216 rubles.

These estimates of total requirements, representing the sum of the individual sector requirements, must be interpreted with caution. The total requirements generated by a given bill of goods is a function of the product-mix of the bill and also of the classification system and the number of sectors in the model. Because these totals include the values of both final and intermediate products, they cannot be taken as measures of "real" costs as such. They do, however, indicate that within the context of this model, 1 ruble's worth of import replacements (distributed proportionally) will require a higher level of total output from the economy than 1 ruble's worth of exports (distributed proportionally).

By any measure, moreover, the USSR is exporting to the West mainly those commodities which are products of agriculture (including forestry) and light industry, while importing mainly the products of heavy industry. Even when Soviet trade is valued in unadjusted domestic prices, the products of heavy industry (sectors 10-23) amount to only 8 percent of Soviet exports to the West but 58 percent of Soviet imports from the West. When direct and indirect requirements are taken into account, the contrast remains, though it is less marked. Of the direct and indirect requirements generated by the export bill analyzed here, 16.8 percent are levied on heavy industry, whereas 53.0 percent of the direct and indirect requirements generated by the import-replacement bill analyzed here are levied on heavy industry. If trade in rubber and rubber products (sector 13), which figures heavily in Soviet imports, is omitted, the resulting computation gives the

\* P. 27, above.

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following relationship: the percentage of direct and indirect requirements on heavy industry generated by the export bill is 16.1 percent of the total, whereas, for the import-replacement bill, it amounts to 35.8 percent of the total. Thus it is clear that the flow of trade in rubber and rubber products, while it has an important influence on the differing composition of the direct and indirect requirements generated by the two bills, is only one of the factors accounting for the difference.

### 3. Labor Requirements.

The same characteristics of Soviet trade with the West appear when attention is diverted to the direct and indirect labor requirements of the assumed bills of exports and import replacements. These data, presented in Table 5,\* are estimates, by sector, of the direct and indirect expenditures on labor involved in fulfilling the assumed bills of exports and import replacements. To facilitate comparison, Table 5 also presents, by sector, the labor requirements per ruble of export or import-replacement bill.

Two general characteristics of the labor requirements of the two bills of goods may be noted. First, the labor requirements generated by the export bill of goods is a greater share of total requirements (43.2 percent) than the labor requirements generated by the import-replacement bill of goods (31.8 percent). This difference is an indication that Soviet exports are more labor intensive than Soviet import replacements would be.

The second characteristic is the sector-mix of the labor requirements generated by the two bills of goods. Almost 70 percent of the total labor requirements generated by the export bill of goods falls in the primary agricultural sectors of the economy (sectors 1-4). On the other hand, labor requirements generated in these sectors by the import replacement bill represent less than 40 percent of the total. Conversely, the labor requirement generated in the heavy industrial sectors of the economy (sectors 10-23) by exports is only slightly more than 10 percent of the total, whereas the requirement generated in these sectors by the bill of import replacements is more than 40 percent of the total.

\* Table 5 follows on p. 30.

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Table 5  
Labor Requirements of Soviet-Western Trade  
1951

Sector	Direct and Indirect Labor Requirements Generated by a Representative Bill of Exports			Direct and Indirect Labor Requirements Generated by a Representative Bill of Import Replacements		
	Gross Value (Rubles)	Distribution among Sectors (Percent)	Value per Ruble of the Export Bill (Rubles)	Gross Value (Rubles)	Distribution among Sectors (Percent)	Value per Ruble of the Import-Replacement Bill (Rubles)
1. Food crops	464,961	57.90	0.354517	142,018	27.23	0.143714
2. Industrial crops	11,913	1.48	0.009083	16,032	3.07	0.016224
3. Agricultural services	17,205	2.14	0.013118	9,296	1.78	0.009407
4. Agriculture, n.e.c. b/	62,992	7.84	0.048029	27,392	5.25	0.027719
5. Grain, mill, and bakery products	1,013	0.13	0.000772	502	0.10	0.000508
6. Food and kindred products	7,445	0.93	0.005677	3,751	0.72	0.003796
7. Textiles, apparel, and house furnishings	19,782	2.46	0.015083	22,779	4.37	0.023051
8. Leather and leather products	3,558	0.44	0.002713	3,373	0.65	0.003413
9. Logging, lumber, wood, and paper products	81,611	10.19	0.062378	40,018	7.67	0.040496
10. Chemicals	6,792	0.84	0.005179	9,416	1.81	0.009528
11. Petroleum and petroleum products	8,286	1.03	0.006318	5,806	1.11	0.005875
12. Coal and coal products	35,234	4.39	0.026865	21,751	4.17	0.022011
13. Rubber and rubber products	984	0.12	0.000750	23,229	4.45	0.023506
14. Nonmetallic minerals and manufactures	4,028	0.50	0.003071	4,487	0.86	0.004540
15. Iron and steel	5,804	0.72	0.004425	14,159	2.72	0.014328
16. Nonferrous metals	6,079	0.76	0.004635	14,509	2.78	0.014682
17. Fabricated metal products	22,930	2.86	0.017483	50,067	9.60	0.050665
18. Industrial equipment	1,665	0.21	0.001270	24,377	4.67	0.024668
19. Automotive equipment and tractors	4,177	0.52	0.003185	2,732	0.52	0.002765
20. Agricultural, construction, and mining machinery	282	0.04	0.000215	2,736	0.52	0.002769
21. Motors, generators, and transformers	382	0.05	0.000291	15,294	2.93	0.015477
22. Communications and electrical equipment	721	0.09	0.000950	8,664	1.66	0.008767
23. Transport, n.e.c.	1,409	0.18	0.001074	24,475	4.69	0.024767
24. Electric power	3,219	0.40	0.002454	5,422	1.04	0.005487
25. Rail transport	16,784	2.09	0.012797	17,638	3.38	0.017849
26. Road transport	5,763	0.72	0.004394	3,839	0.74	0.003885
27. Transport, n.e.c.	3,971	0.49	0.003028	3,384	0.65	0.003424
28. Communications	3,818	0.48	0.002911	4,340	0.83	0.004392
Total	803,008	100.00	0.612266	521,486	100.00	0.527715

a. N.e.c. equals not elsewhere classified.

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4. Conclusions.

The analysis of Soviet trade with the West in 1951 indicates that if Soviet trade decisions are motivated by economic factors, the price base upon which these decisions are made appears to be comparable with the adjusted domestic prices used above. It thus would appear that Soviet-Western trade is being conducted rationally in terms of the Soviet definition of costs.

As a result of the Soviet definition of costs, products of the extractive and light industries are predominant in Soviet exports, and the products of heavy industries are predominant in Soviet imports. This pattern is reflected in the direct and indirect requirements and in the labor requirements generated by the export and import-replacement bills. The USSR exports unskilled and semiskilled agricultural and extractive labor to the West, while importing skilled industrial labor from the West. This has the effect of permitting the USSR to expand its skilled labor force (and the related industrial capacity) without incurring the attendant costs.

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APPENDIX A

MATHEMATICAL NOTE

An intersectoral model has as its primary function a description of activities within an economy. In addition, with certain assumptions, the model may also be employed as an analytical or predictive device. The starting point for such use of an intersectoral model is the assumption that the intersectoral transactions are functions of the output of the purchasing sectors.

It is possible to represent the accounting for intersectoral transactions by a set of equations, one for each sector of the economy. These equations take the following form:

Equation 1:

$$\begin{array}{r}
 X_1 - x_{12} - x_{13} - \dots - x_{1j} - \dots - x_{1m} = x_{1e} \\
 -x_{21} + X_2 - x_{23} - \dots - x_{2j} - \dots - x_{2m} = x_{2e} \\
 -x_{31} - x_{32} + X_3 - \dots - x_{3j} - \dots - x_{3m} = x_{3e} \\
 \cdot \quad \cdot \quad \cdot \quad \dots \quad \cdot \quad \dots \quad \cdot \quad \cdot \\
 \cdot \quad \cdot \quad \cdot \quad \dots \quad \cdot \quad \dots \quad \cdot \quad \cdot \\
 \cdot \quad \cdot \quad \cdot \quad \dots \quad \cdot \quad \dots \quad \cdot \quad \cdot \\
 \cdot \quad \cdot \quad \cdot \quad \dots \quad \cdot \quad \dots \quad \cdot \quad \cdot \\
 -x_{m1} - x_{m2} - x_{m3} - \dots - x_{mj} - \dots + X_m = x_{me}
 \end{array}$$

in which  $X_i$  ( $i = 1, 2, 3, \dots, m$ ) represents the value of the output of the  $i$ TH sector net of its sales to itself.  $x_{ij}$  represents the sale by sector  $i$  to sector  $j$  ( $i, j = 1, 2, 3, \dots, m, i \neq j$ ) and  $x_{ie}$  ( $i = 1, 2, 3, \dots, m$ ) represents the sales by sector  $i$  to the nonprocessing, or final demand, sector. Equation 1 represents only an accounting description of the economy.

The assumption that the purchases by a given processing sector are functions of that sector's output may be expressed as  $x_{ij} = f_i(X_j)$  ( $i, j = 1, 2, 3, \dots, m, i \neq j$ ). Substituting in Equation 1, we have

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Equation 1a:

$$\begin{array}{r}
 X_1 - f_1(X_2)X_2 - f_1(X_3)X_3 - \dots - f_1(X_j)X_j - \dots - f_1(X_m)X_m = x_{1e} \\
 - f_2(X_1)X_1 + X_2 - f_2(X_3)X_3 - \dots - f_2(X_j)X_j - \dots - f_2(X_m)X_m = x_{2e} \\
 - f_3(X_1)X_1 - f_3(X_2)X_2 + X_3 - \dots - f_3(X_j)X_j - \dots - f_3(X_m)X_m = x_{3e} \\
 \vdots \\
 \vdots \\
 \vdots \\
 - f_m(X_1)X_1 - f_m(X_2)X_2 - f_m(X_3)X_3 - \dots - f_m(X_j)X_j - \dots + X_m = x_{me}
 \end{array}$$

The absence of adequate data makes it necessary to restrict the purchase, or input, functions to the following form:

$$f_i(X_j) = x_{ij} + X_j \quad (i, j = 1, 2, 3, \dots, m; i \neq j)$$

That is, the purchases by sector j are assumed to be a constant proportion of sector j output (or cost). This is tantamount to saying that all sectors experience constant costs. If  $f_i(X_j)$  is denoted by  $a_{ij}$  ( $i \neq j$ ), Equation 1a may be written in the following manner:

Equation 1b:

$$\begin{array}{r}
 X_1 - a_{12}X_2 - a_{13}X_3 - \dots - a_{1j}X_j - \dots - a_{1m}X_m = x_{1e} \\
 - a_{21}X_1 + X_2 - a_{23}X_3 - \dots - a_{2j}X_j - \dots - a_{2m}X_m = x_{2e} \\
 - a_{31}X_1 - a_{32}X_2 + X_3 - \dots - a_{3j}X_j - \dots - a_{3m}X_m = x_{3e} \\
 \vdots \\
 \vdots \\
 \vdots \\
 - a_{m1}X_1 - a_{m2}X_2 - a_{m3}X_3 - \dots - a_{mj}X_j - \dots + X_m = x_{me}
 \end{array}$$

The set of equations in Equation 1b may be expressed in conventional matrix notation as

Equation 2:

$$X - AX = E$$

or

Equation 2a:

$$X = (I - A)^{-1} E$$

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Here X refers to the diagonal matrix of net vector outputs;  $(I - A)^{-1}$ \* the inverse, the transpose of which is presented in Figure 4 for the current model; and E, the sector of final demands.

The mathematical formulation presented above is specifically the model used in this report. In intersectoral accounting and analysis there are many different formulations depending on the purpose of the analysis and empirical content of the accounting system. The technical term for the model used in this research aid is the "static open end quantitative [numeraire] current transactions model."

\* The operation  $(I - A)$  results in all the elements in the matrix negative except those along the main diagonal, which in this use have the value of 1.



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APPENDIX B

COMPUTATIONAL NOTE

The number of computations required to invert a matrix of the Figure 2 type is  $n(n^2 + n)$ , where  $n$  is the number of processing sectors. In the case at hand this means 22,736 computations. A matrix of this size can be computed on desk calculators, but the time required is considerable.

It was decided to compute the inverse on a large-scale electronic computer. The Standards Eastern Automatic Computer (SEAC) of the National Bureau of Standards was selected. This machine is an electronic binary digital computer with a memory consisting of cathode and mercury tubes.

There are three distinct steps in employing the SEAC. First, the machine program, or method of computation, must be selected. The program employed is conditioned by size and nature of the matrix to be inverted. For the current matrix the power-series method was used. The program is encoded on wire as instructions to the machine for the operations to be performed. The second step is the encoding and recording on wire of the data included in the matrix to be inverted. Actual computation time was only about 15 minutes. The third step is reading the inverted matrix out of the machine. With the SEAC the answer can be read out directly on teletype.

The computational method, which is self-checking, precludes computational errors. Its limited memory capacity, however, forces the machine to round the data at particular steps of the operation. Independent checks of the resulting inverse have indicated that this rounding error is negligible.

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APPENDIX C

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

<u>Source of Information</u>	<u>Information</u>
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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1. CIA. CIA/RR PR-112, The Structure of the Soviet Economy, 1 May 55. S.
  2. Ibid., p. 3-9. S.  
CIA. CIA/RR RA (ORR Project 13.4), The Role of Interindustry Studies in Economic Intelligence, 29 Jan 54, p. 2-11. S.

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3. [REDACTED]
4. [REDACTED]
5. Ibid.
6. CIA, FDD. Current Digest of the Soviet Press, vol 7, no 33, 28 Sep 55, p. 22. U. (tr of Izvestiya, 18 Aug 55, p. 2. U)
7. Treasury, Bureau of the Budget. Capital Requirements for the Expansion of Industrial Capacity, by R.N. Grosse, 30 Nov 53. U.
8. Labor, Bureau of Labor Statistics. Unpublished tabulation. U.
9. CIA. CIA/RR 55, Construction of Soviet Gross National Product Accounts for 1950-55, 19 Jan 55, p. 41. S.  
RAND Corporation. RM-1443, A Comparison of 1950 Wholesale Prices in Soviet and American Industry, 1 May 55. U.
10. Labor, Bureau of Labor Statistics. I-ON244, "Electric Light and Power Construction," by D. Siskind, New and Maintenance Construction, Aug 52. U.
11. CIA. CIA/RR 54, Postwar Investment in Industry in the USSR, 11 Feb 55, p. 21. S.
12. Ibid., p. 24. S.
13. CIA, EIC. EIC-R-11, The Balance of Payments of the Soviet Bloc and Communist China with the Free World, 1948-53, 11 Jul 55. S.
14. CIA. CIA/RR 55 (9, above).  
RAND Corporation. RM-1443 (9, above).

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47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	101	102	102a	103	104	105	106	GROSS OUTPUT															
																							INVESTMENT		TRADE		SERVICES		EXPORTS		DEFENSE		GOVERNMENT ADMINISTRATION		HOUSEHOLDS		COMMUNICATIONS
								5		*				2	13488			160	1606		803	39143															
															26451			297			2972	51778															
							6															20994															
								5		*				1	73027			2100	1000	8459		91880															
															12144			400	500	1449		23518															
																	7478					37171															
							9		2	*				1	17710			600	1500	2201		24711															
							20															16888															
			*				5	*	70	98	2	5	1	5	49698			1400	300	5711		71938															
							10		70	70					84998			2600	300	4080		100780															
							5		88	70					95458			2800	400	4193		11141															
																						117790															
9	19	6	6	128	30	2	508			84	4	4		*	24168			1254	291	2912	291	200	85539														
16	3	19	3	114	25		17	*	9	*				2	28071	4000	3000	376	1880	300			41141														
37	37	322	118	88	85	44	463		6	74	4			1	8	3000	2000	300	4000	236	5096		30291														
1		5	11	*			55		4	12								2308	20			288	8567														
		21	3				*																5783														
111	33	122	275	129	21	16	397	30	77	199	2	3	*	5	1228	1000	4980	1248	1000	23	8323	46832															
			*				6								237	119	237	119	237		237	30975															
																							3180														
10	3	5	15	28	10	4	29	332	599	2965	41	907	122	3	1028	1095	1048	120	50	50	282	19282															
9	2	4	6	15	2	6	17	3864	6960	62	*	24	*	*	276	1874	1800	180	1487	154	2383	28004															
*	*	*	8	2	*	2	6		17													2728	11489														
8		4	62	496	1	1	35	16	2	1568			7	1	3000	2245	2500		550		3977	18288															
1		*	2	14	6	*	38			20					46626	519	3500	252	519		519	82998															
			*																			2772	2680														
			*					193	8													2963	3751														
*		4	*				298	5	3	*												282	5483														
91	4	58	130	177	1	6	58	309	17	16	*			*							3838	9451															
																							2274														
	*	*	3																				11006														
270	2	81	276	566	136	334	159		175	55				1			2506	188			3986	21872															
232		2	65	533	13	220	17		219	13							899					7388															
			6				6										57						7378														
			2				*															475	2167														
127	385	33	126	68	4	14	87		10					1			482						2551														
			6				*																897	2467													
4	2	7	21	19	1	6	6		5								835						1988														
8	60	9	146	9	*	3	226										404					5500	10008														
38		112	170	78	6	30	127		100	18									177				1947														
117	32	164	386	979	138	58	197		84	87	2	3	*	2			688					27804	49375														
31			3	510	43	106			32	2												689	2258														
																							8206	6228													
				18					8	*													3724	4830													
26	6	16	30	218	1	7	17		20	7													5134	6159													
2		*	4				6																5750	6406													
95		4	91	295	82	139	32	45	88	84			*	*					196			14000	17163														
			11	138	28	118	58		19	47									23				5790	8018													
63		93	67	68	*		3		13														867	1736													
49			3	15	20		12										75	439	1179	1679	518	250	1329	5894													
97		88		522	20	56	46	623	42	93							2						3599	6288													
						*	9	68	14	1787							7	122	122	1224		120	20	10634	16417												
*				*	1			4	131	7		231	419											2322	3383												
11		10	52	62	13	4		26	5	71	2	1	12	3										2329	2409												
23	6	22	32	38	21	10	64		330								654	1305	347					13915	19133												
45	12	41	42	177	22	43	110	1236		433	6	25	5	8	6681	2542	2000			1199	722	73		17997													
11	4	19	17	39	6	12	43	487	238		*	3	3	4	1906	3591	2273			1622	1500	1203		39737													
*			1	5	*		*																		24882												
2	1	1	3	8	1	2	9	415	17	297	2		2	*											1827												
*	*	*	*	1	*	*	*		27	*														42	3500												
14	2	19	17	16	6	6	38	444	46	351	*	1	27				1555							1800													
4003	589	1924	2908	8634	1139	785	5589	4158	17837	7434	654	1416	1499	4743			117	3000	117	117	118	118		6839													
1861	418	2070	1145	4226	1104	337	8258	5461	12212	8465	574	684	177	1754	44300	3036	3775			80801	9533	58921		648965													
577	113	256	48		390	18	2000																		13483												
16	1	63	44	144	6	2	72	288	150	411	1	4	39	182	51210	93600								153013													
															22900										23900												
8015	1735	5594	6388	16417	3383	2409	19138	17997	39737	24882	1527	3800	1900	6839	608965	211209	90400	10018	145913	22900	240376	2618130															

Figure 2

# USSR: INTERSECTORAL TRANSACTIONS, 1951 28 Processing Sectors (Millions of Rubles)

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 FOOD CROPS	2043				8688	29403	2209	1071	1022	423												
2 INDUSTRIAL CROPS	9				79	830	19439			9654												
3 AGRICULTURAL SERVICES	6074	11221		2398																		
4 AGRICULTURE, N.E.C.	2052				2320	12227	96	77	574	1308												
5 GRAIN, MILL, AND BAKERY PRODUCTS	1707									1082												
6 FOOD AND KINDRED PRODUCTS	850	1116	3	4078			628	10055	35	1380	*	5	2	18	24							
7 TEXTILES, APPAREL, AND HOUSE FURNISHINGS	1416	373	4093	4503	663	56		2072	743	945	*	*	4818	98								
8 LEATHER AND LEATHER PRODUCTS	4884						221		196	49												
9 LOGGING, LUMBER, WOOD, AND PAPER PRODUCTS	2439	927	*	594	219	10659	8565	2829	487	4865	53	432	253	2107	387	766	1031	465	99	33	7	
10 CHEMICALS	109	139	4164	911	88	101	354	59	147	1683	733	425	1818	1731	546	904	1146	389	102	27		
11 PETROLEUM AND PETROLEUM PRODUCTS	115	77			108	61	233	340	135	200	2151	8	137	839	4821	170	100	99	38	12		
12 COAL AND COAL PRODUCTS	949	1046	3	404	9	48	80	1122	448	18	2											
13 RUBBER AND RUBBER PRODUCTS	519	414			340	130	1720	28	47	165	2708	16	30	62	1074	165	591	238	192	10		
14 NONMETALLIC MINERALS AND MANUFACTURES	1	210					11	20	153	70	*	241	180	527	372	8642	4407	2406	1045			
15 IRON AND STEEL																						
16 NONFERROUS METALS	350	744					10	63	2585	*	35	1	120	1539	2693	1469	218	48	48	77		
17 FABRICATED METAL PRODUCTS							891	735	3780	1681	39	34	158	158	212	106						
18 INDUSTRIAL EQUIPMENT							13	48	375	71	20	159	28		22	188	40	698				
19 AUTOMOTIVE EQUIPMENT AND TRACTORS	223	232	1880	118	15	52			292	6	98	49		244	23	100	9	9				
20 AGRICULTURAL, CONSTRUCTION, AND MINING MACHINERY	5											168		107	88	288						
21 MOTORS, GENERATORS, AND TRANSFORMERS																						
22 COMMUNICATIONS AND ELECTRICAL EQUIPMENT																						
23 TRANSPORTATION EQUIPMENT, N.E.C.							91															
24 ELECTRIC POWER	214		473	60	113	532	546	202	314	1428	879	858	397	622	1404	1577	327	263	67	35		
25 RAIL TRANSPORT	1537	1251	1305	1047	918	1886	1226	816	1379	3477	56	394	454	1622	2518	787	754	460	291	83		
26 ROAD TRANSPORT	1491	438	533	696	521	774	614	382	817	582	8	115	49	436	294	110	145	98	57	14		
27 TRANSPORTATION, N.E.C.	352	330	333	282	103	75	174	26	318	413	51	81	28	110	498	30	37	22	15	3		
28 COMMUNICATIONS																						
101 HOUSEHOLDS	106755	13700	9026	9878	11820	30155	15528	7718	21132	5038	3660	21821	1266	5906	6150	6381	31801	12385	8715	1532	4003	
102 GOVERNMENT	43117	9640	2008	10667	77635	82027	35352	22266	6705	15083	12080	8871	4813	3647	6635	5587	15356	5551	4940	643	1881	3
103 SERVICES																						
GROSS DOMESTIC OUTLAYS	175188	43908	27171	40700	105878	189252	88782	52566	39166	97189	18114	33712	15432	18078	27025	18015	66063	30584	22629	4820	7438	13

An asterisk denotes an entry of less than 0.5 million rubles.

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	SPORT	TRANSPORTATION, N.E.C.	COMMUNICATIONS	HOUSEHOLDS	GOVERNMENT	SERVICES	NET FOREIGN TRADE	GROSS INVESTMENT	GROSS DOMESTIC OUTPUT			
	23	24	25	26	27	28	101	102	103	104	105	
			10		*	3	112966	2100	10065	1224	3775	175198
							12144	400	1449	-102		43908
								7478				27171
			2		*	1	17710	600	2201	1500		40700
			70	70		5	84998	2600	4090	-782	11812	105678
		*	138	168	8	9	145136	4300	9904	234	11141	189252
56	55		*	93	8	2	52239	8256	5383	667	200	88742
2	6			20			46626	4019	519	252	519	52566
77	109		6	74	5	8	3000	4000	4236	175	5000	39166
46	37	30	81	211	5	5	1465	8644	1260	1075	8818	57199
23	14	332	599	2965	1070	3	1028	2143	100	-1245	282	18114
20	10	3864	6977	62	24	*	276	6674	1591	-539	5009	33712
30	2	16	2	1568	7	1	3000	4745	550	-3964	3977	15432
36	7	502	30	19	*	*				-190	9974	19078
29	703		394	68		1		3399		166	3698	27625
55	64		115	18		1		1935		-663	6672	18015
44	213	26	89	128	20	5		2617		-1653	41419	66063
54	378	45	140	93	*	*				-174	25553	30584
	*	68	14	1787		7	122	1346	140		15840	22652
	18		8	*							3724	4620
49	146		19	47						-554	5700	7438
	96	623	55	93		81	439	3315	250	101	5785	13049
*		4	131	7	650					-406	4551	5385
90	31		330		8	15	722	4573	1851		73	17997
95	65	1236		433	36	8	6661	4542	3122		1203	39737
40	18	487	238		6	4	1906	5864	5863		2273	24882
5	8	415	44	297		1		1555		1286	42	6923
38	12	444	46	351	28		117	3117	236	117		6839
19	1924	4156	17837	7434	3569	4743		112968	98224		58921	648965
33	1461	5461	12212	8465	1435	1754	44300	6810	15779		4314	490300
08	8	288	150	411	44	182	74110	93600				174913
49	5385	17997	39737	24882	6923	6839	608965	301600	166813	-3475	240275	2511903

Figure 3

USSR: DIRECT PURCHASES PER RUBLE OF OUTPUT, 1950-1959

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 FOOD CROPS	.04653	.00052	.00029	.08382	.15536	.02489	.02037	.02809	.00740										
2 INDUSTRIAL CROPS	.00005								.16878										
3 AGRICULTURAL SERVICES	.03487	.25556																	
4 AGRICULTURE, N.E.C.	.01171																		
5 GRAIN, MILL, AND BAKERY PRODUCTS	.00974																		
6 FOOD AND KINDRED PRODUCTS	.00485	.02542	.00011	.10020															
7 TEXTILES, APPAREL, AND HOUSE FURNISHINGS	.00808	.00850	.15064	.12047	.00646	.00030													
8 LEATHER AND LEATHER PRODUCTS																			
9 LOGGING, LUMBER, WOOD, AND PAPER PRODUCTS	.02776			.01066	.00595	.01512	.01066	.03449	.08505	.02293	.01281	.01639	.11044	.01401	.04252	.01581			
10 CHEMICALS	.01392	.02111		.01459	.02027	.05791	.09652	.05382	.01243		.04047	.01281	.12429	.00073	.01976	.05018			
11 PETROLEUM AND PETROLEUM PRODUCTS	.00066	.00175	.15325	.02239	.00083	.00101	.00599	.00112	.02907		.00944	.00291	.03563	.03769	.03113	.02814			
12 COAL AND COAL PRODUCTS	.00542	.02382	.00011	.01179	.00009	.00025	.00080	.02135	.01144		.00059	.00006	.00888	.04398	.17814	.00944			
13 RUBBER AND RUBBER PRODUCTS	.00296	.00943		.00835	.00123	.00909	.00032	.00089	.04734		.00088	.00089	.00402	.00493	.00039	.00018			
14 NONMETALLIC MINERALS AND MANUFACTURES	.00001	.00478																	
15 IRON AND STEEL																			
16 NONFERROUS METALS	.00200	.01694	.12351	.06590	.00277	.02038	.01004	.01398	.02556	.00215	.00101	.01024	.00828	.00767	.00588				
17 FABRICATED METAL PRODUCTS																			
18 INDUSTRIAL EQUIPMENT	.00127	.00528	.00845	.00285	.00014	.00027													
19 AUTOMOTIVE EQUIPMENT AND TRACTORS	.00003																		
20 AGRICULTURAL, CONSTRUCTION, AND MINING MACHINERY																			
21 MOTORS, GENERATORS, AND TRANSFORMERS																			
22 COMMUNICATIONS AND ELECTRICAL EQUIPMENT																			
23 TRANSPORTATION EQUIPMENT, N.E.C.				.01010															
24 ELECTRIC POWER	.00122		.01741	.00147	.00107	.00281	.00615	.00384	.00802	.02497	.04853	.02545	.02573	.03280	.05083	.08754	.00485		
25 RAIL TRANSPORT	.00906	.02849	.04803	.02573	.00869	.00886	.01382	.01552	.03521	.06979	.00309	.01169	.02942	.08502	.09115	.04586	.01141		
26 ROAD TRANSPORT	.00851	.00993	.01962	.01710	.00493	.00409	.00692	.00727	.02086	.01018	.00044	.00341	.00318	.02285	.01064	.00011	.00219	.00820	
27 TRANSPORTATION, N.E.C.	.00201	.00772	.01226	.00644	.00087	.00040	.00196	.00049	.00812	.00723	.00282	.00240	.00181	.00577	.01795	.00167	.00056	.00072	
28 COMMUNICATIONS				.01007	.00047	.00082	.00214	.00224	.00199	.00565	.01275	.00068	.00492	.00686	.00442	.00466	.00238	.00425	

\* Each entry shows direct purchases from sector named at left by industry named at top per ruble of output by the latter.

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	COMMUNICATIONS		TRANSPORTATION, N.E.C.		ROAD TRANSPORT		RAIL TRANSPORT		ELECTRIC POWER		ELECTRICAL EQUIPMENT		MACHINERY	
	20	21	22	23	24	25	26	27	28	20	21	22	23	24
						.00025			.00044					
						.00005			.00015					
						.00176	.00281		.00073					
						.00347	.00675	.00116	.00132					
38	.00043	.00336	.00429	.01021			.00374	.00116	.00029					
36	.00195	.00013	.00015	.00111			.00080							
37	.00714	.00497	.03655	.02024		.00015	.00297	.00072	.00117					
15	.00584	.01506	.03418	.00687	.00167	.00204	.00848	.00072	.00073					
31	.00238	.00134	.00176	.00260	.01845	.01508	.11917	.15456	.00044					
38	.00260	.00121	.00153	.00186	.21470	.17558	.00249	.00347						
0	.02035	.00081	.00690	.00037	.00089	.00005	.06302	.00101	.00015					
18	.00216	.01223	.01502	.00130	.02789	.00075	.00076							
22	.22619	.06749	.03288	.13055		.00992	.00273		.00015					
32	.01039	.02380	.08162	.01188		.00289	.00072		.00015					
30	.04610	.01721	.04935	.03956	.00144	.00224	.00514	.00289	.00073					
28	.12814	.02098	.01180	.07019	.00250	.00352	.00374							
					.00378	.00035	.07182		.00102					
36				.00334		.00020								
10	.03203		.01142	.02711		.00048	.00189							
33	.00693	.02810		.01783	.03462	.00138	.00374		.01184					
					.00022	.00330	.00028	.09389						
36	.00758	.00309	.00460	.00576		.00830		.00116	.00219					
35	.01797	.00605	.00728	.01207	.06868		.01740	.00520	.00117					
32	.00303	.00148	.00307	.00334	.02706	.00599		.00087	.00058					
36	.00065	.00027	.00038	.00149	.02306	.00111	.01194		.00015					
32	.00303	.00188	.00291	.00223	.02467	.00116	.01411	.00404						

**CONFIDENTIAL**

Figure 4

USSR: DIRECT AND INDIRECT PURCHASES PER RUBLE OF FINAL D

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 FOOD CROPS	1.00379	.00753	.03751	.13337	.1021	.00723	.01904	.00025	.03121	.01938	.01027	.06635	.00710	.00478	.00311	.00182	.00120	.00105	.00081
2 INDUSTRIAL CROPS	.05420	1.01990	.28274	.00394	.00143	.02840	.06007	.00033	.01011	.03915	.05269	.01991	.02713	.01410	.01759	.00687	.05828	.0044	.02548
3 AGRICULTURAL SERVICES	.00749	.03978	1.01051	.00084	.00377	.15867	.00069	.00982	.02958	.16560	.02633	.00587	.00283	.00635	.02937	.01021	.13546	.0103	.07235
4 AGRICULTURE, N.E.C.	.02295	.03864	.07010	1.00859	.00122	.10475	.14060	.00063	.02278	.04369	.04263	.01919	.01546	.01413	.01694	.00770	.08513	.0044	.01039
5 GRAIN, MILL, AND BAKERY PRODUCTS	.08522	.00438	.00546	.02348	1.00099	.00323	.01181	.00010	.00883	.00687	.00408	.00413	.00157	.00233	.00154	.00077	.00864	.0001	.00139
6 FOOD AND KINDRED PRODUCTS	.15979	.01933	.01456	.06921	.00293	.10102	.01588	.00029	.02921	.06758	.01030	.01208	.00391	.01467	.00633	.00509	.03334	.0010	.00320
7 TEXTILES, APPAREL, AND HOUSE FURNISHINGS	.04113	.24178	.06355	.00568	.00262	.01713	1.01856	.00281	.02453	1.1012	.02284	.02038	.00864	.00959	.00946	.00739	.03015	.0008	.00715
8 LEATHER AND LEATHER PRODUCTS	.02886	.01036	.00459	.01607	.00089	.00507	.02926	.00526	1.00753	.02320	.01295	.02163	.01434	.00820	.02073	.00852	.10204	.0044	.01010
9 LOGGING, LUMBER, WOOD, AND PAPER PRODUCTS	.02846	.18087	.04878	.02789	.02006	.03944	.03550	.00155	.09995	1.02457	.05010	.06886	.00809	.05434	.01587	.05032	.05455	.0082	.00828
10 CHEMICALS	.00126	.00772	.00309	.00124	.00087	.00150	.00227	.00011	.00908	.04277	1.00443	.01615	.00187	.00369	.00369	.00821	.00610	.00864	.00605
11 PETROLEUM AND PETROLEUM PRODUCTS	.00081	.00270	.00076	.00062	.00033	.00079	.00118	.00011	.01590	.01345	.00607	1.01156	.00089	.00301	.01000	.00280	.00395	.0002	.00222
12 COAL AND COAL PRODUCTS	.01708	.10038	.02658	.00569	.00349	.01033	.33007	.00121	.03865	1.6608	.05037	.03556	1.00449	.01571	.01797	.01045	.02926	.0044	.00444
13 RUBBER AND RUBBER PRODUCTS	.00645	.02068	.00574	.00480	.00263	.00541	.01497	.00083	1.2438	.10294	.05273	.08539	.00986	1.00947	.03965	.01578	.02821	.0051	.01777
14 NONMETALLIC MINERALS AND MANUFACTURES	.00191	.00642	.00179	.00144	.00053	.00271	.00309	.00024	.02948	.03398	.04537	.21843	.00234	.04431	.00121	.00044	.01512	.0044	.00194
15 IRON AND STEEL	.00290	.01070	.00297	.00238	.00129	.00244	.00433	.00039	.05176	.05770	.03780	.05004	.00298	.01673	.03073	1.00635	.01626	.0008	.00808
16 NONFERROUS METALS	.00223	.00933	.00256	.00168	.00081	.00199	.01993	.00121	.02571	.02885	.01214	.03889	.00258	.01740	.13736	.04987	1.00745	.0010	.00101
17 FABRICATED METAL PRODUCTS	.00151	.00429	.00120	.00089	.00041	.00138	.00828	.00183	.02669	.01459	.01504	.04895	.00823	.01796	.16110	.06389	.06784	.0004	.00202
18 INDUSTRIAL EQUIPMENT	.00204	.00958	.00258	.00101	.00058	.00168	.02511	.00107	.01697	.02410	.01308	.03904	.03538	.01804	.13508	.02876	.07035	.0010	.00101
19 AUTOMOTIVE EQUIPMENT AND TRACTORS	.00171	.00626	.00172	.00105	.00060	.00191	.01082	.00239	.02155	.02295	.01849	.06803	.02277	.01723	.25893	.03710	.06188	.0020	.00203
20 AGRICULTURAL, CONSTRUCTION, AND MINING MACHINERY	.00114	.00520	.00142	.00085	.00052	.00110	.00575	.00030	.01380	.02331	.00818	.02984	.00197	.01805	.07708	.03386	.02372	.0001	.00010
21 MOTORS, GENERATORS, AND TRANSFORMERS	.00282	.01033	.00286	.00204	.00101	.00207	.01087	.00056	.04854	.04703	.01137	.02287	.00872	.02176	.04758	.09019	.03910	.0002	.00020
22 COMMUNICATIONS AND ELECTRICAL EQUIPMENT	.00186	.00609	.00188	.00103	.00046	.00147	.01379	.00150	.00931	.01815	.01301	.04504	.00241	.01107	.15393	.02971	.05170	.0001	.00010
23 TRANSPORTATION EQUIPMENT, N.E.C.	.00076	.00256	.00071	.00052	.00049	.00106	.00248	.00012	.00967	.01190	.03027	.23440	.00377	.03024	.00792	.00528	.06749	.0002	.00020
24 ELECTRIC POWER	.00126	.00132	.00041	.00058	.00193	.00387	.00081	.00005	.00426	.00686	.01830	.18294	.00081	.00249	.01379	.00486	.04220	.0001	.00010
25 RAIL TRANSPORT	.00328	.01079	.00296	.00148	.00345	.00845	.02753	.00103	.00967	.02793	.12704	.01513	.06640	.00478	.01651	.00559	.01477	.0001	.00010
26 ROAD TRANSPORT	.00068	.00236	.00065	.00042	.00022	.00164	.00332	.00017	.00517	.00986	.15600	.01145	.00184	.00200	.01561	.00355	.00859	.0001	.00010
27 TRANSPORTATION, N.E.C.	.00083	.00043	.00016	.00034	.00077	.00143	.00066	.00002	.00200	.00163	.00089	.00124	.00038	.00045	.00159	.00138	.00178	.0001	.00010
28 COMMUNICATIONS																			

\* Each entry shows, per ruble of deliveries to final demand by sector named at left, the total ruble production directly and indirectly required from sector named at top.

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# EMAND, 1951\*

BY	COMMUNICATIONS TRANSPORTATION, N.E.C. ROAD TRANSPORT RAIL TRANSPORT ELECTRICAL EQUIPMENT, N.E.C. ELECTRICAL EQUIPMENT OTHERS								
	20	21	22	23	24	25	26	27	28
2	.00018	.00017	.00054	.00052	.00433	.01599	.01111	.00347	.00092
9	.00058	.00066	.00206	.00146	.01266	.05272	.01856	.01300	.00233
0	.00112	.00151	.00512	.00174	.03245	.06430	.02446	.01570	.00470
4	.00048	.00108	.00213	.01127	.01100	.04344	.02305	.00975	.01262
6	.00007	.00010	.00027	.00045	.00234	.01225	.00683	.00176	.00107
2	.00028	.00033	.00082	.00107	.00796	.02335	.00952	.00288	.00277
1	.00038	.00055	.00233	.00084	.01424	.03663	.01407	.00668	.00415
1	.00027	.00030	.00092	.00057	.01037	.03066	.01247	.00290	.00416
3	.00046	.00093	.00195	.00128	.01362	.04510	.02374	.00997	.00386
8	.00161	.00069	.00266	.00196	.04018	.08880	.02028	.01286	.00938
3	.00023	.00055	.00245	.00051	.05131	.01149	.00299	.00470	.01458
2	.00516	.00033	.00130	.00042	.02766	.01696	.00508	.00364	.00180
5	.00057	.00044	.00245	.00095	.03937	.05765	.01210	.00697	.00897
1	.00865	.00084	.00454	.00146	.04631	.10809	.03025	.01058	.01055
9	.00560	.00097	.00560	.00313	.06832	.11048	.01669	.02166	.00832
3	.01662	.00108	.00456	.00152	.09620	.06254	.01214	.06017	.00872
7	.00155	.00645	.00897	.00068	.02014	.03356	.00654	.00452	.00457
8	.00197	.04683	.02324	.00079	.02678	.04046	.00808	.00521	.00700
2	.01058	.00578	.03476	.00068	.01814	.03646	.00708	.00458	.00409
3	1.00190	.03875	.01307	.00107	.03081	.05437	.00949	.00721	.00689
8	.00102	1.00158	.02957	.00041	.01302	.02057	.00439	.00267	.00348
8	.00186	.01253	1.00211	.00050	.01940	.02580	.00746	.00313	.00517
4	.00461	.03125	.02187	1.00079	.02058	.03539	.00789	.00571	.00480
0	.00154	.00090	.03607	.00285	1.01082	.07839	.03007	.02497	.02664
7	.00127	.00090	.00229	.00357	.01547	1.00604	.00760	.00245	.00224
3	.00094	.00274	.00719	.00169	.01151	.02746	1.00238	.01366	.01708
4	.00050	.00305	.00258	.09408	.01139	.01083	.00226	1.00138	.00685
4	.00004	.00017	.01200	.00004	.00262	.00195	.00084	.00030	1.00017



Approved For Release 1999/09/26 : CIA-RDP79-01093A001000120001-4

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Approved For Release 1999/09/26 : CIA-RDP79-01093A001000120001-4