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INPUT-OUTPUT ANALYSIS OF THE STRUCTURE OF SOVIET FOREIGN TRADE* —A COMPARATIVE VIEW—

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I. *Introduction*

This paper presents a "skyline" chart analysis of the Soviet, East European and major market economies, including the United States and Japan, in order to investigate the patterns and changes of the foreign trade of these countries from a comparative view.

The investigation is limited to the period 1959 to 1977, because of the scarcity of current data. For certain countries, for example East Germany, there is a complete lack of official data, preventing us from making a comparative study involving these countries.

As is well known, the "skyline" concept in input-output analysis was conceptualized by Leontief (1963) as a tool to study the structure of the economic development and foreign trade patterns of developing countries. We apply this concept to clarify foreign trade characteristics of the Soviet and East European economies.

A primary reason for employing the "skyline" concept is that one of the most useful ways to see how these countries stand today is to construct a model of the economy as it would appear if it enjoyed self-sufficiency; namely, to determine the structure of production these economies would have to attain in order to maintain their present actual consumption and investment without access to foreign trade. The "skyline" chart graphically depicts these features, and also shows the degree of import and export activity of each economy.

II. *Basic Description of the Composition of a "Skyline" Chart*

In the "skyline" chart, the vertical axis of the chart represents the self-sufficiency rate. The self-sufficiency rate is defined as the actual gross domestic output (GDO) divided by the hypothetical GDO, which is induced by domestic final demand. The hypothetical GDO is the GDO directly and indirectly required to produce domestic final demand, which consists of consumption plus investment, including imported consumption and investment goods. The hypothetical GDO is based on the assumption that all outputs required to meet domestic final demand are produced domestically, with no imports.

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The horizontal axis represents the hypothetical GDO of each sector. In the "skyline" chart all hypothetical GDO's are assumed to be 100% (100% self-sufficiency rate). Atop each GDO block is added a direct and indirect "export" block.

Direct and indirect "imports" are subtracted from the direct and indirect "export" block, and the remainder is added to the GDO to derive the final configuration of the sector block. This procedure is performed for each industrial sector. The actual industrial structure is therefore described by the solid line which has the appearance of a city skyline. Let us explain the mathematical background for "skyline" chart analysis.

Define

$X=(X_i)$: a gross domestic output (GDO) vector;
$Y=(Y_i)$: a domestic final demand vector;
$E=(E_i)$: an export vector;
$M=(M_i)$: an import vector.

Using an input coefficient matrix A, a standard competitive-type input-output model can be written as

$$X=AX+Y+E-M. \tag{1}$$

Hence we have

$$X=(I-A)^{-1}(Y+E-M). \tag{2}$$

Let

$$X_Y=BY;\ X_E=BE;\ X_M=BM, \tag{3}$$

where $B=(I-A)^{-1}$.

X_Y, X_E and X_M are a hypothetical GDO vector, and direct and indirect "export" and "import" vectors, respectively.

Eq. (2) can be written as

$$X_i=X_{Yi}+X_{Ei}-X_{Mi}. \tag{4}$$

Define

$$\begin{aligned} s_i&=X_i / X_{Yi};\\ e_i&=X_{Ei} / X_{Yi};\\ m_i&=X_{Mi} / X_{Yi}. \end{aligned} \tag{5}$$

It follows from these definitions and Eq. (4) that

$$s_i=1+e_i-m_i. \tag{6}$$

s_i is the i-th sector's self-sufficiency rate. e_i and m_i are respectively direct and indirect "export," and "import," ratios of the i-th sector.

IV. *A Description of the I-O Data*

In the case of the Soviet Union we use Soviet 1959, 1966, 1972, and 1977 Input-Output Tables constructed or reconstructed by Professor Treml and his associates.

In the reconstructed tables in producers' prices, export and import vectors are not separated, with the exception of the 1972 input-output table, which is the most disaggregated version of the tables provided by the Treml group. Therefore, in the aggregated 15-sector input-output analysis we must use I-O data in purchasers' prices furnished by Professor Treml and his associates.

In estimating separate export and import vectors many problems present themselves. Primarily, we must adjust the official trade data in order to make it consistent with national accounts and input-output accounts. The problem, therefore, is to devise a method for determining the conversion rates of the official foreign trade prices to the domestic prices. Treml and his associates have made great efforts to determine these conversion rates. These rates are the only reliable tools we have at this time to make any type of accurate assessment of the Soviet economy. However, the conversion rates published in several monographs are not always consistent. This has limited the accuracy of the Soviet data, but given the scarcity of accurate data, we must use whatever is available.

East European Economies

In the input-output analysis of East European economies we mainly use input-output tables provided by the ECE. The ECE has published standardized input-output tables for the years around 1959, 1965, 1970 and 1975. In the ECE tables we can find Hungarian, Polish, Czechoslovakian, Yugoslavian and Bulgarian input-output tables. Only the 1963 Bulgarian table is available. The Hungarian and Polish input-output tables for the years around 1970 are missing. The Hungarian and Polish statistical offices have published the original input-output tables, but they are not available for analysis. The original Hungarian input-output tables for the 1970's are non-competitive types (B-type in Hungarian terminology). The original Polish tables for the years 1971 to 1973 are competitive types, but they do not include separate export and import vectors. Further, the Hungarian and Polish ECE tables for the years around 1975 are available. While these tables are non-competitive types, they are none-the-less of interest, since they are based on SNA and MPS accounts. All ECE tables employed in this paper are in producers' prices or basic prices. It should be noted that most of the Soviet input-output tables are compiled on the basis of purchasers' prices. Therefore, when the Soviet economy is compared with other economies, inconsistancies may occur.

Western Economies

In the case of the United States we use the original data published by the Bureau of Economic Analysis of the U.S. Department of Commerce. It should be noted that the BEA changed its method for compiling input-output tables, starting with the 1972 table. While in the 1958, 1963 and 1967 input-output tables secondary products are treated using the "Transfer Method," in the 1972 and 1977 tables separate make and use tables are compiled, and secondary products are explicitly shown. However, the BEA has not provided us with the merged version of the input-output tables. Therefore, we merged the U.S. 1972 and 1977 make and use tables employing the industry technology assumption.

In the case of Japan, original tables published by the Japanese Government are used.

In the case of West Germany, the 1975 ECE table compiled by the Federal Statistical Office are used. As in the case of the United States, the method used to compile the West

German tables was changed, starting with the 1978 tables.

General Limitations of the Data

When making inter-temporal comparisons of a national economy we should use tables calculated in constant prices. However, the tables presented here are calculated in current prices, since the reliable published data for some countries, most notably the Soviet Union and the United States are lacking, or are available only in current prices.

The accurate comparison of international economies requires the standardization of industry and commodity classifications. However, to date, this standardization remains incomplete. One reason for this is that the CMEA countries usually do not separate the "Metal Ore Mining" and "Basic Metal" sectors. This makes it difficult to derive accurate statistics for the metal block, as has been pointed out by many input-output analyses. Therefore, when making comparisons of the U.S. and Soviet economies, we are sometimes forced to employ hybrid sectors, as in the "Metallurgy" sector. The "Metallurgy" sector covers ore mining and basic metals. It must also be noted that while the sector names employed by various countries are similar, the actual activities covered under those sectors may differ. For example, in the case of the Soviet Union and Bulgaria, the intermediate use row for the "Construction" sector is regarded as a zero vector. The "Construction" sector does not supply intermediate inputs for other sectors.

Evaluation

Most of the available Soviet input-output tables with separate export and import vectors are compiled in purchasers' prices, as is the case with France. Most other countries, including the CMEA countries, compile their tables in producers' prices. More importantly, when compiling input-output data, the CMEA countries usually evaluate imports in CIF prices, but employ data which does not realistically reflect world prices. This fact is especially true in the case of the Soviet Union.

SNA/MPS Adjustment

When comparing the centrally planned economies with the market economies, a well-known statistical treatment, namely adjustment between SNA and MPS occurs. Although the author is aware of the importance of this treatment, in this paper the adjustment has been omitted, since market economies after the Second World War could not exist without expanding the non-material service sector. However, this is not true of the MPS economies.

IV. *"Skylines" of Soviet and East European Economies*

"Skyline" chart analysis was first developed to study changes of input-output structure of an economy with its economic development from the viewpoint of the degrees of domestic production and import substitution by sector, assuming that final demand by sector is given. In this section we apply this method in order to investigate macro and multi-sectoral analysis of foreign trade of the centrally planned economies.

Table 1 presents macro-foreign trade structures and Leontief self-sufficiency rates of the

TABLE 1. MACRO-STRUCTURE OF FOREIGN TRADE: SELECTED MPS COUNTRIES

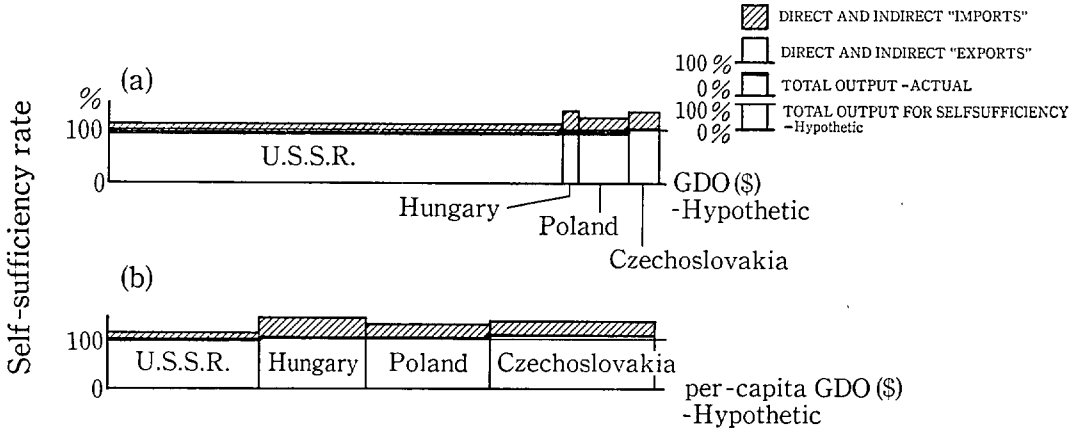
(unit: %)

	around 1959			around 1965			around 1970			around 1975		
	e	m	s	e	m	s	e	m	s	e	m	s
S	3.60	6.22	97.38	3.16	5.02	98.14	5.08	8.94	96.14	6.30	11.36	95.44
H	27.11	14.54	112.57	31.69	28.97	102.72	34.54	33.31	101.23	36.71	40.79	95.92
P	18.07	19.18	98.90	19.18	20.98	98.20				23.48	27.69	95.79
C	17.12	15.96	101.15	27.24	23.92	103.32	31.09	28.81	102.29	33.03	33.78	99.25
Y	20.83	22.10	98.73	19.40	21.80	97.60	18.97	25.54	93.43	18.06	24.71	93.35

S = SOVIET UNION
H = HUNGARY
P = POLAND
C = CZECHOSLOVAKIA
Y = YUGOSLAVIA

e = direct and indirect "export" ratio
m = direct and indirect "import" ratio
s = self-sufficiency rate (1 + e − m)

FIG. 1. AN INTERNATIONAL "SKYLINE" CHART FOR 1975



six centrally planned economies. From this table the following three facts can easily be seen.

First, the self-sufficiency rate of each country shows a uniformly declining trend, with some fluctuations. This self-sufficiency rate around 1975 is about 95%. A decrease in the self-sufficiency rate from 1970 to 1975 seems to be caused by the deterioration of trade conditions due to the first "oil shock" in 1973. We can also see the degree of decline in the self-sufficiency rate of Hungary, which accounted for the highest decline, and of Czechoslovakia, which was the most stable. Secondly, both export and import ratios of Hungary and Czechoslovakia were very high in each bench-mark year, and the growth rates of these ratios were also high over this period of time.

Thirdly, the export and import ratios of the Soviet Union are remarkably lower than the other five planned economies in each bench-mark year over this period. The import ratios of the Soviet Union, while low in comparison with the other five, show a marked increase. In terms of this third fact, it appears that the Soviet Union is a self-sufficing economy without access to foreign trade. However, we must keep in mind that economic data for Soviet exports and imports is statistically suspect and biased toward the low side.

FIG. 2. SKY-LINE CHARTS OF SOVIET & EAST EUROPEAN ECONOMIES

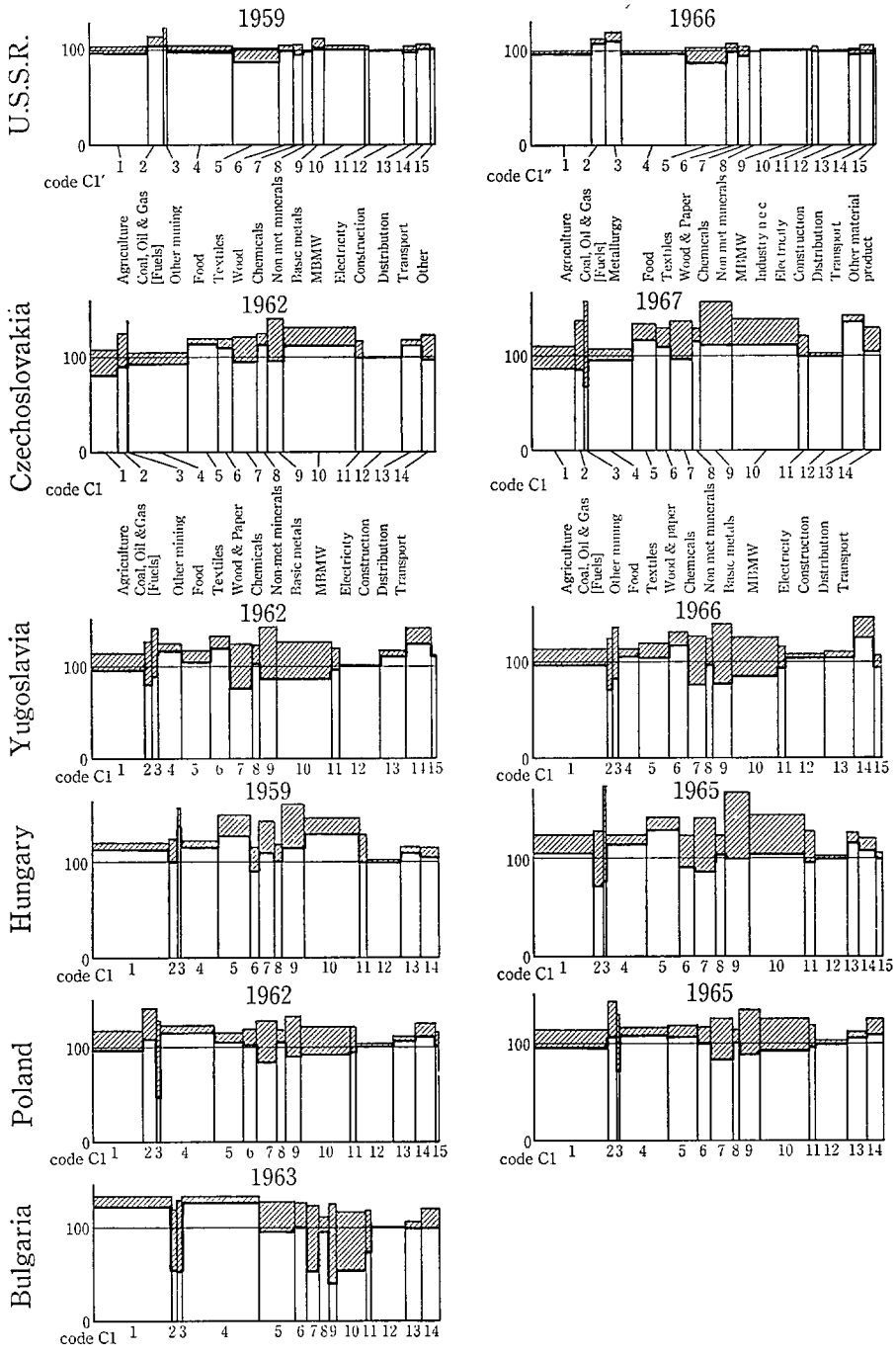
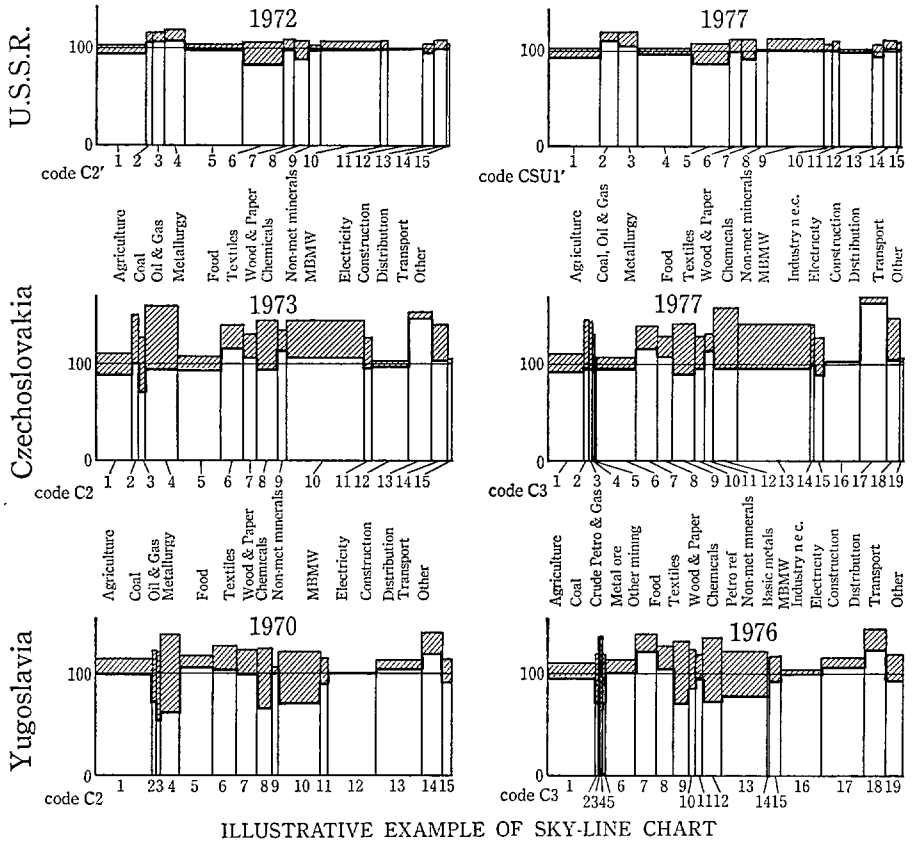


FIG. 2. SKY-LINE CHARTS OF SOVIET & EAST EUROPEAN ECONOMIES (continued)



ILLUSTRATIVE EXAMPLE OF SKY-LINE CHART

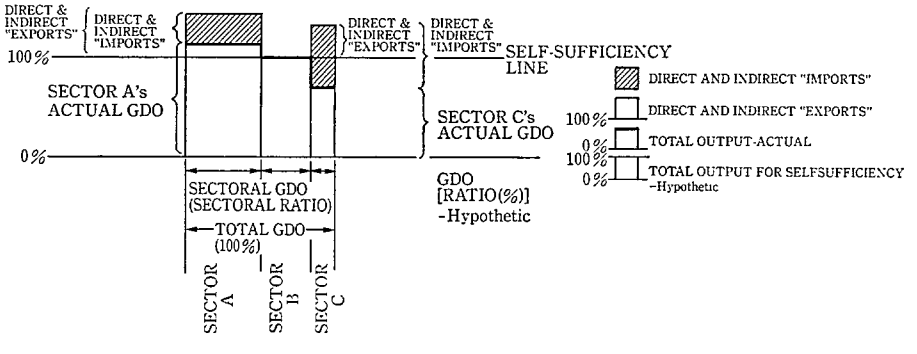


Figure 1, based on Alton (1977) and aggregated input-output tables, shows an "international skyline chart" of four countries, in and around 1975. In this chart each country is regarded as an industrial sector for input-output analysis. From this figure we can see that the line showing the self-sufficiency rate for each country is rather flat. The shaded area of the "silhouette" for imports and the import expansion of the three countries, with the exception of the Soviet Union, is remarkably large. Also shown is the much greater gross domestic output of the Soviet Union, in comparison with the other three. Further, when we depict gross domestic output-per-capita horizontally, each country's share of gross domestic output-per-capita tends to be equalized.

Unlike the macro analysis, it should be noted that the input-output "skyline" chart analysis assumes the existence of competitive import-type input-output tables on the GDO base, and the analysis requires use of the $(I-A)^{-1}$ -type Leontief inverse, and not the $(I-(I-M)A)^{-1}$ or $(I-A^d)^{-1}$ -type inverse. Therefore, we cannot describe the Hungarian "skyline" chart for the 1970's, and the Polish "skyline" chart for 1976, because the input-output tables for these countries for the 1970's are non-competitive import-types. (The Polish input-output tables for 1971–3 do not have separate import and export columns, although they are competitive import-type tables).

Figure 2 shows a "skyline" chart of the Soviet and East European economies using 14 to 19-sector input-output tables. Sector classification codes for East European countries are not identical, except for the years in and around 1959 and 1965. However, the sector classification codes are the same vertically but not horizontally. The "skyline" charts of the Soviet Union in Figure 2 are based on input-output data in purchasers' prices. In Figure 3 is shown the 1972 Soviet "skyline" chart based on producers' prices.

For convenience, the horizontal dimensions of each country's "skyline" chart are the same, so that the share of each industry's GDO can be seen. From Figure 2, it can be seen that the "skyline" of the Soviet Union is rather flat over time, while the "skylines" of the East European economies, particularly that of Yugoslavia, show remarkable jumps and drops. For each country we can show the following characteristics:

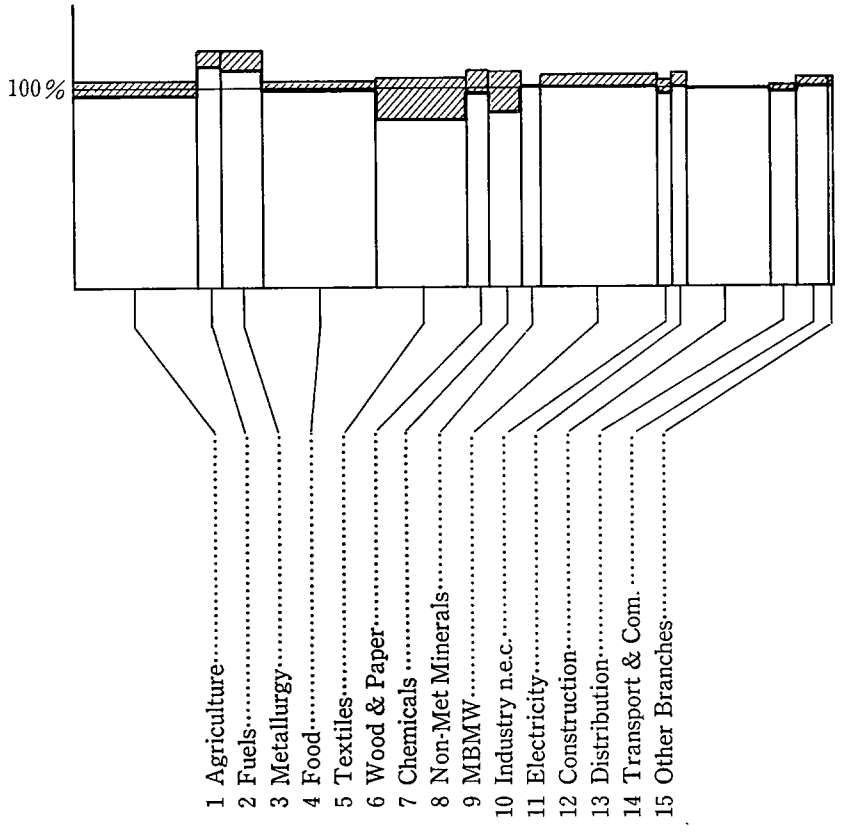
U.S.S.R.

The self-sufficiency rates of the energy, mining and basic metals industries are rather high, while the rates for light industry, particularly the textile, apparel and leather industry are low. This is a basic, constant feature of the Soviet "skyline" over time. The self-sufficiency rate of agriculture shows a decline in the 1970's. Both the exports and imports of the machinery industry increase over time. It should be noted, however, that the changes in the shapes of the Soviet "skylines" are rather static in nature.

Czechoslovakia

The self-sufficiency rate of the machinery industry decreases over time, and the rate around 1975 drops below 100%. The rates of agriculture and the food industries are consistently low, and the rate of the energy sector is remarkably low. The rates of the textile, apparel and leather industry and the non-metallic mineral products industries are rather high, over 100%. The fact that the output share and export and import ratios of the metal block, namely basic metals machinery, are remarkably high compared with other East European countries shows the high level of Czechoslovakian economic development. The horizontal

FIG. 3. SKY-LINE CHART: 1972 U.S.S.R. (PRODUCERS' PRICES)



shape of the "skyline" tends to be rather flat, except for the distribution sector.

Yugoslavia

The low level self-sufficiency rate of the metal block and the large shaded area for metal block imports suggest that Yugoslavia remains a typically developing country. The rate of light industry, particularly the textile, apparel and leather industry, is over 100%. The rate of agriculture is below the 100% line, except for around 1970. The rate of the energy sector is remarkably low. The shape of the "skyline" is remarkably jagged over time.

Hungary

Although the self-sufficiency rates of the agriculture, mining and manufacturing industries, especially the metal block and energy industries, remarkably decrease from around 1959 to 1965, the rates of the agriculture and machinery industries remained over 100%. The rate of the textile, apparel and leather industry increased, while the export and import ratios of the industry declined. The complexity of the shape of the Hungarian "skylines" tends to decrease over time, although the "skylines" show the greatest degree of change in comparison with the other East European economies.

Poland

The self-sufficiency rate of the energy sector around 1959 and 1965 is rather high, but the rates of agriculture and the food industry decreased.

Bulgaria

The shape of the Bulgarian "skylines" is jagged, and the shape of the "skyline" is quite particular compared with other East European countries. This is due to the fact that the output shares of agriculture and the food industry are both large, the export ratios of these sectors are high and the import ratios are low. Only Bulgaria shows a remarkable contrast between the self-sufficiency rate of agriculture and the food industry and that of the metal block sector.

TABLE 2. CHANGES IN SOVIET FOREIGN TRADE: DIFFERENCE BETWEEN TWO PERIODS

(unit: %)

Sector		Output Ratios -Actual	"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
1972–1966					
1	Agriculture	−2.51	1.32	4.46	−3.14
2	Fuels	1.10	2.88	3.84	−.96
3	Metallurgy	1.02	−.60	2.14	−2.73
4	Food	−2.35	1.42	2.88	−1.46
5	Textiles	−.53	1.18	6.64	−5.46
6	Wood & Paper	.01	.27	5.72	−5.45
7	Chemicals	.54	2.05	9.06	−7.01
8	Non-Met Minerals	.17	.66	2.15	−1.48
9	MBMW	1.38	3.21	3.26	−.04
10	Industry n.e.c.	.27	1.35	2.69	−1.34
11	Electricity	.25	2.27	3.54	−1.27
12	Construction	.99	.00	.00	.00
13	Distribution	.00	1.39	4.34	−2.95
14	Transport & Com.	−.15	1.49	3.92	−2.41
15	Other Branches	−.19	2.41	5.24	−2.83
1977–1972					
1	Agriculture	−.29	.13	2.70	−2.58
2	Fuels	.19	3.68	1.56	2.12
3	Metallurgy	−.22	.52	5.18	−4.67
4	Food	−.93	−.20	3.42	−3.63
5	Textiles	−.36	2.03	.14	1.90
6	Wood & Paper	−.23	1.90	1.62	.28
7	Chemicals	.46	2.84	2.33	.51
8	Non-Met Minerals	−.13	.45	.46	−.01
9	MBMW	1.08	4.65	5.03	−.39
10	Industry n.e.c.	.77	1.32	.64	.68
11	Electricity	−.02	2.39	1.91	.47
12	Construction	−.58	.00	.00	.00
13	Distribution	−.02	.98	2.69	−1.70
14	Transport & Com.	.20	2.16	2.43	−.29
15	Other Branches	.08	1.02	−.04	1.06

TABLE 3. A COMPARISON OF SOVIET AND EAST EUROPEAN FOREIGN TRADE

(unit: %)

Sector		Output Ratios -Actual	"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
		1977 Czechoslovakia—1977 U.S.S.R.			
1	Agriculture	−4.52	8.02	7.83	.20
2	Fuels	−1.03	15.72	63.26	−47.54
3	Metallurgy	2.48	33.53	53.83	−20.30
4	Food	−3.66	5.33	4.79	.55
5	Textiles	−4.72	35.04	3.11	31.91
6	Wood & Paper	1.12	18.53	10.09	8.45
7	Chemicals	2.28	31.53	30.64	.89
8	Non-Met Minarals	−.68	30.84	16.85	13.99
9	MBMW	4.40	31.60	32.33	−.73
10	Industry n.e.c.	−1.76	35.89	11.02	24.87
11	Electricity	1.07	18.22	28.06	−9.83
12	Construction	.75	2.45	4.35	−1.90
13	Distribution	4.45	63.32	−4.97	68.28
14	Transport & Com.	−.15	38.12	32.43	5.70
15	Other Branches	−0.03	1.21	2.40	−1.19
		1976 Yugoslavia—1977 U.S.S.R.			
1	Agriculture	−1.19	6.80	3.78	3.03
2	Fuels	−2.60	2.66	56.53	−53.87
3	Metallurgy	1.20	14.04	47.38	−33.33
4	Food	−6.59	10.43	4.23	6.21
5	Textiles	−4.76	33.36	−2.69	36.04
6	Wood & Paper	1.59	16.42	11.54	4.88
7	Chemicals	.55	20.40	40.28	−19.87
8	Non-Met Minarals	−1.23	15.64	22.26	−6.61
9	MBMW	−3.20	11.30	32.96	−21.65
10	Industry n.e.c.	−2.33	7.57	26.14	−18.57
11	Electricity	1.19	6.89	16.61	−9.71
12	Construction	2.16	2.20	1.62	.58
13	Distribution	9.08	7.93	−2.75	10.67
14	Transport & Com.	2.23	31.88	11.48	20.41
15	Other Branches	3.91	10.00	19.86	−9.86

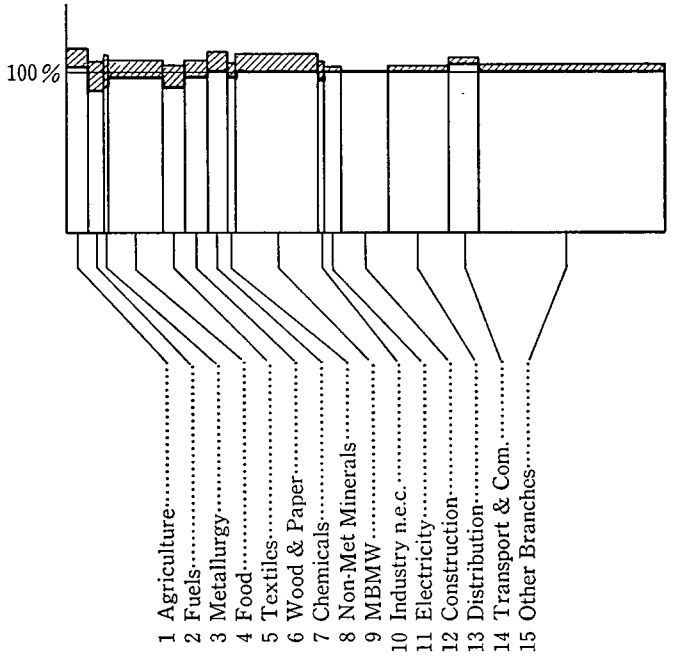
In addition to the above facts, the self-sufficiency rates of the energy and natural resources sectors of East European countries are generally low, although there are some exceptions. For example, the self-sufficiency rate of Poland around 1959 and 1965, and of Hungary around 1959.

Let us now move from a general description of the "skyline" chart to a more detailed description.

First we analyze the changing trade pattern of the Soviet Union over a period of time. Table 2 shows the differences in rates of output, "export," and "import" ratios, and the self-sufficiency rates between 1966 and 1972, and also between 1972 and 1977. It should be noted that these tables are based on data in current purchasers's prices. With regard to the difference in "export" and "import" ratios between 1972 and 1966, we can see that all sectors,

FIG. 4. SKY-LINE CHARTS OF THE UNITED STATES (15-SECTOR VERSIONS)

SKY-LINE CHART: 1972 U.S.



SKY-LINE CHART: 1977 U.S.

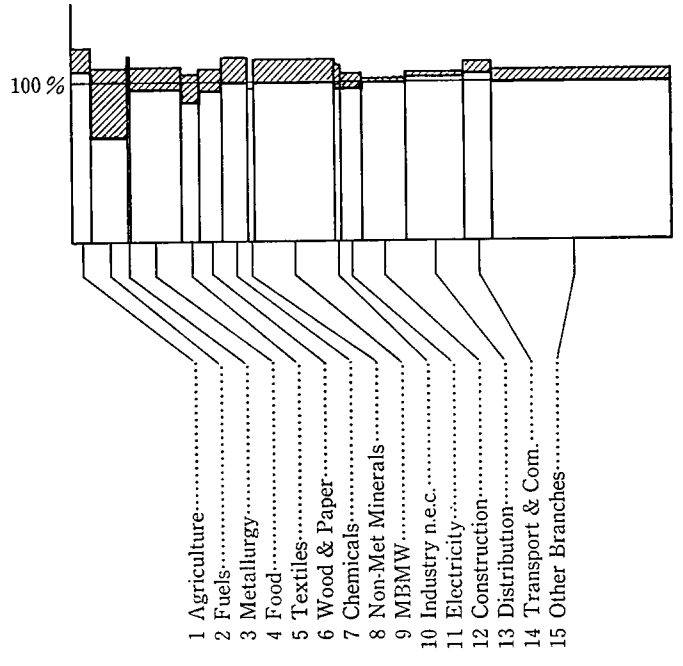
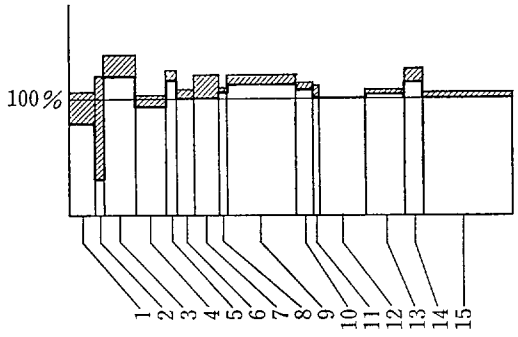
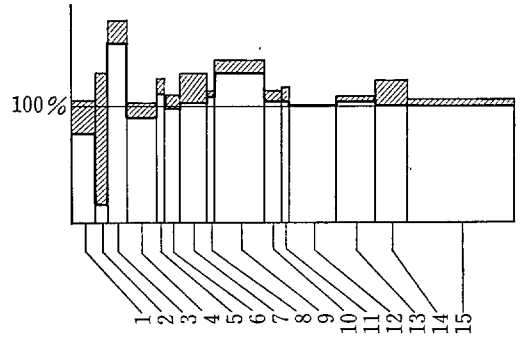


FIG. 5. SKY-LINE CHARTS OF JAPAN

SKY-LINE CHART : 1970 JAPAN



SKY-LINE CHART : 1975 JAPAN



SKY-LINE CHART : 1980 JAPAN

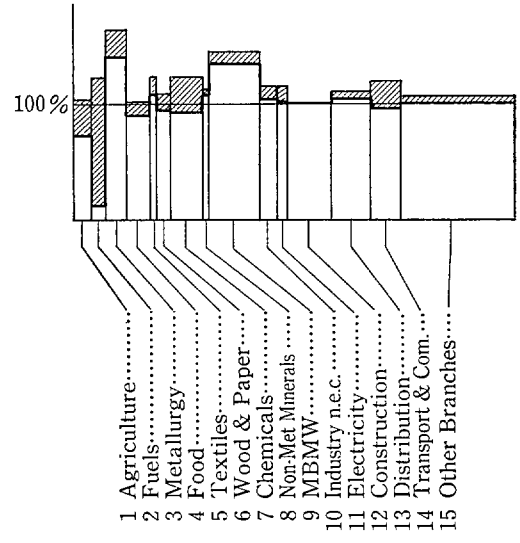
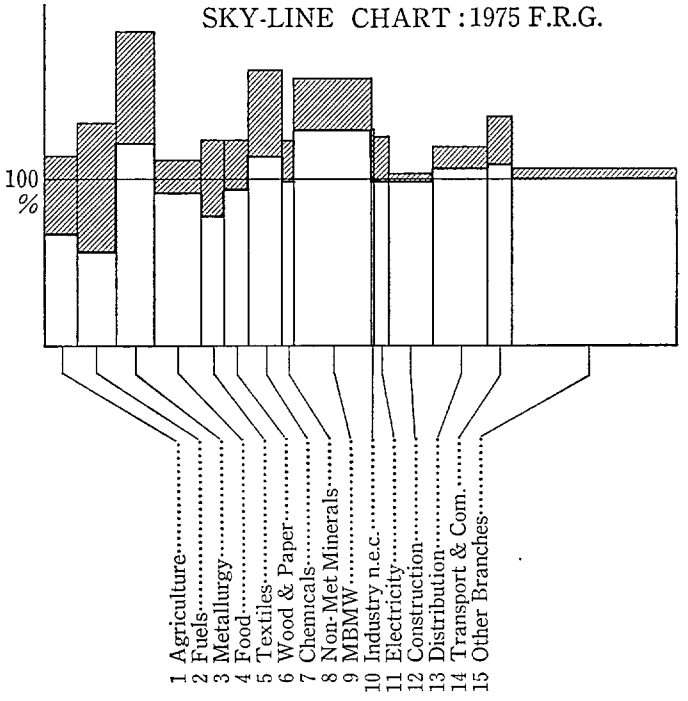


FIG. 6. SKY-LINE CHART OF THE F.R.G.



with the exception of metallurgy, have shown positive growth of "export" and "import" ratios.

In all sectors the growth of "import" ratios is greater than the growth of "export" ratios. Therefore, the self-sufficiency ratios of all sectors decrease. The chemical industry shows the greatest decrease, followed by light industry, wood and paper, and agriculture. The machine building and metal-working (MBMW) sector shows the lowest decline. It should be noted, that while the construction sector shows a zero rate of decrease, this sector is treated as a non-export and non-import sector. With regard to the difference in "export" and "import" ratios between 1977 and 1972, we can see that all sectors, with the exception of the food industry and other material branches, have shown positive growth of "export" and "import" ratios. Unlike the dynamic decreasing trend from 1966 to 1972, during the period 1972 to 1977, some sectors, including energy and light industry, show a slight increase in self-sufficiency rates. The metallurgy sector shows the greatest decline in self-sufficiency rates, followed by food industry and agriculture. The MBMW sector shows a slightly greater decrease compared to the period 1966 to 1972, but the growth rates of "export" and "import" ratios of this sector are the highest.

Let us now compare the foreign trade patterns of the Soviet Union with the East European countries. Table 3 shows the difference in "export," and "import" ratios, and self-sufficiency rates between the 1977 Czechoslovakian economy and the 1977 Soviet economy.

As can be seen in Table 3, all sectors of the Czechoslovakian economy, with the excep-

tion of the distribution sector, show much greater "export" and "import" growth rates. Compared with the Soviet Union, the self-sufficiency rate of the Czechoslovakian distribution sector shows a remarkable increase, followed by the light industry and non-metallic mineral products sectors. In contrast, the energy sector shows the greatest decrease, followed by the metallurgy sector. As for the relative deviation of "export" ratios between Czechoslovakia and the Soviet Union, the non-metallic mineral product sector shows the greatest value; 1733%. Also, for the relative deviation of "import" ratios, this sector shows the second greatest value; 503%. The MBMW "export" and "import" ratios show a much greater increase, but the self-sufficiency rate shows a slight decrease.

Figure 4, 5 and 6 show "skyline" charts of the U.S., Japanese and West Germany economies, respectively.

Let us next compare the foreign trade patterns of the Soviet Union with the Western

TABLE 4. A COMPARISON IN THE FOREIGN TRADE PATTERNS OF THE U.S.S.R., THE U.S.A. AND THE F.R.G.

(unit: %)

Sector		"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
		1977 U.S.A.—1977 U.S.S.R.		
1	Agriculture	21.03	2.58	18.46
2	Fuels	−9.50	30.94	−40.44
3	Metallurgy	−1.35	15.64	−16.98
4	Food	9.22	5.18	4.05
5	Textiles	.78	−4.01	4.78
6	Wood & Paper	−.71	.47	−1.18
7	Chemicals	7.05	−4.35	11.40
8	Non-Met Minerals	7.77	8.84	−1.07
9	MBMW	5.31	1.68	3.63
10	Industry n.e.c.	6.48	8.50	−2.02
11	Electricity	−3.74	−.93	−2.80
12	Construction	2.01	2.39	−.38
13	Distribution	1.31	−10.04	11.34
14	Transport & Com.	1.88	−4.86	6.75
		1975 F.R.G.—1977 U.S.S.R.		
1	Agriculture	10.87	34.99	−24.10
2	Fuels	14.01	66.12	−52.11
3	Metallurgy	70.01	51.56	18.46
4	Food	8.97	10.85	−1.88
5	Textiles	17.66	24.09	−6.44
6	Wood & Paper	12.44	15.87	−3.43
7	Chemicals	55.13	29.76	25.37
8	Non-Met Minerals	21.32	20.86	.46
9	MBMW	49.88	17.76	32.12
10	Industry n.e.c.	24.15	49.86	−25.70
11	Electricity	16.36	16.94	−.57
12	Construction	3.53	4.23	−.70
13	Distribution	14.24	1.07	13.16
14	Transport & Com.	26.87	16.41	10.47

economies.

Table 4 shows the difference in "export" and "import" ratios and self-sufficiency rates between the 1977 U.S. economy and the 1977 Soviet economy. Table 4 also shows the difference in "export" and "import" ratios and self-sufficiency rates between the 1975 FRG economy and the 1977 Soviet economy.

From Table 4 we can see that the U.S. agriculture sector shows a much greater "export" ratio, followed by food, non-metallic mineral products and chemicals. The U.S. fuels sector shows a much greater "import" ratio, followed by the metallurgy and non-metallic mineral products sectors. Consequently, the U.S. self-sufficiency rates of the fuels and metallurgy sectors have shown a much greater decrease, while the U.S. self-sufficiency rate for the agriculture sector has shown a greater increase.

From Table 4 we can also see that the FRG metallurgy sector shows a much greater "export" ratio, 70%, followed by the wood, paper and non-metallic minerals sectors. Unlike the comparison of the U.S. and Soviet foreign trade pattern, all sectors of the FRG economy show much greater "export" and "import" ratio increases. The FRG fuels sector shows a much greater "import" ratio, 66%, followed by the metallurgy and agriculture sectors. Consequently, the self-sufficiency rates of the FRG fuels and agriculture sectors show a much greater decrease, while the self-sufficiency rates of the FRG MBMW, chemical and metallurgy sectors show a much greater increase.

V. *A Comparison of the Soviet Union and the United States: A Disaggregated Case*

When making an input-output analysis, the greater the degree of dissaggregation, the better able we are to make concrete analysis of the input-output structure of an economy.

The most detailed input-output table for the Soviet Union is the 88-order version compiled by Treml, Kostinsky and Gallik (1983). We employ this version, incorporating the 88-order export and import vectors, in producers' prices to compare the Soviet foreign trade patterns with that of the United States.

In the case of the United States we employ the 85-order commodity-by-commodity table compiled by merging the make and use tables of the BEA. For both countries, very few studies have been conducted in terms of direct comparisons to date. Therefore, we employ the original codes presently used in both countries.

Figure 7 and Figure 8 show the "skyline" charts of the Soviet Union and the United States, respectively. In the 1972 aggregated 15-sector versions both "skyline" charts are very flat. However, in the disaggregated version the charts of both countries are complex in shape. Table 5 shows the ten highest sectors of the self-sufficiency rates for the Soviet Union and the United States. From this table we can see that the Soviet Union uses the terms "Energy and Power Machinery and Equipment," and "Mining and Metallurgical Machinery and Equipment", while the United States uses the terms "Energy and Turbines" and "Construction and Mining Machinery" for the same respective categories. These two sectors and the coal sector show the relatively high self-sufficiency rates in both countries.

Secondly, Table 5 shows that the Soviet Union has a high self-sufficiency rate in such basic resources-related sectors as "Oil Extraction" and "Metallurgy and Ore." For the

FIG. 7. 1972 U.S.S.R. SKY-LINE CHART (88-sector: producers' prices)

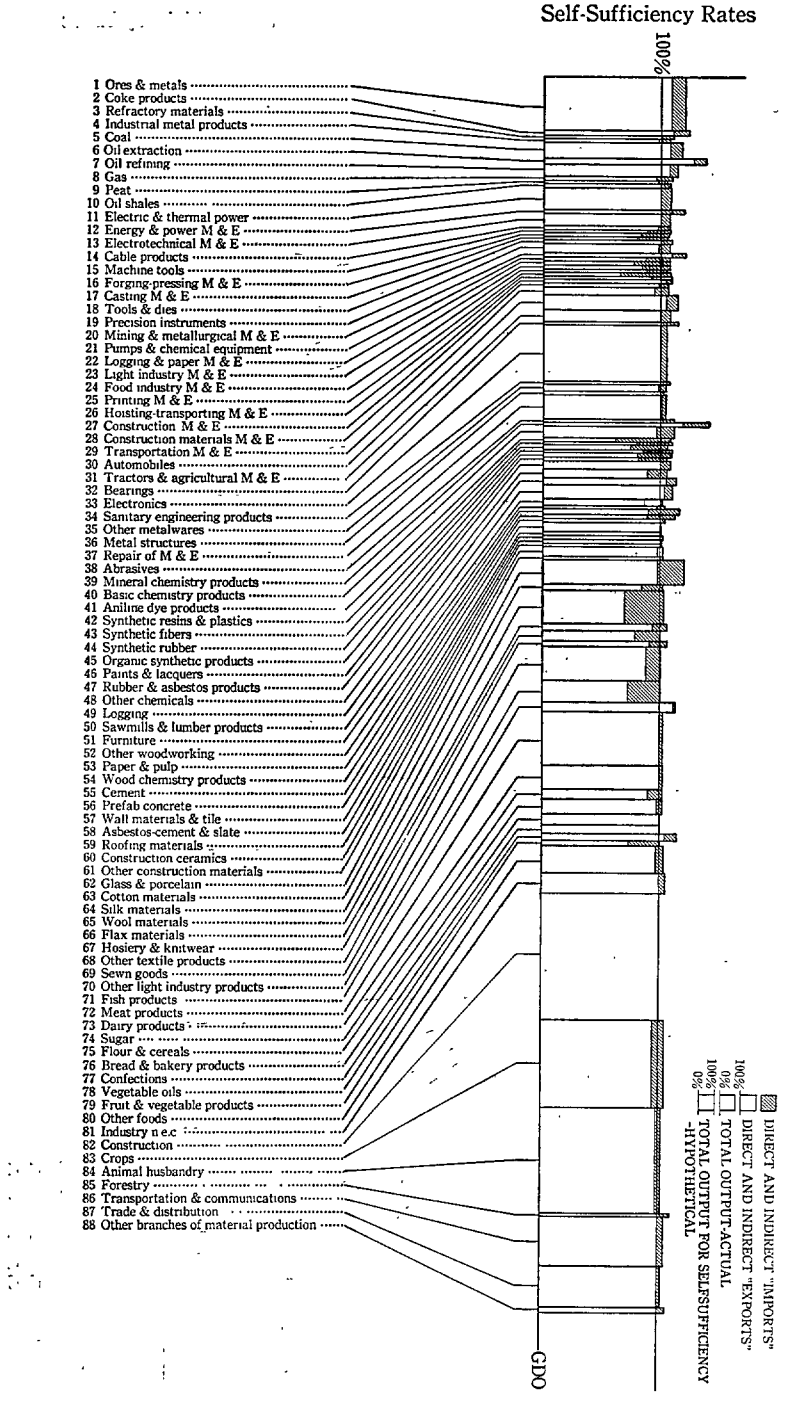


FIG. 8. 1972 U.S. SKY-LINE CHART (79-Sector; producers' prices)

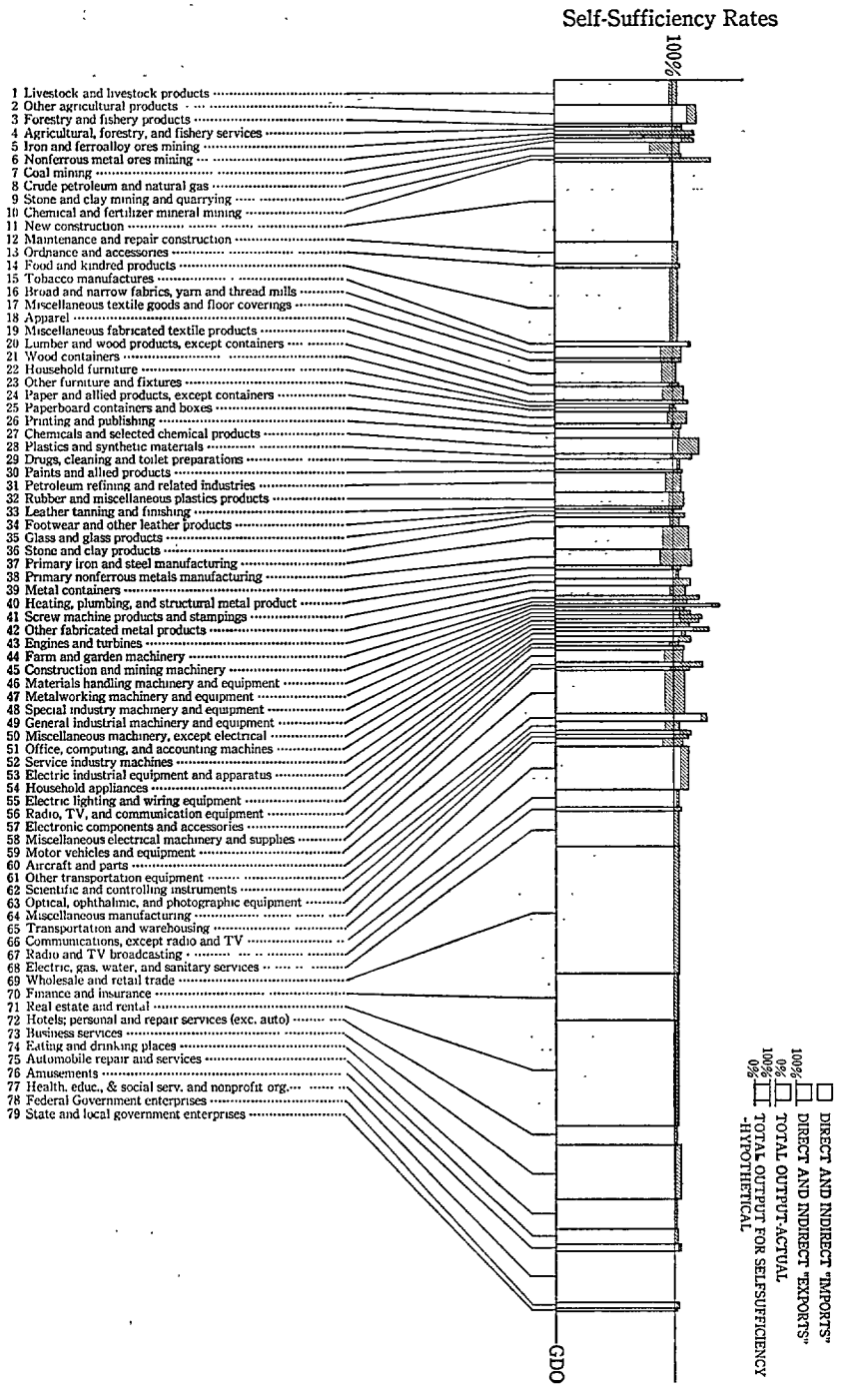


TABLE 5. SELF-SUFFICIENCY RATES: THE TEN HIGHEST SECTORS

1972 U.S.S.R. (Producers' Prices)

(unit: %)

Rank	Sector Treml's 88-Order Code	Output Ratios -Actual (-hypothetic)	"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
1	6 Oil extraction	0.62 (0.47)	37.32	10.10	127.22
2	39 Mineral chemistry products	0.09 (0.07)	40.10	21.43	118.68
3	71 Fish products	0.96 (0.83)	12.74	1.62	111.12
4	2 Coke products	0.37 (0.32)	23.50	13.91	109.60
5	20 Mining & metallurgical M&E	0.33 (0.29)	20.20	11.16	109.04
6	12 Energy & power M&E	0.21 (0.19)	19.15	10.40	108.75
7	1 Ores & metals	4.93 (4.36)	19.78	11.21	108.57
8	5 Coal	1.43 (1.28)	17.90	10.79	107.11
9	7 Oil refining	1.12 (1.01)	13.30	6.49	106.80
10	34 Sanitary engineering products	0.19 (0.17)	6.99	1.04	105.96

1972 U.S.A. (Producers' Prices)

(unit: %)

Rank	Sector BEA's 85-Order Code	Output Ratios -Actual (-hypothetic)	"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
1	45 Construction & mining machinery	0.39 (0.29)	37.72	5.65	132.07
2	60 Aircraft & parts	0.84 (0.68)	27.70	5.44	122.26
3	51 Office, computing & accounting machines	0.41 (0.35)	28.21	12.80	115.41
4	2 Other agricultural products	1.74 (1.53)	19.82	6.93	112.88
5	15 Tobacco manufactures	0.47 (0.42)	13.16	1.23	111.93
6	43 Engines & turbines	0.29 (0.26)	20.59	11.12	109.47
7	7 Coal mining	0.28 (0.26)	17.15	8.58	108.57
8	52 Service industry machines	0.41 (0.39)	8.97	3.43	105.53
9	65 Transportation & warehousing	3.90 (3.69)	11.80	6.58	105.22
10	57 Electronic components & accessories	0.44 (0.42)	23.53	18.49	105.04

United States, the "Aircraft" and "Office, Computing and Accounting Machines" sectors show a high degree of self-sufficiency in these high-technology related areas.

Thirdly, with regard to sectors related to agriculture and fisheries, it can be seen that in the case of the Soviet Union, the self-sufficiency rate for "Fish Products" is very high. In the United States the "Other Agricultural Products" sector, which covers fruits and vegetables, and "Tobacco Manufactures" show a high self-sufficiency rate. Sectors which reflect a high rate of self-sufficiency usually account for high direct and indirect "exports;" namely, the ten highest sectors shown in the Table 5 are also high export sectors.

The Soviet sector with the highest self-sufficiency rate, "Oil Extraction," reflects the second highest "export" ratio. This sector's "import," actual, and hypothetical output ratios are respectively 10.10, 0.62 and 0.47%.

The second highest self-sufficiency sector in the Soviet economy, "Mineral Chemistry Products," reflects the highest "export" ratio, 40.10%. This sector's "import," actual, and

TABLE 6. SELF-SUFFICIENCY RATES: THE TEN LOWEST SECTORS

1972 U.S.S.R. (Producers' Prices)

(unit: %)

Rank	Sector Treml's 88-Order Code	Output Ratios -Actual (-hypothetic)	"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
1	41 Aniline dye products	0.05 (0.08)	7.90	46.15	61.75
2	25 Printing M&E	0.01 (0.01)	7.59	42.20	65.39
3	65 Wool materials	1.97 (2.70)	2.35	32.29	70.05
4	70 Other light industry products	1.25 (1.65)	1.16	28.55	72.60
5	79 Fruit & vegetable products	0.32 (0.42)	1.14	28.10	73.04
6	43 Synthetic fibers	0.27 (0.35)	4.87	30.65	74.21
7	22 Logging & paper M&E	0.04 (0.05)	6.91	30.07	76.84
8	65 Hosiery & knitwear	0.68 (0.83)	0.58	22.32	78.26
9	42 Synthetic resins & plastics	0.25 (0.30)	9.32	30.25	79.07
10	17 Casting M&E	0.01 (0.01)	4.76	25.26	79.50

1972 U.S.A. (Producers' Prices)

(unit: %)

Rank	Sector BEA's 85-Order Code	Output Ratios -Actual (-hypothetic)	"Export" Ratios	"Import" Ratios	Self-Sufficiency Rates
1	3 Forestry & fishery products	0.11 (0.17)	8.33	44.01	64.32
2	5 Iron & ferroalloy ores mining	0.07 (0.11)	17.19	52.53	64.66
3	6 Nonferrous metal ores mining	0.11 (0.14)	13.96	38.37	75.59
4	33 Leather tanning & finishing	0.05 (0.06)	6.86	29.86	77.01
5	8 Crude petroleum & natural gas	0.85 (1.04)	5.91	24.92	80.99
6	34 Footwear & other leather products	0.23 (0.28)	0.90	19.77	81.12
7	38 Primary nonferrous metals manufacturing	1.19 (1.34)	13.86	25.64	88.22
8	16 Broad & narrow fabrics yarn & thread mills	0.88 (0.98)	5.90	16.79	89.11
9	17 Miscellaneous textile goods & floor coverings	0.31 (0.34)	5.57	15.64	89.93
10	64 Miscellaneous manufacturing	0.58 (0.64)	6.71	16.48	90.24

hypothetical output ratios are respectively 21.43, 0.09, and 0.07%. The output share of this sector is rather low, and hence, this sector does not effectively impact on the economy as a whole.

The third highest self-sufficiency sector, "Fish Products," does not reflect the relatively high "export" ratio, but rather, reflects the low "import" ratio. This sector's "export," "import," actual and hypothetical output ratios are respectively 12.74, 1.62, 0.96, and 0.83%. The highest self-sufficiency sector for the United States, "Construction and Mining Machinery," reflects the highest "export" ratio, a remarkable 37.72%. This sector's "import", actual and hypothetical output ratios are respectively 5.65, 0.39, and 0.29%.

The second highest self-sufficiency sector, "Aircraft and Parts," reflects the fourth highest "export" ratio, 27.70%. This sector's "import," actual and hypothetical output ratios are respectively 5.44, 0.84, and 0.68%. The sector, "Oil Shales," shows the second highest

"export" ratio, 33.55%. Therefore, the self-sufficiency rate of this sector is below 100%. The third highest self-sufficiency sector, "Office, Computing and Accounting Machines," reflects the third highest "export" ratio, 28.21%. This sector's "import," actual and hypothetical "output" ratios are respectively 12.80, 0.41, and 0.35%. The fourth highest self-sufficiency sector, "Other Agricultural Products," reflects the eighth highest "export" ratio, 19.82%. This sector's actual and hypothetical "output" ratios are rather high; 1.74 and 1.53% respectively.

Let us now turn to the ten sectors with the lowest self-sufficiency rates. From Table 6 and the "skyline" chart it can be seen that for both the United States and the Soviet Union "Leather Tanning and Finishing" and "Other Light Industry Products" (U.S.S.R.) have the fourth lowest self-sufficiency rates. The U.S. sector "Footwear and Other Leather Products," which is included in the Soviet sector "Other Light Industry Products," has the sixth lowest self-sufficiency rate. Secondly, with regard to the agriculture and fisheries-related sectors the "Fruit and Vegetable Products" sector (U.S.S.R.) is the fifth lowest sector of the Soviet economy. This is in great contrast to the American case. In the case of the United States "Forestry and Fishery Products" is the lowest self-sufficiency sector.

Thirdly, in contrast with the Soviet Union, the U.S. sectors related to basic resources are among the four lowest sectors. Among these sectors are included "Iron and Ferroalloy Ores Mining," "Nonferrous Metal Ores Mining," "Crude Petroleum" and "Natural Gas," and "Primary Nonferrous Metals Manufacturing." The "export" ratios of these sectors, with the exclusion of "Crude Petroleum" and "Natural Gas," are not particularly low, but the "import" ratios are very high. The "Iron and Ferroalloy Ores Mining" and "Nonferrous Metal Ores Mining" sectors have the highest and third highest "import" ratios; 52.53 and 38.37% respectively. Unlike the United States, there is no sector among the ten lowest sectors in the Soviet Union with an "export" ratio higher than 10%. The highest "export" ratio of the ten lowest self-sufficiency sectors in the Soviet Union is recorded by the "Synthetic Resins and Plastics" sector: 9.32%. Fourthly, the Soviet sectors, "Aniline Dye Products" and "Synthetic Resins and Plastics" constitute the lowest and ninth lowest self-sufficiency sectors; 61.75 and 79.0%. The former sector's "import" ratio is the highest; 46.15%. The latter sector's "import" ratio is the second highest; 42.20%.

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