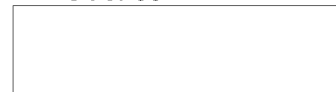




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The Soviet Economic Predicament and East-West Economic Relations



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*SOV 82-10001X
January 1982*

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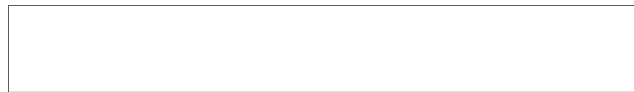
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*Information available as of 15 December 1981
has been used in the preparation of this report.*



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Comments and queries are welcome and may be
addressed to the Chief, Soviet Economy Division,
SOVA 

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This paper has been coordinated with the Office of
Scientific and Weapons Research and the National
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January 1982*

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**The Soviet Economic
Predicament and East-West
Economic Relations** 

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Foreword

This is a supplement to the Special National Intelligence Estimate *Dependence of Soviet Military Power on Economic Relations With the West*, SNIE 3/11-4-81, 17 November 1981. That estimate examined the contribution of Western goods and technology to Soviet economic performance and defense programs and outlined possible Western restrictions on East-West economic relations. This assessment provides more detailed discussion of topics covered in the estimate.

Although not coordinated with other NFIB agencies, the assessment has taken into consideration comments from those agencies. Like the estimate, it omits consideration of such topics as: the economic costs to Western countries participating in trade restrictions; the problem of obtaining Western cooperation; how to restrict leaks, diversions, espionage, or the flow of open information; and how to differentiate between Eastern Europe and the Soviet Union in Western export control policy.



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**The Soviet Economic
Predicament and East-West
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Key Judgments

As the Soviet Union completes the first year of its new five-year plan, the economy has turned sour—even before the long-anticipated labor and energy problems have come into play. Three bad harvests have left agriculture in disarray, and transportation and materials bottlenecks and dwindling productivity gains have reduced industrial growth sharply. Soviet GNP growth may well be limited to 1 to 2 percent on average by the mid-1980s.

Slower economic growth will give President Brezhnev and his colleagues increasingly tough and politically painful choices in resource allocation and economic management. Annual increments to national output in the early 1980s will be too small to simultaneously meet mounting investment requirements, maintain growth in defense spending at the rates of the past, and raise the standard of living. Simply stated, something will have to give.

The Soviet need for Western goods and credits will therefore increase greatly. Imports can relieve some economic problems by raising the technological level of key Soviet industries and by reducing shortages of grain and such important industrial materials as steel. During the 1970s, increased imports made a sizable contribution to the Soviet production of oil and gas, chemicals, and motor vehicles, and vastly increased grain purchases were critical to raising and then sustaining Soviet meat consumption. In the 1980s, Western equipment and know-how will be particularly important to raising productivity in the critical machine-building and energy industries. The Soviets must continue importing large amounts of agricultural products and will probably expand their purchases of steel and some other industrial materials.

In obtaining and exploiting Western technologies and equipment, however, the Soviets give priority to those having military application. Through legal and illegal means—including clandestine acquisitions and third-country transfers—they have obtained Western designs, test data, production know-how, and actual hardware and have used them in developing new weapons or improving existing military capabilities. The Soviet defense establishment has in some cases been able to:

- Avoid false starts in early weapon design.
- Reduce the time in which more reliable weapon testing programs are conducted and weapon systems manufactured.

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- Save years in improving production processes for critical weapon parts.
- Incorporate acquired Western components directly into weapon prototypes to maintain development schedules.
- Develop countermeasures effective against specific Western weapons.

The USSR knows that it must scramble in the 1980s to keep pace with technological improvements of Western weapon systems. Western technology could be especially valuable in:

- Production of microelectronic devices critical to guidance systems for missiles, precision-guided munitions, and signal-processing devices for ASW and ballistic missile defenses.
- Manufacture of electro-optical devices for night vision.
- Production of advanced airframes and aircraft propulsion systems.

The USSR will also need Western equipment and technology to manufacture weapon systems more cheaply for itself and its Warsaw Pact allies.

A Western effort to hamper Soviet defense programs by increasing the restrictions of East-West economic relations could take several forms:

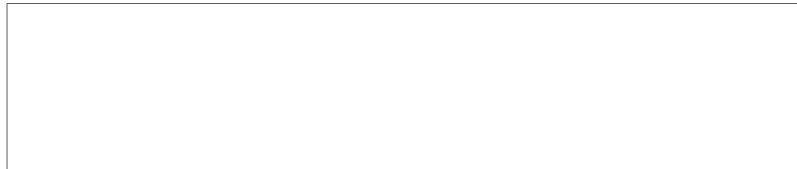
- Because the prospects for Soviet hard currency earnings in the 1980s are far from bright, Western credits will have to cover an increasing proportion of Soviet imports from the West. Limits on credit availability could therefore force the USSR to reduce hard currency purchases, especially in the early 1980s.
- To stop the flow of technology most directly useful to Soviet military programs would require the tightening of existing export controls and the expansion of the existing controls to cover emerging technologies such as robotics and nonmetallic materials, as well as more effective blockage of illegal acquisitions.
- Western embargoes of selected goods and technology—such as grain and petroleum equipment—could seriously aggravate existing Soviet economic problems.
- A sustained, total embargo by the USSR's principal Western suppliers could hurt Soviet economic growth by creating more bottlenecks in key sectors than Moscow could handle simultaneously.

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If Moscow were convinced that it could not break up an embargo by playing upon the economic interests of individual Western countries, it would probably respond by becoming less cooperative in some aspects of its foreign policy and by pursuing more autarkic economic development. Heavy military spending probably would continue, with Soviet consumers forced to tighten their belts. Even so, a denial of critical strategic technology would delay Soviet defense development and procurement programs, although the main impact on Soviet military capabilities probably would not be felt until the 1990s.

In the longer run, as economic problems increase, a post-Brezhnev leadership will be forced to reconsider development priorities and—perhaps—to consider economic reform. Any decision to reduce defense spending at that point will depend heavily on the political balance in the Politburo, the confidence of the new leaders, how much more desperate the economic situation has become, the level of consumer dissatisfaction, and—above all—the international environment.



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The Soviet Economic Predicament and East-West Economic Relations (U)

The Soviet Economic Predicament

As was described in the estimate, Soviet economic performance is worsening. Although the economy is still growing, its rate of growth is falling, from nearly 4 percent per year in the 1970s to an average of 1.5 percent per year in 1980 and 1981. The chief causes of the slowdown are rising resource costs, an inefficient economic system, production shortfalls in agriculture and industry, and an accumulation of planning mistakes. As a result, growth in labor productivity has slowed just as demographic trends are beginning to curtail the supply of new labor.

Agriculture

Agriculture has been Moscow's biggest headache. The Soviets have now suffered their third straight harvest failure. We estimate that the 1981 grain crop was about 170 million tons—19 million tons less than 1980's poor crop. Meat production and most other Soviet crops are expected to exceed last year's depressed level, however, and total farm output, therefore, probably increased slightly compared with that of 1980. Nevertheless, output will still fall short of the 1976 level.

While the odds are that the weather will be better next year, an early return to the unusually favorable weather patterns that existed from the mid-1960s to the mid-1970s seems unlikely. Rather, the somewhat harsher conditions that prevailed for 20 years prior to the mid-1960s are likely to be the rule. In that environment, the gains in agricultural output that accrued between the mid-1960s and mid-1970s—largely the result of good weather—will be nearly impossible to achieve in the 1980s unless Moscow speeds up sharply the delivery of machinery and fertilizer to agriculture.

Industry

While agriculture has had most of the headlines, industry also has been doing poorly. Growth in almost every major sector is running behind the pace of a

year ago. Industrial output grew by less than 2 percent in 1981, well below its nearly 3-percent growth during 1980. This is the worst performance in the postwar period (see table 1). Key problem areas include:

- **Industrial Materials.** Lagging output of raw materials and semifinished products is a major reason for the economy's malaise. Shortages of basic materials such as steel, cement, nonferrous metals, and lumber have become serious in recent years. This has constrained new fixed investment, created bottlenecks throughout the economy, and disrupted—and in some cases halted—construction activity and industrial operations.
- **Energy.** Sluggish increases in energy output will pose a major problem during the coming decade. Growth in primary energy production probably fell to less than 2 percent in 1981 and is likely to average only 2 to 3 percent through the mid-1980s, despite a substantial investment in energy. (Energy growth during most of the 1970s, in contrast, averaged almost 5 percent annually.) Oil output at best is likely to stagnate at 12 million barrels per day (b/d) through the early 1980s before dropping, and production of coal will increase only slightly during most of the decade. Consequently, natural gas and nuclear power must provide practically all of the growth in energy output through at least the mid-1980s. Meanwhile, spot fuel shortages have become more frequent, reflecting a tighter energy supply as well as distribution problems. The Soviets are trying to increase the efficiency of energy use, but substantial success is unlikely until the late 1980s. (c)
- **Machinery.** Machine building has been the focus of Soviet investment programs—both military and civilian—and has outperformed other industrial sectors in recent years. Nonetheless, growth of civilian

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Table 1

Average Annual Percentage Rates of Growth
of Soviet Industrial Production

	1961-65	1966-70	1971-75	1976-80	1981 ^a
Total industry	6.6	6.3	5.9	3.4	1.9
Industrial materials	6.8	5.8	5.4	2.6	1.6
Ferrous metals	7.2	5.1	4.0	1.1	-0.1
Nonferrous metals	7.6	7.4	5.9	2.6	0.1
Chemicals	12.0	8.9	8.6	3.9	3.9
Construction materials	5.4	5.7	5.4	1.8	0.9
Wood, pulp, and paper	2.6	2.9	2.6	0	2.0
Fuels	6.3	5.0	5.0	3.3	1.1
Electric power	11.5	7.9	7.0	4.5	2.1
Machinery	7.4	6.9	7.9	5.4	2.4
Civilian	8.9	8.2	9.0	5.8	1.5
Military	4.1	3.6	4.5	3.4	6.0
Consumer nondurables	4.8	6.4	3.4	1.6	1.7
Light industry	2.6	7.2	2.7	2.6	1.7
Processed foods	6.8	5.9	3.9	0.7	1.7

^a Estimates are based on 10-month data.

machinery output (after increasing at about 6.5 percent annually in 1976-79) fell below 4 percent per year in 1980 and to roughly 1.5 percent in 1981.

- **Rising Costs.** The rising cost of exploiting raw materials has become an increasing drag on industrial productivity. The general quality of mineral deposits has declined, and most minerals, energy, and timber must now be obtained from remote areas, notably Siberia.
- **Labor Productivity.** The continuing deceleration of the increase in labor productivity reflects rising raw material costs, imbalances in production, a slower rate of technical progress, and worker disinterest (see table 2). Productivity in industry during 1981 increased at an estimated annual rate of 1.2 percent—far below the average of 4.2 percent targeted for the 1981-85 plan.

Support to Eastern Europe

During the past decade Moscow has also shouldered a sharply increasing foreign aid burden in order to maintain a buffer of politically reliable regimes on its western border. Soviet economic support of Eastern Europe rose from nearly US \$5 billion in 1975 to more than \$18 billion in 1980. (This was almost 80 percent of Moscow's total aid to Communist countries and more than 1 percent of Soviet GNP.) The aid has taken two primary forms: selling fuels and commodities to East European countries at below-market prices and permitting some of them to incur trade deficits with the USSR occasionally. Although Moscow is trying to reduce its aid burden, mainly by reducing annual oil deliveries, its concern for continued political stability and Soviet influence in the region will not permit substantial aid cutbacks soon.

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Table 2

**Output and Productivity in Soviet Industry
(Average Annual Percentage Increase)**

	1951-60	1961-70	1971-75	1976-80	1981 ^a
Output	9.2	6.4	5.9	3.4	1.9
Man-hours	2.6	3.0	1.5	1.6	0.7
Labor productivity	6.4	3.3	4.4	1.8	1.2

^a Estimates are based on 10-month data.

Capital Shortages

The Soviets have apparently decided to cope with tightening resource constraints by cutting back on the growth of investment in fixed capital. Fixed investment in the 1981-85 Five-Year Plan is to increase at an average annual rate of less than 2 percent—well below the 7 percent per year achieved in 1966-75 and below the 3.5 percent attained in 1976-80. This constraint will exacerbate the Soviets' already difficult problems in investment allocation. Within industry, energy is slated for a sharp 50-percent increase in investment and machine building for a 40-percent increase. Agriculture will retain its past 27-percent share of total economy-wide investment.

To meet the rising requirements of energy, the defense industry, and agriculture, Soviet planners will have to shortchange the branches that produce consumer goods and even some critical sectors such as steel and transportation. They will make their production plans look consistent on paper only by decreeing unrealistically high goals for conservation of the raw materials and the semifinished products produced in lower priority sectors.

The growth in investment can slow down—or even fall—without a sharp impact on economic growth in the near term. The Soviets' stock of plant and equipment will continue to increase fairly rapidly for a time, even with little growth in investment. But the investment decisions taken now are bound to reduce the growth of fixed capital in the economy considerably by the mid-1980s.

Hard Currency Bind

Moscow can loosen some of the domestic resource constraints by importing foreign goods and technology—but its ability to import is threatened by declining hard currency revenues. The Soviet hard currency position deteriorated in 1981 because of softer world prices for Soviet oil and other raw materials and sharply increased imports of Western agricultural goods. The 1981 Soviet trade deficit probably reached \$6 billion.

Moscow's overall financial position with the West is still good; its hard currency debt service ratio is only about 15 percent. Nevertheless, hard currency earnings will almost certainly worsen during the 1980s as exports decline. The basic problem is that Soviet oil deliveries to the West will probably fall in the next few years because of stagnating or falling production and rising demand at home. The Soviets' only substantial new hard currency earner will be gas exports, when the Siberia-to-Europe pipeline project is completed. Gas earnings will not rise substantially before the mid-1980s, however, and total gas earnings by the late 1980s will barely cover the drop in oil revenues.

In commodities other than oil and gas, the Soviets will do well to hold annual exports constant at roughly \$9 billion through the 1980s. As table 3 shows, these commodities have not been doing well lately. Prospects are poor for sales of both raw materials and manufactured goods, because:

- Western demand for raw materials is sluggish, and Soviet production costs are high.

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Table 3

Million 1970 US \$

**Soviet Hard Currency Exports of Products
Other Than Oil and Gas**

	1970	1975	1976	1977	1978	1979	1980
Total	1,801	2,281	2,430	2,313	2,994	3,160	2,821
Coal and coke	93	86	89	88	70	65	58
Machinery and equipment	140	277	319	314	514	566	507
Ferrous metals	129	182	174	123	142	141	134
Wood and wood products	365	361	449	427	405	380	328
Chemicals	67	159	129	143	196	324	403
Agricultural products	205	264	227	256	175	138	112
Diamonds	175	282	284	291	376	380	376
Other	627	670	759	671	1,116	1,166	903

• Most Soviet manufactures are not well suited to Western markets. Soviet arms sales are already substantial—currently \$5 billion a year—and are unlikely to increase much further, while exports of Soviet gold and platinum group metals could not increase substantially above current levels without depressing the market.

Consumer Welfare

The Soviet population enjoyed substantial improvement in living standards during the 1960s and 1970s, but this improvement is beginning to taper off. The year 1981 was the third in succession of increasing food shortages, mostly in the area of quality foods—meat and dairy products. Rationing of these items, mostly in the form of informal purchase limits, has become increasingly frequent and widespread since the winter of 1980/81. Factors other than the nationwide per capita availability of food supplies, however, explain the shortages. These are: large-scale leakages from government food distribution channels, the maintenance of fixed prices in state retail outlets, and growing demand generated by wage increases.

Whatever the cause of the shortages, the consumer's mood is generally one of pessimism and resigned acceptance. Although some work stoppages occurred in 1981, Soviet workers are still a long way from venting their dissatisfaction as the Polish workers have. To diminish the potential for labor unrest, the leadership has allowed the proliferation of special food distribution systems (once reserved largely for the Soviet elite) at the factory level. The special food distribution, coupled with the traditional stoicism of the populace, has been enough to maintain labor peace. In effect, the leadership has shifted the worst burden of the food shortage to social groups like the elderly, who are the least likely to protest.

The most serious consequence of the slowing growth in consumer welfare, from the leaders' point of view is its impact on labor productivity. We expect per capita consumption to stagnate during the mid-to-late 1980s; and this interruption in the Soviets' modest progress toward improved living standards is likely to reduce worker motivation—and hence productivity. The leadership is counting upon gains in labor productivity alone to provide 90 percent of the growth in industrial output and the entire growth in agricultural output called for in the current five-year plan.

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Moscow thus faces a dilemma. Rather than increasing investment to restore past rates of economic growth and boost consumer welfare, it is relying upon a strategy of promoting efficiency and productivity throughout the economy. But the Soviet labor force is less willing than it once was to defer material satisfactions to the future, and unless Moscow provides sufficient increases in quality foods and goods now, we do not think this strategy will work.

Leadership Response

So far the leadership's response to growing economic difficulties has been cautious and conservative. We have seen, for example, no sign of an effort to curb military outlays in order to boost the civilian economy. Physical indicators of future levels of defense spending—such as programs in train and investment in defense production and R&D facilities—point to continued real growth of about 4 percent per year. Nor have we seen the Politburo take any significant steps to change the system of planning and management in order to cope with the economic slowdown. The planners' main concession to the resource bind has been to cut investment growth during 1981-85 to the lowest rate since World War II.

Soviet economic situation is less pessimistic than ours. They have taken some steps to improve planning and stimulate technological progress and believe these will be successful eventually. In addition, Soviet leaders believe that some of their problems are transitory. They apparently expect that:

- Demographic trends will lead to an upturn in the labor supply in the 1990s.
- Better weather and greater efficiency will restore growth in farm output and help solve the food problems.
- Increased production of gas—plus energy conservation in general—will more than offset any stagnation in oil production in the years ahead.
- New technological fixes and breakthroughs will improve economic performance and productivity.

More generally, they tend to make their economic assessments in comparative terms and may take some solace in the fact that the Western economies are also experiencing serious difficulties and challenges.

Perhaps the most important reason for the inertia in Soviet domestic economic policy, however, is the inability or unwillingness of an aging leadership to undertake decisive actions and fundamental reforms. The ruling group seems incapable of making the hard policy choices involved in shifting resources in a major way, modifying administrative arrangements, and changing organizational structures. Such choices, which would necessarily affect entrenched institutional interests and generate bureaucratic conflicts, would be fraught with political uncertainties. Fundamental changes in economic policy thus must await a different leadership.

Outlook for the Economy

The economic problems now facing the Soviets in agriculture, industry, and capital formation are for the most part familiar. They have increased in intensity, however, leaving the Politburo less and less room for maneuver. In the 1960s and early 1970s, Moscow was able to satisfy a number of economic priorities simultaneously:

- Average living standards rose appreciably.
- Productive capacity increased rapidly in all sectors of the economy.

Nonetheless, the leaders' reluctance to make any fundamental changes in resource allocation or economic organization suggests that their view of the

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Table 4

Soviet Hard Currency Trade

	Exports, f.o.b.						Imports, f.o.b.					
	1970		1975		1980		1970		1975		1980	
	Million US \$	Percent of Total	Million US \$	Percent of Total	Million US \$	Percent of Total	Million US \$	Percent of Total	Million US \$	Percent of Total	Million US \$	Percent of Total
Total	2,201	100	7,835	100	23,498	100	2,708	100	14,257	100	26,017	100
Of which:												
Fuels	493	22	3,887	48	15,095	64	8	NEGL	497	3	700 ^a	3
Crude oil and petroleum products	387	18	3,276	41	12,028	51	8	NEGL	497	3	700 ^a	3
Natural gas	13	1	220	3	2,706	12	0	0	0	0	0	0
Coal and coke	93	4	391	5	362	2	0	0	0	0	0	0
Machinery and equipment	140	6	560	7	1,388	6	927	34	4,593	32	6,039	23
Ferrous metals	129	6	167	2	246	1	279	10	2,567	18	3,469	13
Chemicals	67	3	256	3	765	3	208	8	742	5	1,565	6
Wood and wood products	365	17	712	9	1,476	6	84	3	214	2	203	1
Agricultural products	205	9	572	7	478	2	615	23	3,856	27	8,800	34
Grain	22	1	3	NEGL	0	0	101	4	2,323	16	4,400	17
Other	183	8	569	7	478	2	514	19	1,533	11	4,400	17
Consumer goods	76	3	215	3	152	1	260	10	436	3	745	3

^a Estimated.

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Table 5

Percent

Share of Hard Currency Trade
in Total Soviet Trade

	Soviet Exports			Soviet Imports		
	1970	1975	1980	1970	1975	1980
Total	17	23	31	23	38	38
Fuels	24	36	42	4	34	NA
Crude oil and petroleum products	26	40	43	10	72	NA
Natural gas	2	34	48	0	0	NA
Machinery and equipment	5	9	3	22	37	26
Ferrous metals	10	6	7	47	77	75
Chemicals	18	25	36	34	42	42
Wood and wood products	44	37	48	34	27	15
Agricultural products	14	24	25	27	42	66
Grain	5	1	0	73	87	90
Consumer goods	23	26	13	12	9	9

After three consecutive poor grain harvests, imports of grain will play a more critical role than ever before. Even with respectable grain crops, the USSR will need large imports—20 to 25 million tons of grain annually—for several years just to push up per capita meat consumption by 1 to 2 percent annually. If the USSR could buy no grain after 1981, its average annual meat production would be cut by about 2 million tons, even if its own grain crops were respectable. Without foreign meat as well as foreign grain, per capita availability of meat would fall by roughly 20 percent.

Other Agricultural Commodities. During the 1970s, hard currency outlays for agricultural products other than grain—largely meat, butter, vegetable oil, sugar, and soybeans and meal—have registered fairly steady growth. If these purchases had not been made, the quality of the average Soviet citizen's diet would have deteriorated substantially. Imports of soybeans and

Table 6

Million US \$

Soviet Hard Currency Trade
With Selected Countries, 1980

	Exports	Imports	Trade Balance
Total	23,498	26,017	-2,519
Developed West	21,304	21,330	-26
Australia	9	1,194	-1,185
Austria	894	610	284
Canada	46	1,496	-1,450
France	3,453	1,326	1,127
Italy	3,235	1,438	1,797
Japan	1,463	2,730	-1,267
Netherlands	1,582	555	1,027
Sweden	546	496	50
Switzerland	686	620	66
United Kingdom	1,323	1,467	-144
United States	233	2,081	-1,848
West Germany	4,767	4,603	164
Others	3,067	1,714	1,353
LDCs	2,194	4,687	-2,493
Argentina	47	1,790	-1,743
Brazil	34	390	-356
Iraq	729	398	331
Libya	252	443	-191
Others	1,132	1,666	-534

soybean meal have become particularly important as domestic oil seed production has declined and as the need to stretch feed supplies for livestock has grown.

If the Soviet Union could not buy these products in the West, its people would not go hungry, but they would be forced to consume an increasing share of calories from grain and potatoes. The already serious food shortages would become more widespread, and worker morale and productivity would suffer correspondingly.

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Table 7

Measures of the Importance of Soviet-Western Trade to Selected Western Countries, 1980

Soviet Trading Partner	Exports to USSR as Percent of Exports to World	Imports From USSR as Percent of Imports From World	Percent of Trading Partner's GNP	
			Exports to the USSR	Imports From the USSR
Argentina ^a	15.0	0.2	0.8	NEGL
Australia	5.1	0.1	0.8	NEGL
Austria	2.7	4.2	0.6	1.3
Brazil ^a	2.1	0.2	0.2	NEGL
Canada	2.1	0.1	0.5	NEGL
France	2.2	2.7	0.4	0.6
Italy	1.6	3.0	0.4	0.8
Japan	2.1	1.3	0.3	0.2
Netherlands	0.7	1.6	0.3	0.8
United Kingdom	0.9	1.5	0.2	0.4
United States	0.7	0.2	0.1	NEGL
West Germany	2.3	2.2	0.5	0.5

^a Estimated.**Oil and Gas Equipment**

Western equipment was important in increasing the Soviets' energy production in the 1970s and will be critical to the modest gains planned for the 1980s. Western products are most needed in the oil and gas industries. For example:

- Soviet deficiencies in drilling, oil extraction, and gas and oil pipeline construction prompted Moscow to buy about \$5 billion in oil and gas equipment in the 1970s.
- High-capacity US oil pumps have probably added 2 million b/d to Soviet oil output in recent years.
- Purchases of large-diameter pipe from Western Europe and Japan (\$4-5 billion in the 1970s) have been critical to rapid growth of gas production.

The Soviets now need to import a broad range of Western petroleum equipment, including equipment for exploration, drilling, oil production, offshore operations, and gas pipeline construction. They have already found most of the relatively shallow, easily

located, accessible oil and gas deposits, and will need Western seismic and well logging technology to boost oil reserves in the 1980s. The 5- to 6-year time lag between discovery and production would prevent Western equipment ordered today from having much impact on oil production before the late 1980s.

Western rigs, drill pipe, tool joints, drill bits, blow-out preventors, and drilling-fluid technology can substantially aid Soviet efforts to nearly double the amount of drilling for oil and gas in 1981-85 and to increase it further in the late 1980s. The Dresser drill-bit plant, expected to be in operation soon, would certainly enhance Soviet oil production by the late 1980s.

Foreign equipment is important to Soviet plans to double the number of oil wells aided by submersible pumps and gas-lift equipment. Soviet-made submersible pumps and gas-lift equipment are of low capacity and reliability, and because the amount of water

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extracted along with oil is increasing, fluid lifting capacity will have to increase by the mid-1980s merely to maintain oil output at 12 million b/d. The Soviets probably expect to import about 100 submersible pumps annually (in the 1970s they imported a total of 1,200).

The Soviets also have an increasing need for Western enhanced-oil-recovery technology, but the effect of Western assistance would be relatively small and felt only after 1985. Moscow has received substantial assistance from the West in exploring offshore zones that will enhance oil and gas production by the late 1980s. Continued Western assistance could especially speed development in the Caspian area.

The USSR relies extensively on the West for gas pipeline equipment—large-diameter pipe and valves, compressors, and pipelayers. It imported 10 to 12 million tons of line pipe alone in the past decade, at a cost of \$4-5 billion. Although the Soviets have recently built a plant to manufacture large-diameter pipe, they have yet to master the production technology.¹ Pipeline capacity is therefore the principal bottleneck in Soviet gas production, and a denial of pipeline equipment would be a major setback to the industry.

If the USSR did not have access to Western equipment and pipe, the oil and gas production lost could amount to 2 or 3 million barrels a day (calculating gas in oil-equivalent terms) in the middle and late 1980s. The larger part of this loss would be gas. The oil and gas output foregone in that case would represent up to roughly 10 percent of the energy output which we expect by 1985. If Soviet oil production declined and gas production increased much less than we currently forecast, Moscow's hard currency earnings might fall sharply, and economic growth would be even slower than the rate of 2 percent or less that we now expect.

¹ Although the Soviets produce pipe up to 1,420 mm (56 inches) in diameter, little is for natural gas pipeline service. Most Soviet pipe is spiral welded and lacks the high-strength, low-alloy metallurgy of Western steel for Arctic pipeline service. Most of the large pipe imported by the USSR is fabricated with a single longitudinal weld made by the submerged arc process

Industrial Materials

The only industrial materials for which the USSR relies substantially on the developed West are steel, molybdenum, and some chemical products. Steel imports—primarily large-diameter pipe from Western Europe and Japan—helped Moscow avoid serious bottlenecks in some industrial sectors during the 1970s. Imports of molybdenum, much of it from the United States, increased from 3,000 tons in 1970 to 13,000 tons in 1980, making Moscow a net importer. The bulk of Soviet imports of tin, cobalt, and tungsten come directly from less developed countries.

Continued large purchases of steel would help offset the inadequacies of current investment in new steel-making capacity and help offset shortfalls in the production of iron ore and coking coal. The USSR also needs continuing access to Western metallurgical technology to reduce its dependence on imports of Western specialty steels. The French are helping to build the important Novolipetsk steel plant, which will produce 7 million tons of specialty steels per year when it comes on stream (in 1986 at the earliest).

Moscow continues to buy chemical products from the West, including phosphate materials, plastics, dyes, pesticides, manmade fibers, and catalysts. Purchases from the West totaled nearly \$1.6 billion in 1980. Several major trade and technical cooperation agreements with Western firms will provide support for this trade:

- Among the most important is a \$6.5 billion 10-year reciprocal trade agreement (signed in late 1980) with France's Rhone Poulenc for equipment and technology, pesticides, fertilizers, and animal feed in exchange for Soviet energy-intensive chemicals such as naphtha, ammonia, methanol, and possibly crude oil.
- The Soviets signed a \$1.5 billion 10-year deal in early 1980 with Italy's Montedison for seven chemical plants (together valued at \$800 million) in return for raw materials, fertilizer, and petrochemicals.

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- Smaller agreements signed with UK and Japanese firms will provide the Soviets with oil-recovery chemicals, pesticides, dyes, plastics, and catalysts.

[redacted]

Chemical Equipment

Western equipment and related process technology has contributed heavily to the growth of the chemical industry:

- In the 1970s the Soviets doubled their output of nitrogen fertilizer and plastics and tripled their synthetic fiber production, largely because of imported equipment.
- Relying heavily on Western technology, Moscow has doubled ammonia output and become the world's leading ammonia exporter.
- Chemical equipment imports accounted for almost one-third of Soviet purchases of Western machinery in the 1970s.

[redacted]

Soviet equipment imports increasingly have been associated with product buy-back or "compensation" deals, under which Western firms agree to long-term purchases of Soviet products—usually the products that are manufactured in the Western-equipped facilities.

The Soviets plan substantial orders during 1981-85 for Western chemical equipment and/or technology to produce urea, pesticides, ethylene, benzene, and downstream petrochemicals—as well as 14 additional ammonia plants. Deficiencies in Soviet pesticide development and the need to achieve balanced development of pesticides and fertilizers will also prompt purchases of Western pesticide production equipment. Moscow will probably buy Western equipment for planned West Siberian complexes producing fertilizers, plastics, manmade fibers, synthetic rubber, and petrochemicals.

[redacted]

Denial of Western chemical equipment and technology would:

- Slow down the increases in Soviet production of consumer goods and chemical-based industrial materials.
 - Hurt agricultural production.
 - Delay Soviet acquisition of a more efficient chemical industry with enhanced export capabilities.
- Without Western equipment, the Soviets would have to import many more chemicals than they currently

[redacted]

do—or cope with more serious shortages than they already have.

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Machinery and Technology in Other Priority Sectors

Western equipment and technology have aided other priority machine-building sectors considerably in the 1970s. Moscow has a pressing need to raise the quality of its industrial output while using fewer material resources, and this need ensures a continuing Soviet demand for Western products.

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Motor Vehicles. The Soviets have modernized and expanded their motor vehicle industry with Western help. When they began an ambitious 15-year modernization program in the mid-1960s, specialized Soviet machinery for mass automotive production was scarce. They turned to the West for massive help, spending an estimated \$3 billion for equipment and technology during 1966-80.

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The truck industry received the lion's share of the imports:

- About one-half of Soviet hard currency investments were for the Kama Truck Plant; the United States provided some of the world's most advanced automated foundries, as well as automated diesel engine machining and assembly lines.
- The Likhachev Truck Plant (ZIL), a major producer of military trucks, received substantial manufacturing technology from US, Japanese, and West German firms.

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The 15-year program was completed in 1980, and investment in the automotive industry will probably decline. No new truck or passenger car plants are called for in the current five-year plan period (1981-85). Existing Soviet plans to install new capacity for heavy trucks could be activated after 1985, however, creating a large new demand for Western production technology.

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Construction Equipment. Many industrial programs have been delayed because the construction and earthmoving equipment needed to build plants has not been available in sufficient variety or quantity. Soviet

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production of a 75-ton off-highway truck, for example, began only in the late 1970s, more than 10 years late. Manufacture of heavy industrial tractors and bulldozers has been set back by faulty tractor and engine designs. The USSR also is weak in the manufacture of heavy-duty transmissions, suspension systems, and axles that can support weights of 50 tons or more. [redacted]

To overcome domestic shortcomings, Moscow now plans to buy Western plants and technology for producing construction equipment:

- Fiat of Italy will supervise construction of a turnkey facility to produce earthmoving equipment.
- Negotiations are under way with several Western firms for technology to produce industrial tractors and engines.
- The USSR will purchase US technology to produce electric wheel drives.
- The Soviets are interested in obtaining licenses and technical help for manufacturing US tractors. [redacted]

Until these programs are completed, the Soviets still will need to buy construction and earthmoving equipment from the West. Denial of Western goods would seriously disrupt their plans to become more self-sufficient and would force them to use less efficient equipment. East European production of construction equipment is too limited in scale and variety to meet Soviet demand. [redacted]

Mining Equipment. The Soviets produce most of their own mining equipment, but imports have been important, especially where higher capacity machinery is required. Between 1972 and 1980, Moscow imported about \$1.6 billion worth of Western equipment, primarily heavy-duty dump trucks, excavators, bulldozers, and mining drills. About one-third of this total was provided by the United States and most of the remainder by Japan and West Germany. Most of the mining equipment that the USSR buys abroad, however, is provided by Eastern Europe—notably East Germany, Czechoslovakia, and Poland. [redacted]

The South Yakutia coal mines, developed with Japanese assistance, have employed most of the Western mining equipment. Earthmovers, particularly bulldozers, are used in gold mining operations in the

Magadan, Irkutsk, and Lena regions, as well as in other coal and ore mines. [redacted]

We believe that the Soviets will continue to depend on Western mining equipment in the 1980s. For example:

- Vast open-pit Siberian coal mines are being developed and will require enormous earthmoving and hauling capability.
- Development of the Ekibastuz coal basin has been lagging badly, and increased imports of large-capacity dump trucks, for example, could speed it up. [redacted]

Without access to Western equipment, the Soviets would encounter some short-run problems. The biggest would be the grounding of some existing machinery soon because of the lack of new spare parts. In time, however, the Soviets could increase imports from Eastern Europe or shift their own production lines [redacted]

Machine Tools. The USSR is the world's largest producer of both conventional and numerically controlled (NC) machine tools. Its output, however, consists mainly of general-purpose machine tools rather than special-purpose and complex types. Moreover, many machine tool models are still produced well after they are obsolete. This practice yields some economies of scale, but it reduces the flexibility and precision of the Soviets' machine tool park [redacted]

Machine tool production has fallen far short of requirements in recent years:

- Output of basic metal-cutting machine tools has dropped the past five years.
- A few new plants were built in the 1970s to produce automatic transfer machinery for the automotive industry, but little new capacity has been added in other areas of machine tool production.
- Computer numerical control (CNC), used increasingly in the West by 1980, exists in the USSR only in prototypes.

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- The USSR produces more NC tools than the United States does, but they are inferior because of the poor quality of controller, electromechanical positioning, and feedback devices and the relatively backward state of minicomputer technology.

The Soviets accordingly have turned to the West for some of their machine tool needs. Over the past decade they spent more than \$4 billion for tools, of which three-fourths were conventional types. Imports of automated lathes supplemented domestic production; imports of gear-cutting machinery (from the United States) provided superior precision and productivity; and imports of closed-loop, multi-axis NC machine tools provided tools that had no domestic counterparts. The USSR has also purchased many machine tools from Eastern Europe, even though they are inferior to Western models. East Germany exports up to half its annual output to the USSR, and other suppliers include Czechoslovakia, Hungary, and Yugoslavia.

The Soviets almost certainly will continue to import machine tools, especially advanced types of NC tools and machining centers. Moscow recognizes their value in raising industrial productivity and saving metal. Present CoCom controls on sales to Communist countries are limited to the more advanced types of NC machine tools and some specialized machine tools for military production.² Most Soviet machine tool purchases have satisfied these guidelines, but the USSR also has bought advanced equipment when member nations have loosely interpreted ambiguous CoCom definitions or downplayed the strategic implications of a given sale. The Soviets have also responded quickly to most changes in CoCom regulations. When CoCom restrictions on three-axis machining centers and boring mills of small size and limited accuracy were relaxed in 1977, for instance, the USSR quickly increased its purchases of such equipment, especially the more sophisticated West German and Japanese models.

Robotics. The Soviet robotics industry is in its infancy. It has a production capacity of only about 350 units a year and is incapable of series production. By

² CoCom members include the NATO nations—except Iceland—and Japan.

the end of 1980, the USSR was using an estimated 1,500 to 2,000 robots—well below the 5,000 planned. Many of these were of foreign origin. Robots will be increasingly needed to improve productivity in mass-production industries.

Soviet industrial robots are relatively primitive by Western standards. Most are first-generation machines performing either a single repetitive function or an unvarying sequence of functions. Most of them lack the microprocessor controls, large memories, and advanced sensors needed for pattern recognition and adaptive operation. The Soviets have made only a few experimental models of more complex robots.

The Soviets have relied on imports for a low-cost supply of reliable industrial robots. They have bought more than 500 robots from Hungary and an unknown number from Japan, France, and Italy. They also have been using foreign design and manufacturing technology.

The need for substantial imports of robots and related technology probably will continue for some time. Moscow has approached several Japanese firms about acquiring industrial robot technology and related know-how. It has arranged with Renault of France to jointly develop miniature robot drive units and industrial robots for serial production.

High Technology

The technology gap between the USSR and the West in high-technology products is large and growing.

Computers. Large computers and minicomputers in the Soviet Union are two generations behind current US offerings. Development of even these older models has been slow. The most important deficiencies are:

- Soviet computer systems are unreliable. This is due in part to the low quality of the imported materials and in part to a lack of modern computer production and test equipment.

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- Neither the USSR nor its East European partners can supply the large numbers of magnetic disk auxiliary memory devices with the high speed and large capacity essential to advanced data processing.
- Proper software and other support (such as maintenance and spare parts) have been deficient, if not absent altogether.
- In microelectronics, the Soviets have not kept up with the West in making rapid advances in technologies related to production and test equipment, materials, assembly, and packaging. The strong military orientation of the microelectronics program instead has encouraged the use of the tried and true.

Weaknesses in computer production in the Council of Mutual Economic Assistance (CEMA) countries have induced the Soviets to buy Western. Since 1972, Moscow has imported more than 1,300 computer systems (valued at \$400 million) and \$70 million worth of add-on peripheral equipment and spare parts. Minicomputers, generally for R&D, represent 95 percent of the units imported and 64 percent of their value. The relatively few large systems purchased have been for high-visibility, high-priority projects such as the Kama River Truck Plant, the Moscow regional air traffic control system, and the Olympic Games system.

CoCom controls on computers are extremely complex. In general, however, they provide that:

- Low-performance computers, including most minicomputers, may be exported at the discretion of the exporting country.
- Somewhat more powerful computers, including many high-speed, high-capacity computers, are subject to a pro forma submission to CoCom. The CoCom members have agreed in advance to approve the export of these computers if certain conditions are met.
- The most powerful computers require unanimous CoCom agreement for sale to proscribed destinations.

Computers of the type that CoCom has agreed in advance to approve are available from the United States and other CoCom countries. They are built in Japan by Fujitsu and Hitachi, in the United Kingdom by ICL, in France by CII, and in West Germany by Siemens. The USSR would continue its campaign to acquire the most powerful Western computers whether legal sales were halted or not. The value of illegal acquisitions would be enhanced if Moscow could also acquire the related software and support applications.

East European countries would be inhibited from diverting their legally acquired computers to the USSR by fear of discovery and sanctions—and because they need the computers themselves. However, Moscow is in a position to obtain East European help if it insists.

Microelectronics. During the past decade the USSR has obtained a full range of microelectronics-related technology, materials, and equipment from the West worth several hundred million dollars. These purchases have included unembargoed items, embargoed items legally approved for export by CoCom, and embargoed items acquired illegally and clandestinely. The overwhelming majority of acquisitions are embargoed items obtained illegally by diversion. Such equipment is generally of reduced effectiveness, however, since illegal channels do not easily convey a manufacturer's installation, training, or maintenance services or provide easy access to spare parts.

Although most of the equipment that has been acquired illegally is of US origin, Japan and West European countries have become important suppliers. Firms in Italy, Switzerland, the United Kingdom, and West Germany have diverted basic materials and technologies, and firms in these countries and France have diverted some advanced production equipment.

Telecommunications. The Soviet common carrier telecommunications system, like the Bell Systems in the United States, provides communications services to government, the military, commerce and industry,

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and the general public. The Soviet system, however, cannot satisfy the rapidly growing demand for services in either quantity or quality. It is therefore undergoing major expansion and modernization. [redacted]

The USSR supplements domestic production of communications equipment with imports. The United States is not a major supplier. The USSR buys radio relay links, switching equipment, and transmission equipment from Eastern Europe for use in its common carrier system. A few of these items are manufactured under Western license, but the United States cannot prevent these sales. [redacted]

The USSR also imports communications equipment from CoCom countries and from Sweden, Yugoslavia, and Finland. Most of the equipment it needs either is not on the CoCom list of controlled items or can be sold at the discretion of the exporting country.³ [redacted]

The Role of Western Credits

Western willingness to extend credits to the USSR and Soviet willingness to accept an increasing debt burden will heavily influence the scale and timing of Soviet hard currency imports in the 1980s. Between 1971 and 1978, Western credits provided approximately 12 percent of the USSR's import capacity. [redacted] During 1979-80, thanks to the rapid increase in oil and gold prices, Moscow was able to increase its imports from the West without increasing its net debt. The share of imports covered by credits will have to rise, however, if East-West trade is to contribute significantly to offsetting domestic shortfalls on a broad front, rather than in a narrow range of producing sectors. [redacted]

Overall, we expect Soviet imports that must be paid for in hard currency to grow at an annual average rate of 3 percent during 1982-90. This is faster than the

³ CoCom controls do apply to a \$172 million French contract with the USSR for computer-controlled telephone switching equipment and a turnkey plant for its manufacture. The plant would give Moscow a serial production capability for modern telephone exchanges. The equipment technology, moreover, exceeds that required for the communications system. France apparently now agrees with the US contention that the sale should not proceed in its original form. However, even if the sale is stopped, the Soviets could obtain less sophisticated switching equipment and production technology not subject to CoCom restrictions. [redacted]

rate implied by Planning Chairman Baybakov in his plenum address on the 1981-85 Plan but not as fast as the annual 5-percent rate recorded in 1976-80. As Soviet planners face domestic resource constraints in the next several years, a slower rate of increase in import volume would add to their troubles in dealing with prospective shortages and raising the technological level of domestic fixed investment. [redacted]

Moscow encountered a hard currency bind in 1981 (page 3), and, with no relief in sight, it faces even more of a crunch in the coming years. It could try to get around the earnings constraint by borrowing more, but this would increase its debt very rapidly. The key considerations are:

- If hard currency oil exports were held at current levels through mid-decade, the maintenance of a 2- to 3-percent real growth of hard currency imports—a reasonable rate for meeting the economy's major import needs—would raise Soviet debt from \$19 billion in 1981 to almost \$40 billion in 1985.
- If oil exports virtually disappeared during 1982-85, however, debt would exceed \$50 billion.
- Beyond 1985, debt would rise in either case to unmanageable levels. [redacted]

Neither Soviet planners nor Western bankers would permit such a massive financial burden to develop. The Soviets might try to borrow on such a scale if they thought their earnings constraint would end soon; but because it probably will not, their borrowing is likely to become much more conservative. Thus a Western imposition of credit restrictions—plus Soviet retrenchment—would accelerate the decline in Soviet import capacity in 1982-85. In the late 1980s, however, Moscow could import almost as much as if no credit restrictions had been imposed, because the restrictions would have appreciably reduced its debt service. [redacted]

A harder Western stance on financing terms would also raise the cost of Soviet imports. Moscow now

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benefits substantially from subsidized credits extended by Western Europe and Japan:

- Roughly 40 percent of the USSR's outstanding debt carries interest rates 4 to 5 percentage points below commercial market rates.
- A denial of concessionary terms on the roughly \$2 billion a year the USSR now receives in official financing, for example, would raise Moscow's annual debt service costs by an average of \$100 million per year in 1982-90.

The Defense Burden and East-West Technology Transfer

The problems in the economy as a whole have made the acquisition of Western goods and technology increasingly important to Soviet defense programs:

- Western goods have helped to improve the performance of a strained economy (page 6), and this has lightened the burden of growth in defense spending.
- More directly, legal and illegal acquisitions of military-related technology have saved the Soviets considerable time and resources in designing and producing new weapons and military support systems. The importance in the 1980s of raising the technological sophistication of weapons will ensure continued Soviet interest in obtaining advanced Western technologies.

Guns vs. Butter

Moscow continues its extraordinary allocation of resources to the military. Soviet defense programs accounted for an average of 11 to 13 percent of gross national product (GNP) in 1965-78 and 12 to 14 percent in 1979-80. Since the mid-1960s, military programs have preempted about 15 percent of final industrial output. This figure includes more than 30 percent of the final output of the critical machine-building and metalworking sector, leaving less than 60 percent for investment and the consumer.

The effect of defense spending on production for the civilian economy is not easily measurable but is

certainly considerable. Soviet leaders seem to be increasingly concerned about the defense burden. There have recently been indications of disagreement among Soviet leaders over the extent of the connection between consumer material well-being and labor productivity. This suggests that guns-or-butter questions are more contentious now than they were when the economy was performing better.

Most resources freed up by defense budget reductions would not increase production for civilian consumption immediately, but consumer welfare would benefit in the longer run. For example, the release of some of the skilled labor, R&D capability, and technologically advanced machinery that is now producing weapon systems would eventually improve productivity in critical sectors of civilian industry. A redirection of materials bound for defense would also raise output by easing the supply bottlenecks that have played an important role in slowing industrial growth.

The Acquisitions Effort

Although Soviet weapons are designed to minimize the requirements for technologies in which the USSR is deficient, the USSR has turned to legal and illegal acquisitions of Western technologies to make up for domestic shortcomings. The Soviet program to acquire and exploit Western technologies having military applications has top priority.

Through the acquisitions of Western technology and hardware, the Soviets have:

- Reduced engineering risks by following or copying proven Western designs.

imports of herbicides, clearly fall into the third category and are in competition with grain imports (included in the second category).

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- Cut R&D time and production costs by using Western designs and technology and equipment.
- Incorporated countermeasures early in the Soviet weapon development process.

Methods of Exploiting Foreign Technology

The Soviets exploit Western technology and hardware in several ways:

- Researchers adapt Western materials research, manufacturing processes, and specifications to develop improved Soviet materials for military applications.
- Military designers compare Western technical documentation on preliminary designs and on successful finished designs, gaining insights which they use to avoid technical risks and to reduce the traditional Soviet resistance to the use of unproven components in military systems. This permits them to avoid unprofitable R&D paths, saving substantial time and resources.
- Technical insights gained from the analysis of Western military hardware samples often influence Soviet weapon designs; they also contribute to the development of measures for countering the exploited Western weapons.
- Developers make direct use of Western test procedures, technical data, and instrumentation to improve their own diagnostic routines. This allows them to use shorter, more reliable testing programs for complex components and systems and conserves highly skilled military development manpower.
- Soviet defense industries often use Western production processes, equipment, and know-how directly. Production process specifications and process control systems acquired through legal and illegal channels are used to manufacture critical high-quality military components—years before Soviet defense industries could develop the same capability on their own.

In a few cases, Soviet weapon designers have even directly incorporated key components purchased in the West into Soviet weapon designs in order to meet a critical mission requirement. This practice is

nearly always a stopgap measure to accelerate the initial operating capability of the weapon while Soviet defense industries develop an ability to produce the components.

Examples of Military Gains From Technology Transfer

Evidence has been accumulating on Soviet gains in the military area from legally and illegally acquired Western equipment and technology. Some examples follow. Illegal acquisition of ASW-related technology and a wide variety of CoCom-controlled minicomputers has enhanced Soviet ASW capabilities. The Soviets are applying Western designs and industrial technology to the IL-76 aircraft that will be used in their AWACS program; numerically controlled Western machine tools are used in the production of the SUK-25 ground support fighter; and Western wide-body technology has been incorporated into the new bomber/cruise missile carrier, the AN-400. The United States has provided powdered-metallurgical manufacturing know-how that the Soviets probably will use to develop improved domestic tungsten-based alloys for kinetic-energy armor-piercing ammunition.

The USSR has been willing to tolerate a short-term dependence on foreign sources of technology in order to speed the development and production of high-priority weapon systems. The SA-7 shoulder-fired tactical surface-to-air missile is a good example of direct Soviet use of Western components for a weapon system. Certain components purchased from Japan reportedly were used by the Soviets for the first several years of serial production.

The Soviets have reduced their resource costs and enhanced their manufacturing capabilities by using foreign materials technology and manufacturing know-how. For example, the direct use of US semiconductor production and test equipment (including turnkey lines) has significantly raised the technological level, quality, and reliability of critical Soviet microelectronics components. The Soviets have used Austrian precision high-speed rotary forging equipment in their production of small arms gun barrels and artillery gun tubes rather than expending considerable time and resources to develop their own domestic capability.

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Only rarely have the Soviets successfully reverse-engineered sophisticated production tooling in order to produce equivalent equipment in the USSR. To the extent that the improvement in military materials and manufacturing can find more generalized applications in other products, the acquisition of technology improves the general level of the Soviet development and production base, to the benefit of the entire economy. The Austrian rotary forges that produce gun barrels are used to produce axles for railcars.

Through illegal acquisition, the Soviets have in addition been able to evaluate specific Western weapons and develop effective countermeasures. Some Soviet prototype tanks reportedly mount standoff screens around their turrets as a measure against shaped-charge munitions.

Avoiding false starts and worthless research is one of the most important ways in which the Soviets can achieve savings via technology transfer. Had they learned from the experience of the US-manned lunar landing program, for example, they would have achieved tremendous savings in time and resources in their own program. The US development program for the manned lunar landing prompted the Soviets to undertake development of the TT-05 large space-launch vehicle. For over 14 years the TT-05 program consumed the energies of thousands of designers and engineers at a major missile design bureau, a major production plant, and numerous subcontracting organizations. The phenomena that destroyed three prototypes on the launch pad—vibration and acoustic disturbances—had been diagnosed by the United States during its Saturn V missile program in the early 1960s. The Soviet Union did not begin to appreciate these problems until the mid-1970s, after the space-launch vehicle program had been canceled and its chief designer fired.

Military Requirements for the 1980s

The need for substantial qualitative improvement in military capabilities will heighten Soviet interest in obtaining Western goods and technology. During each of the last two decades the Soviets have deployed about 200 military and aerospace systems (this count includes both newly designed and substantially modified systems). Preliminary analyses suggest that the

USSR may have more than 200 under development in the 1980s. We have already identified about 110 systems slated by the Soviets for deployment in the 1980s, of which 60 to 70 are expected to be deployed by the middle of the decade.

Because of the rising importance of quality in the competition between Eastern and Western military capabilities, advances in sophisticated microelectronics and materials probably will pace the development of new weapon systems. Accordingly, the Soviets and their Warsaw Pact allies will probably find that many of the new Western component and subsystem technologies are critical to their military programs.

For example, Soviet ability to produce sophisticated microelectronic devices is critical to production of guidance components for missiles and precision-guided munitions, of signal-processing devices for ASW and airborne radar systems, and of minicomputers for electronic warfare systems and other battlefield electronics. Production of ultrapure detector materials is critical to the production of electro-optical devices for night vision and target acquisition. Advances in powdered-metallurgical materials processing are critical to the production of advanced airframes and aircraft propulsion systems and penetrators for kinetic-energy munitions.

After acquiring these advanced technologies, the Soviets will need to master material-processing technologies before they can apply them to their military hardware. Production of microelectronics requires strict clean-room environment, ultrapure material processing techniques, and such sophisticated fabrication techniques as electron-beam welding and laser trimming, etching, and masking. The ultrapure materials themselves require advanced refining techniques. In addition to advanced powdered-metallurgical manufacturing processes for making high-quality turbine blades, high-performance turbojet and turbofan engines require very precise, intricate disks and gears that can be machined only by computer-assisted numerically controlled tools. Production of composite materials for airframes depends on advanced techniques for processing and fabricating fiber-reinforced polymer materials.

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The specific technology transfers that are or would be useful to a particular Soviet weapon program are often difficult to identify, however. For example:

• Delays encountered in the acquisition abroad of component technologies for a major system may force the Soviets to develop substitute technologies that could go undetected for years. The West may thereby perceive a Soviet deficiency where none actually exists. This was the case with Soviet MIRV development. That program began in the early 1960s but went unnoticed by the United States until the early 1970s, in part because of our estimates of what the Soviets would need—but did not have—to develop a MIRV capability.

• Technologies abandoned by the West may prove useful to the Soviets. Long after the United States had discarded the Dynasoar and Manned Orbiting Laboratory satellite programs, the Soviets apparently pursued the discarded US technologies in their corresponding development programs.

• The acquisition of some material on foreign technology may give the Soviets only a few pieces of a technological puzzle. We may know they have these pieces but not know what they still lack; and the missing pieces may be critical to the successful integration of the range of complex technologies and intricate components that comprise a modern weapon system.

Limits to US and Western Restrictions

The countries participating in CoCom control almost all of the technology directly related to Soviet military R&D and weapons programs. In theory, therefore, they could take steps to stop the leakage of equipment, designs, test data, and the like to the USSR. A sustained and effective denial of goods and technology by the United States and its allies would also create appreciable problems in most Soviet economic sectors. In some cases, however, CoCom-wide actions would not be sufficient to block Soviet access to valuable goods and technology (see table 8). In most cases, an embargo limited to US exports would be ineffective.

Denial of agricultural products by the United States alone would not have a major effect, even in the short run:

- Moscow could buy most of the grain it needs in the next few years from other suppliers, although it might have to pay premium prices.
- In the longer run, Moscow could expand its trade with major non-US grain exporters; non-Soviet markets could be supplied out of US stocks.
- Under a US embargo the Soviets could not get the mix of wheat and corn they prefer, however, because the United States is the world's major corn exporter.

Unilateral US restrictions of sales of energy equipment and technology would also not have much impact:

- US producers now have a monopoly in manufacturing critical high-capacity pumps for extracting oil, but other Western suppliers could enter the field within two years if those pumps were embargoed.
- Western firms also could eventually fill any gap created by US denial of equipment for oil exploration and drilling.
- Only West European and Japanese firms manufacture the large-diameter gas pipe and valves essential to Soviet gas production, and they can also supply the necessary pipelayers and compressor station equipment.

In chemicals and other industrial materials, the United States has only a slightly greater potential for causing economic difficulties for Moscow:

- US suspension of sales of superphosphoric acid (SPA) would upset development of the Soviet fertilizer industry, forcing Moscow either to install evaporators to concentrate merchant-grade phosphoric acid, or to import additional phosphate materials.
- Denial of US chemicals other than SPA would have little impact. In 1980 the United States supplied, in value terms, only 0.1 percent of the pesticides, 2 percent of the plastics, and 4 percent of the man-made fibers imported from the West. (Two years

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Table 8

**Potential Impact of Western Trade Restrictions
on Selected Soviet Economic Sectors**

Product or Technology	Impact of an Embargo		Remarks
	By US Alone	By US and Allies	
Grain	Small	Substantial	Allied action, including Australia, could reduce Soviet imports by 70 percent; Soviets can import grain from non-US suppliers to fulfill needs.
Other agricultural products	Small	Moderate	Allied embargo would aggravate already serious food shortages; US is not a major supplier.
Oil and gas equipment	Small	Substantial	Allied denial would reduce expected Soviet oil and gas output by 2-3 million barrels/ day by late 1980s. Allied countries within roughly two years could overcome US monopoly in high-capacity oil pumps.
Industrial materials			
Large-diameter pipe and rolled steel	Small	Substantial	Western Europe and Japan supply all of the pipe critical to growth in gas production and most of the rolled steel imports for machine building and metalworking.
Chemical products	Moderate	Moderate	Allied embargo would be felt throughout economy; US denial of superphosphoric acid would hurt Soviet fertilizer production. Pesticides are needed to boost crop yields.
Chemical equipment	Small	Moderate	Western denial would affect all economic sectors; US provides only a small share of equipment imports.
Machinery			
Machine tools and robots	Small	Substantial	CoCom countries provide most of Soviet needs; non-US suppliers are numerous.
Construction and mining	Small	Moderate	Western denial of production technology for construction equipment would disrupt Soviet plans to increase domestic equipment manufacture; denial of mining equipment would create only short-run difficulties; non-US equipment is widely available.
Automotive	Small	Small	Soviets are unlikely to need substantial imports of Western equipment and technology in next few years.
Computers	Moderate	Moderate	Allied restrictions would have considerable impact on large computers but not on minicomputers, which are available from non-CoCom members; Soviets prefer US products and services, although non-US firms could almost duplicate some US offerings.
Microelectronics	Small	Substantial	Soviets will need substantial acquisition of Western equipment and technology—by legal and illegal means; US retains leading edge, but Japan and Western Europe can supply most Soviet needs.
Telecommunications	Small	Small	Soviets can cover most needs from Eastern Europe and non-CoCom Western countries.

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earlier the comparable US shares were about 10 percent, 5 percent, and 6 percent.)

- US unilateral restrictions on other industrial materials could do little, since Western Europe and Japan dominate the Soviet steel market, and molybdenum—which the United States has sold to the Soviets—could be purchased through a chain of Western brokers or through East European trading organizations. [redacted]

Similarly, in construction and mining equipment and machine tools, the United States has no technological monopoly:

- Komatsu and Sumitomo of Japan and Fiat, in particular, now match—or have the technological capability to match—US-produced off-highway trucks, industrial tractors, and earthmoving equipment.
- Most Soviet needs for Western mining equipment can also be satisfied by Japan and Western Europe.
- Much of the advanced numerically controlled machine tool technology is widely available from non-US suppliers.
- The United States has the most advanced robot technology, but the Soviets more urgently need simpler types for routine applications, such as repetitive welding operations in car manufacturing. Moscow may thus prefer Japan to the United States, since Japan has a greater robot production capacity and more experience in practical applications. [redacted]

In computers and microelectronics, the Soviets still prefer US equipment. Other countries, however, could rapidly fill most Soviet needs should the United States pull out:

- The United States leads the world in manufacturing the very-high-speed, high-capacity scientific computers and the most advanced peripherals and microprocessors.

- The United States can also provide a more complete range of hardware, software, and support than can Japan, its closest competitor.
- Several foreign firms, however, could come close to duplicating US services.
- The United States could not prevent other CoCom countries from selling their own computers unless (1) it were willing to renege on its prior agreement in CoCom not to object to exports by others and (2) other CoCom countries concurred.
- The United States has some control over sales of other foreign systems to the USSR because parts and peripherals may be of US origin.
- Moscow prefers US microelectronics equipment because it has found some non-US products to be poor substitutes and because the United States can supply the full range of state-of-the-art technology from basic materials through final test. In the event of a US embargo, however, Japan and Western Europe could satisfy most Soviet microelectronics needs. [redacted]

Not even a CoCom-wide embargo could seriously affect some Soviet economic sectors:

- The participation of Australia would be needed to reduce Soviet imports of grain and grain products as much as 70 percent.
- CoCom restrictions on offshore oil production equipment would be undercut by sales from Finland, Singapore, Mexico; and Yugoslavia.
- Non-CoCom countries such as Austria, Switzerland, and Sweden have been important (though small) suppliers of machine tools to Moscow. (MAAG of Switzerland is one of the world's top manufacturers of precision grinding machinery.)
- Minicomputers are available in non-CoCom countries such as Brazil, Austria, Switzerland, and Israel. [redacted]

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The Economic-Defense Linkage: Summing Up

The survey of Soviet policy and practice presented above shows how the USSR's military programs have benefited indirectly as well as directly from East-West economic relations. Although the Soviet economy is large and diverse, with a broad technological and scientific base, the USSR has had to make an extraordinary commitment of resources to achieve its present military power. Beseet by stagnating productivity and growing resource constraints, it has used imported Western products to:

- Minimize the encroachment of growing civilian economic needs on defense production facilities, primarily those in machine building.
- Raise the efficiency and quality of industrial production intended for military procurement.

Western restrictions on trade and technology transfer, by increasing the strain on the economy, would therefore hinder the Soviet defense effort.

The Economic Base

Restricting the quantity of Western goods and technology imported for civilian use would increase the strain on military programs since most defense industries also produce for the civilian sector. The focus of the USSR's efforts to improve both civilian and military industrial capabilities is the machine-building and metalworking branch of Soviet industry. Western embargoes on machinery and materials that are used either to produce machinery or to supplement domestic machinery production therefore would impinge most quickly on the resources available for military production.⁵

- An embargo on specialized oil and gas production equipment would force Moscow to allocate military-oriented metallurgical and machine-building facilities to produce such equipment; reduced Soviet petroleum output in the interim would aggravate civilian industrial problems and might therefore cause additional encroachment on defense production.

⁵ The following discussion assumes that any Western restrictions imposed are sustained and effective.

- An embargo on large-diameter gas pipe and other high-quality steel products could cut into production of such military items as submarine hulls.
- An embargo on equipment for plants manufacturing cars, trucks, and mining and construction vehicles (as well as an embargo on such vehicles themselves) would increase the pressure in the Soviet Union to devote more floorspace in military plants to producing those items.

Western denial of grain and other agricultural products would also hamper the Soviet military effort. To increase domestic farm output, Moscow might have to allocate more factory space, for example, to producing farm machinery instead of tanks and armored personnel carriers. A Western embargo on selling farm machinery or on building the facilities that manufacture such machinery would also put pressure on existing priorities. Reduced per capita food consumption would work against Soviet efforts to raise worker productivity, increasing the problems facing industry.

By curtailing Soviet import capacity—primarily by restricting credits but also by hampering Soviet oil and gas production and thus hard currency exports—the West would clearly raise the cost to the Soviet Union of maintaining the present policies on resource allocation. Moscow probably could maintain top-priority imports and thus cushion the immediate impact on military industries. The increased number of bottlenecks created in the civilian economy, however, would eventually force allocation of military-related resources to general economic needs.

Military Procurement

Tighter restrictions on Moscow's acquisition of Western industrial technology would slow the qualitative improvements in Soviet weapon systems needed to keep pace with Western military capabilities. As has been shown, the Western know-how and the plant and equipment that can improve civilian industrial output often serve a dual function—particularly in machine building and metalworking—by aiding weapon development. Reducing Moscow's access to advanced materials, specialized machine tools, and electronics would particularly affect Soviet defense procurement.

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A Western embargo of industrial plant and equipment would clearly hurt military programs:

- Denial of microelectronics components and production technology would hamper the development of weapon guidance systems and precision machine tools for specialized defense production.
- Denial of minicomputers and related technology would hamper the development of electronic warfare capabilities.
- Denial of numerically controlled machine tools would hamper many defense-related industrial processes, such as the manufacture of gears and disks for high-performance turbojet engines.
- Preventing Western design or construction of industrial plants—like the agricultural combine factory proposed by International Harvester—would hamper Soviet production of vehicles, ships, and other equipment for military as well as civilian use.

[Redacted]

Because many advances in Soviet weapon capabilities will depend on substantial improvements in materials processing, Western restrictions on Moscow's acquisition of processing technology might also affect defense procurement.

- Denial of powdered-metallurgical material processing know-how would retard development of advanced airframes.
- Denial of techniques for producing ultrapure materials would slow microelectronics development for both military and civilian use considerably.

[Redacted]

Impact of Western Restrictions on Trade and Credits
The Soviets' worsening economic performance presents the West with correspondingly greater opportunities to aggravate their defense burden. The economy is increasingly strained to meet the demands of consumption, investment, and defense. Although Moscow planned to increase investment in the non-defense sector, it reportedly has redirected some

[Redacted]

resources back to the military because of the stepped-up US defense program. If Soviet military spending continues to grow at a high rate, the civilian sector will receive increasingly smaller increments in economic output for both consumption and investment. Efforts to raise productivity will be undercut as a result, intensifying the pressure on supplies of raw materials and semifinished goods. Moscow will thus have less flexibility than before to adapt to bottlenecks created by substantially reduced availability of Western goods and technology.

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Several forms of Western restrictions on East-West trade and technology transfer could hurt Soviet economic performance and—directly or indirectly—Moscow's defense programs. The restrictions differ, however, in their ability to affect areas of major economic and military importance. Western actions with the greatest potential for hindering the military effort include:

- The expansion of CoCom controls to include emerging technologies such as numerically controlled machine tools and robotics, older Western technologies that the Soviets have not mastered, and areas such as shipbuilding and the manufacture of cars, trucks, and construction vehicles.⁶
- Greater efforts to prevent illegal technology transfer, including increased compartmentation and classification of US weapon designs and test data—actions that can be taken unilaterally.
- Embargoes on key products and technologies such as grain and oil and gas equipment, which would seriously aggravate Soviet economic problems without halting East-West trade entirely.

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In the short run, Western restrictions on technology transfer probably would not prompt Soviet reduction of military spending. Although the Brezhnev regime would have to deal with several painful choices regarding resource allocations that it has thus far avoided, it almost certainly would maintain the high priority of defense, particularly if East-West tensions

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⁶ Because the USSR uses Eastern Europe as an illegal conduit for hard-to-trace technology, the value of any extension of the CoCom list would be seriously weakened if Eastern Europe were not covered.

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[] were high. A post-Brezhnev regime would try to convey an impression of stability, continuity, and unity—avoiding radical changes in resource allocation. In such an environment, it is unlikely that any Soviet leader would be inclined or able to challenge the defense establishment's top priority. Consumer-oriented programs would suffer as a result. []

[] Over the longer run, however, the military's priority may decline as a new generation of leaders takes command. Being less personally committed to today's approaches, and facing mounting economic problems aggravated by the sustained denial of Western goods and technology, the new leaders might eventually see substantial advantages in reducing military spending in order to free up the labor and material resources urgently sought in key civilian sectors. []

Any cuts in defense programs would occur slowly, however, particularly if international tensions remained high. Overall Soviet military capabilities would therefore be affected only gradually. The cuts would probably be concentrated in the general purpose forces, especially the Ground Forces, because:

- The Soviets probably are relatively comfortable with their military positions—against both the West and China—in general purpose forces. In particular, they probably consider themselves ahead in the number of their ground force weapon systems.

- A reduction in general purpose forces could return more people to the general civilian work force than would a reduction, for example, in the ICBM force.
- The production facilities and industrial materials— notably steel—now used for general purpose forces are less specialized than those now used for strategic forces and thus can be transferred more readily to critical civilian needs such as energy, transportation, and agriculture. []

In addition to possibly prompting reductions in general purpose forces, a stringent Western denial of goods and technology could interfere with qualitative improvements across a range of Soviet weapon systems. The effects of this denial on Soviet military power would be delayed but would accumulate in the last half of the 1980s and could have a major impact on Soviet programs in the 1990s. [] []

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