6

Industrial Production

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Industry has been the dominant economic sector in the Soviet Union and is likely to remain so for the rest of the century. In its current post-agriculture, pre-service stage of growth, industrial production would be a natural priority of Soviet planners even without Marxism. That economic philosophy, as is well known, has had the effect (at least in the past) of glorifying industrial production at the expense of other sectors, notably agriculture and housing construction.

To discuss Soviet industrial production in the second half of this century is a very general mandate. My treatment will naturally reflect my own preferences and prejudices as an economist. There will be a major theme and several minor ones. The major theme concerns how we are to understand the post-war record of Soviet industry. In more technical jargon, I want to inquire into the proper "model" of economic growth, to be in a better position to understand the past and to predict the future.

Now this set of issues might be construed as rather technical and narrow, but I don't see it that way. Without adequate understanding of the mechanics of economic growth, we are not in a position to say much of any real substance as economists; we are then left with rather impressionistic descriptions and it is difficult to say where Soviet industry is coming from and where it is going.

Although I will try not to make the present paper overly technical, behind it lies a fairly thorough econometric investigation of Soviet industry from 1950–78 that extends and updates earlier work, and in which many different specifications and regressions have been tried out with varying degrees of success.

Unfortunately, it is not as if production-function-type analysis provides unambiguous answers to the questions we are asking or should be asking. Indeed, one of the depressing things about the analytical approach is the wide scope of uncertainty about methods, specifications, and results. But the alternative approaches, as I see them, are practically nonexistent. If you are going to analyze economic growth, you must have some model, explicit or implicit.

In some ways, Soviet industry provides a relatively hospitable

subject for applying analytic methods. The output-measurement problems for industry are far less severe than for such sectors as services or construction, where there are basic difficulties defining output and in practice one is frequently forced to fall back on measuring outputs by inputs. Compared to capitalist economies, Soviet industry is relatively free of fluctuations, which increases the possibility of identifying sources of growth. Although there are problems with official Soviet statistics, these can be circumvented to some extent, and we do have a capital-stock series. It is perhaps less wild to assume an aggregate constant-returns-to-scale production function for industry than for agriculture, services, or some other sectors.

Putting the matter somewhat more negatively, if we cannot use analytic methods to understand and project industrial output, there is little hope of doing it in other places.

What is the growth record of Soviet industry? In Table 6.1 are recorded output series from 1950 to 1978 reconstructed by the Office of Economic Research (OER) of the CIA.

This is a synthetic series made by aggregating with value-added weights individual component sub series, consisting largely of physical units, but with some ruble values.

A conceivable alternative might be Soviet gross-value-of-output (GVO) indices, preferably reaggregated by synthetic value-added sectoral weights. The official unadulterated Soviet GVO for all industry is displayed in Table 6.2, primarily for comparison purposes. The later years are from *Nar. khoz.* volumes and the earliest years have been chain-linked from *Promyshlyennost' SSSR* (1964). There are so many things wrong with this index as a conceptual measure and

Table 6.1 *Soviet Industrial Output (OER) (1970=100)*

Year	*Output*	*Growth (%)*	*Year*	*Output*	*Growth (%)*
1950	20.36		1965	73.65	7.0
1951	22.68	11.4	1966	77.98	5.9
1952	24.61	8.5	1967	83.82	7.5
1953	27.33	11.1	1968	89.59	6.9
1954	30.22	10.6	1969	94.03	5.0
1955	33.64	11.3	1970	100.0	6.4
1956	37.1	10.3	1971	106.87	6.9
1957	41.18	11.0	1972	112.03	4.8
1958	45.77	11.1	1973	119.02	6.2
1959	50.42	10.2	1974	126.46	6.3
1960	53.59	6.3	1975	133.49	5.6
1961	56.9	6.2	1976	138.45	3.7
1962	61.3	7.7	1977	144.12	4.1
1963	64.75	5.6	1978	149.46	3.7
1964	68.81	6.3			

Source: CIA (OER) *Handbook*, various years.

Table 6.2 *Industrial Output (Official Soviet GVO) (billion rubles)*

Year	*Output*	*Growth (%)*	*Year*	*Output*	*Growth (%)*
1950	52.00		1965	229.4	8.0
1951	60.53	16.4	1966	248.3	8.2
1952	67.55	11.6	1967	285.9	15.1
1953	75.55	11.8	1968	322.8	12.9
1954	85.55	13.2	1969	345.0	6.9
1955	96.17	12.4	1970	374.3	8.5
1956	106.4	10.6	1971	395.7	5.7
1957	117.0	10.0	1972	420.0	6.1
1958	129.0	10.3	1973	447.3	6.5
1959	143.8	11.5	1974	479.6	7.2
1960	157.4	9.5	1975	511.2	6.6
1961	172.6	9.7	1976	527.9	3.3
1962	188.4	9.2	1977	553.7	4.9
1963	201.0	6.7	1978	577.0	4.2
1964	212.4	5.7			

Source: Nar. khoz., various years; *Promyshlyennost' SSSR*, 1964 (later years in current rubles; earlier years in constant rubles chain-linked).

they are so well known that I will not spend time going over this issue here. Incidentally, the two series move together. Regressions I have run indicate that the official Soviet GVO series grows at about 1.6% faster per year than the OER reconstruction but with no systematic time trend in the difference.

Both series show a rather marked slowdown over nearly three decades. While the meaning and significance of this slowdown will be discussed presently, I just want to note for now that it is too pronounced in various aggregate and disaggregate series to be dismissed as a statistical artifact.

While we will be using the OER numbers of Table 6.1 because they are undoubtedly the most accurate complete series available for Soviet industrial production, they are not without their own points of controversy. If the OER and GVO indexes are disaggregated into subsectors, most of the difference in growth rates shows up in but two subsectors: machine building and metal working (MBMW), and chemicals. Now these happen to be precisely the two sectors with most extreme differentiation of commodities and proliferation of new products. The usual Western explanation for the relatively large gap between the growth of Soviet GVO and Western reconstructions based primarily on physical samples is the notorious Soviet practice of introducing new products at artificially inflated prices. This practice is too widely reported, both inside and outside the SU, to be of no significance. Still, I have a feeling the issue is overstressed. There is another side of the coin, which is rarely mentioned. It is exactly in such sectors as chemicals or MBMW, with their wide spectrum of heterogeneous and new products, that indexes based

on a few standardized, old-fashioned models or types would be most likely to bias growth rates downward. This is a subject worthy of future study, for the issue has not yet been resolved, at least in my mind.

At any rate, the trends in Table 6.1 are clear enough, and if the growth rates should be slightly but unsystematically altered, that would most likely reflect itself only in different estimates of the rate of technical change.

Even considering the slowdown of later years, and without yet inquiring of the input side, the industrial-growth reward of Table 6.1 is more than respectable by world standards. Of course it does not match the magnificent Japanese industrial performance, but it does compare favorably with the other large industrialized economies in the postwar period.

Incidentally, one quick explanation for the very fast growth rate of Soviet industry in the fifties, which then slackens in the later periods, might be that the early years represent some form of postwar recovery. I don't find this explanation compelling because already by 1949 every subbranch of Soviet industry was producing at higher than prewar peak levels.

It is traditional to analyze economic growth in terms of its two major factor inputs, labor and capital. With this in mind, Table 6.3 presents the OER series on industrial workers and personnel (this is very close to the official Soviet numbers), whereas Table 6.4 presents Rapaway's (1976) estimates of worker-hours of industrial employment. The two series differ primarily by the average hours worked per person per year, which does not systematically change very much except in those years from 1956 to 1961 after a program was initiated by the Twentieth

Table 6.3 *Industrial Workers and Personnel (in millions)*

Year	*Labor Force*	*Growth (%)*	*Year*	*Labor Force*	*Growth (%)*
1950	15.324		1965	27.447	4.3
1951	16.241	6.0	1966	28.514	3.9
1952	16.889	4.0	1967	29.448	3.3
1953	17.641	4.5	1968	30.428	3.3
1954	18.535	5.1	1969	31.159	2.4
1955	18.922	2.1	1970	31.593	1.4
1956	19.641	3.8	1971	32.03	1.4
1957	20.312	3.4	1972	32.461	1.3
1958	20.988	3.3	1973	32.875	1.3
1959	21.67	3.2	1974	33.433	1.7
1960	22.62	4.4	1975	34.054	1.9
1961	23.82	5.3	1976	34.815	2.2
1962	24.677	3.6	1977	35.417	1.7
1963	25.442	3.1	1978	36.014	1.7
1964	26.313	3.4			

Source: Nar. khoz., various years.

Table 6.4 *Industrial Manhours (in billions)*

Year	Manhours	Growth (%)	Year	Manhours	Growth (%)
1950	33.054		1965	49.377	3.5
1951	34.927	5.7	1966	51.553	4.4
1952	36.209	3.7	1967	53.389	3.6
1953	37.736	4.2	1968	55.288	3.6
1954	39.569	4.9	1969	56.741	2.6
1955	40.531	2.4	1970	57.405	1.2
1956	41.02	1.2	1971	58.554	2.0
1957	41.386	.9	1972	59.217	1.1
1958	42.393	2.4	1973	59.557	.6
1959	42.56	.4	1974	60.725	2.0
1960	42.752	.5	1975	61.737	1.7
1961	43.061	.7	1976	63.12	2.2
1962	44.616	3.6	1977	64.069	1.5
1963	45.897	2.9	1978	65.149	1.7
1964	47.713	4.0			

Source: Rapawy, 1976; updated by personal communication.

Congress of the CPSU to gradually reduce the standard work week from 48 to 41 hours.

The weekly working hours in Soviet industry fell as much as 15% from 1955 to 1961. That is a sharp decline, and there might well have been some offsetting increase in the quality of a working hour. While the effects on quality must remain speculative, it seems to be the case that overall results or conclusions are not very sensitive to the differences in the two series.

For the purposes of this paper I have used labor hours of Table 6.4 as my primary labor-input series. In most cases I have verified that substituting "workers and personnel" from Table 6.3 would not reverse major conclusions.

The capital series is the least controversial, in part because we have little choice but to use the only official Soviet data available, the TSU series on "industrial productive basic funds." The capital stock of a given year listed in Table 6.5 refers to the (arithmetic) average of what is in place at the beginning and end of that year.

The growth of labor and capital productivity (Table 6.6) show some interesting trends. The growth of labor productivity is very high by world standards. Note the decline in the growth of capital productivity, reflecting an increase in the capital-output ratio. This effect would be more pronounced if we detrended technical change from output.

What I am going to do now is engage in some standard exercises in growth accounting and production-function analysis, applied to the context of Soviet industry, 1950–78.

The aggregate production function is an incomplete or even ambiguous concept, but it may be one of the few useful ways of piecing together an overall picture of economic growth. The standard

Table 6.5 *Midyear Industrial Capital Stock (billion rubles)*

Year	Capital Stock	Growth (%)	Year	Capital Stock	Growth (%)
1950	31.9		1965	160.65	9.7
1951	35.55	11.4	1966	175.45	9.2
1952	40.0	12.5	1967	190.1	8.4
1953	44.35	10.9	1968	205.75	8.2
1954	49.3	11.2	1969	223.7	8.7
1955	55.4	12.4	1970	244.1	9.1
1956	62.0	11.9	1971	266.3	9.1
1957	68.5	10.5	1972	288.75	8.4
1958	76.05	11.0	1973	313.2	8.5
1959	84.75	11.4	1974	340.8	8.8
1960	94.4	11.4	1975	370.05	8.6
1961	105.55	11.8	1976	400.5	8.2
1962	118.1	11.9	1977	431.5	7.7
1963	132.1	11.9	1978	463.95	7.5
1964	146.4	10.8			

Source: *Nar. khoz.*, various years (1959–78 in 1973 prices, earlier years in chain-linked constant prices; midyear calculated as average of end years)

Table 6.6 *Growth of Labor and Capital Productivity*

Year	Growth of Labor Product-ivity (%)	Growth of Capital Product-ivity (%)	Year	Growth of Labor Product-ivity (%)	Growth of Capital Product-ivity (%)
1951	5.7	0.0	1965	3.5	−2.7
1952	4.8	−4.0	1966	1.5	−3.3
1953	6.9	0.2	1967	3.9	−0.9
1954	5.7	−0.6	1968	3.3	−1.3
1955	8.9	−1.1	1969	2.4	−3.7
1956	9.1	−1.6	1970	5.2	−2.7
1957	10.1	0.5	1971	4.9	−2.2
1958	8.7	0.1	1972	3.7	−3.6
1959	9.8	−1.2	1973	5.6	−2.3
1960	5.8	−5.1	1974	4.3	−2.5
1961	5.5	−5.6	1975	3.9	−3.0
1962	4.1	−4.2	1976	1.5	−4.5
1963	2.7	−6.3	1977	2.6	−3.6
1964	2.3	−4.5	1978	2.0	−3.8

Source: Tables 6.1, 6.4, 6.5.

exercises like looking at capital–output ratios or labor productivity are but special cases of this approach rather than genuine alternatives in any real sense.

The basic starting point is an explicit or implicit assumption about the form of the aggregate production function. Typically it is assumed that the expression

$$Y(t) = A(t)\, F(K(t),L(t)) \tag{1}$$

is a serviceable approximation relating aggregate output Y to aggregate capital K and labor L at time t.

Because there are inherent difficulties in disentangling economies of scale from technical change in any time series, and also because there do not seem to be any compelling reasons toward economies or diseconomies of scale in the aggregate industrial sector of a large, advanced economy, the production function F(K,L) is typically assumed to be homogeneous to degree one, often Cobb-Douglas. Alternatively, this can be viewed more mechanically as simply a convenient way to combine factor inputs into one synthetic aggregate input. The Hicks–neutral technical-change term A(t) is really a catch-all, since it is capturing any contribution to growth other than of capital and labor as conventionally measured and combined in a constant-returns-to-scale production function. For this reason I prefer the term "residual" or "total factor productivity" for A(t), rather than "technical change", "technical progress", etc., which sound too purposeful about what is really a measure of our ignorance.

The most useful form into which Eq. (1) can be transformed is the so-called "growth equation"

$$g_y = g_a + \eta_l\, g_l + \eta_k\, g_k \tag{2}$$

where the symbol g stands for growth rates. Thus

$$g_y = \frac{\frac{dY}{dt}}{Y}, \tag{3}$$

$$g_a = \frac{\frac{dA}{dt}}{A}, \tag{4}$$

$$g_l = \frac{\frac{dL}{dt}}{L}, \tag{5}$$

$$g_k = \frac{\frac{dK}{dt}}{K}. \tag{6}$$

The symbol η_l and η_k stand for the imputed shares of labor and capital, respectively, under a marginal-productivity theory of distribution:

$$\eta_l = \frac{L\frac{\partial Y}{\partial L}}{Y}, \tag{7}$$

$$\eta_k = \frac{K\frac{\partial Y}{\partial L}}{Y}. \tag{8}$$

because Y is homogeneous of degree 1 in K and L,

$$\eta_l + \eta_k = 1 \tag{9}$$

Thus, under formulation (1) the rate of growth of output is a weighted average of the growth rates of capital and labor, plus the growth rate of the residual. In standard growth accounting, Eq. (2) is the starting point for analyzing the contribution of the three sources of growth: labor, capital, and the "residual".

Since the residual is the least understood component and cannot usually be independently quantified, g_a is typically calculated as a true residual

$$g_a = g_y - \eta_l\, g_l - \eta_k\, g_k \tag{10}$$

The growth rates g_y, g_l, and g_k are obtainable from Tables 6.1, 6.4, 6.5. Estimating η_l and η_k presents somewhat of a problem for Soviet industry. In competitive economies, we might use market shares, although personally an aggregate production function has always struck me as being a tenuous-enough idea even without assuming a marginal-productivity theory of distribution. At any rate this is not really a meaningful alternative for Soviet industry. Instead, what is typically done is to use empirical shares from the manufacturing sectors of advanced capitalist countries, usually about three-quarters for the share of labor and a quarter for the share of capital.

If this procedure is followed, something paradoxical and downright peculiar emerges. In Table 6.7 the growth of the residual, g_a, is calculated with $\eta_l = 3/4$, $\eta_k = 1/4$. If we are to believe this approach, the growth of the residual has declined rather dramatically from about 5 or 6% in the early fifties to about 1% in the late seventies.

Such a conclusion is a bit difficult to absorb in its entirety. Why should total factor productivity be increasing so much faster two decades ago than now? Certainly judging by the literature, far greater attention is paid to questions of economic efficiency in more recent years than in the past.

An alternative explanation goes something like this. In a generation of time from the early fifties to the late seventies, Soviet industry has

Table 6.7 *Growth Rate of the Residual with Labor – Capital Shares of 3:1*

Year	*Residual Growth (%)*	*Year*	*Residual Growth (%)*
1951	4.3	1965	2.0
1952	2.6	1966	0.3
1953	5.2	1967	2.7
1954	4.2	1968	2.1
1955	6.4	1969	0.8
1956	6.4	1970	3.2
1957	7.7	1971	3.1
1958	6.5	1972	1.8
1959	7.0	1973	3.6
1960	3.1	1974	2.6
1961	2.7	1975	2.2
1962	2.0	1976	−0.6
1963	0.5	1977	1.3
1964	0.6	1978	0.5

Source: Tables 6.1, 6.4, 6.5.

been transformed from a labor-surplus sector, where capital was the main constraint on output (as in the Harrod-Domar growth model), into a labor-scarce sector not unlike that of other modern industrial economies. Labor was essentially "free" in the old days because vast amounts of it were available to be siphoned out of low-priority, low-marginal-productivity agriculture. That is no longer the case, and the change has come about relatively swiftly because of the incredibly rapid accumulation of industrial capital and the unfavorable demographics of the work force.

In the jargon of economic theory, I am arguing that an alternative historical explanation to the Soviet industrial slowdown is not to make the residual take all the blame, but to allow a low elasticity of substitution between capital and labor to share some of it. The standard approach, which fixes η_k and η_l, in effect assumes a Cobb-Douglas or unit-elasticity-of-substitution production function.

The elasticity of substitution is a measure of the rate at which diminishing returns set in as capital is increased relative to labor. A lower-than-unity elasticity of substitution would have special relevance to understanding the slowdown in Soviet industry because the growth of capital and labor has been so disproportionate in the postwar period. What happens in such a situation is that the weight on capital in the growth equation, η_k, declines relative to the weight on labor, η_l. In Table 6.8 are displayed a time series of imputed shares of capital and labor derived from the econometric estimation of a constant-elasticity-of-substitution production function with constant growth of the residual. The estimated value of the elasticity of substitution is .5 (with a standard error of about .1) and that of technical change is .9%. I have

verified that the trend behavior of imputed shares is roughly similar for "elasticities of substitution" and "distribution parameters" differing by one standard deviation in either direction.

Now the sad truth is that without further information we do not know how to decide on statistical grounds alone between the unit-elasticity (Cobb-Douglas) production function with declining growth of the residual (Table 6.7) and the constant growth of residual, less-than-unity elasticity-of-substitution specification that generates factor shares like those of Table 6.8. Both regressions yield about the same error sum of squared residuals. The real world might even be some mixture of the two scenarios. Fortunately the choice may not make that much difference for short-term forecasting at the current time.

Incidentally, the work of Desai (1973) seems to indicate that the results observed here are not merely coincidences of aggregation, but occur as well on the sectoral level for individual branches of industry.

The extended time period examined in this paper, from 1950 to 1978, allows us to inquire about a phenomenon that has struck some observers. Looking casually at the numbers, it appears that there might perhaps be a structural break in the data sometime in the early 1960s. Some people have felt that maybe the production function changed qualitatively at some break point in the early 1960s.

Dividing the period 1950–78 into the two equal subperiods 1950–63 and 1964–80, we have run a standard F-test for structural change between the two subperiods. In all the different cases of production-function forms (and the choice of workers or manhours) we are unable

Table 6.8 *Imputed Labor and Capital Shares from a CES Regression*

Year	*Imputed Labor Share*	*Imputed Capital Share*	*Year*	*Imputed Labor Share*	*Imputed Capital Share*
1950	.21	.79	1965	.52	.48
1951	.22	.78	1966	.54	.46
1952	.23	.77	1967	.55	.45
1953	.25	.75	1968	.56	.44
1954	.26	.74	1969	.58	.42
1955	.28	.72	1970	.60	.40
1956	.31	.69	1971	.62	.38
1957	.33	.67	1972	.64	.36
1958	.35	.65	1973	.66	.34
1959	.38	.62	1974	.68	.32
1960	.41	.59	1975	.69	.31
1961	.44	.56	1976	.71	.29
1962	.54	.46	1977	.72	.28
1963	.49	.51	1978	.73	.27
1964	.50	.50			

to reject the null hypothesis of no structural shift. For what it is worth, the statistics do not appear to support the idea of a structural break in the data.

So far as projections are concerned, without going into all the details, which are technical, the two approaches represented by Tables 6.7 and 6.8 do approximately converge, as luck would have it, to give about the same recommendations for predicting Soviet industrial growth in the near future (presumably mixed or intermediate approaches would also give similar answers).

The growth of Soviet industrial output should be a sum of about 75% of the growth of industrial labor plus 25% of the growth of industrial capital plus a bonus of about 1% representing growth of the residual (assuming it continues to grow at about that level).

My honest opinion is that this represents the current state of the art in forecasting the growth of Soviet industry. I have gone into some background details to emphasize controversial aspects of the Soviet growth story and to point out why there may be special dangers in making mechanical long-term projections on the basis of this or another model because we really don't know the long-term stability of basic parameters with a great deal of assurance.

After having made that long-winded caveat, let me proceed to the business of exploring future prospects.

If we accept the growth equation

$$g_y = \tfrac{3}{4}\, g_l + \tfrac{1}{4}\, g_k + 1\% \qquad (11)$$

I feel we have some legitimate basis for projecting industrial growth for the next 5 or 10 years or so. Basically I am assuming: either a Cobb-Douglas specification with share weights of ¼, ¾ and a constant rate of technical change equal to what it has been recently, or a CES specification with constant rate of technical change where the share weights are not expected to change much because the rate of growth of capital has slowed down considerably or because the capital-scarcity period is over and the future elasticity of substitution is likely to be closer to 1 than to ½. A low elasticity of substitution would put a lower weight than 1:3 on capital relative to labor in future years, but my hunch is this second-order effect will not be operative for another decade, and even then it should not change the conclusions much.

Even if we accept Eq. (11), we still have to plug in estimates of the growth of industrial capital and labor, difficult to do without a complete specification of planners' intentions. Since growth projections are not an exercise for the timid-hearted, my feeling is we may as well throw in some numbers without pretending to too much scientific basis. It is very difficult to predict the growth of industrial inputs of capital and labor because they depend on planners' preferences about relative commitments to industry, as well as absolute levels of investment and labor-force growth. Bearing these caveats in mind, for

industrial inputs of the next decade perhaps $g_l = 1.5\%$ and $g_k = 7\%$ is an upper bound. As lower bounds I might pick $g_l = 1\%$, $g_k = 4\%$. This results in a range of industrial growth as measured by OER from about 3% to about 4%, which sounds approximately right to me. The reader who wants to can plug different numbers into the formula (11) but I think the analysis is suggesting to us that Soviet industry will be growing in the 3 to 4% range over the next several years, certainly not more.

Let me conclude this selective survey of Soviet industrial production by opinionating briefly on two related areas not treated so far: energy and technology transfer.

I do not believe the *direct* effects on Soviet *industry* of petroleum scarcity are going to be severe or profound. The Russians, even more than we, are wastefully burning large amounts of mazout, or what we call Bunker #6, in electricity and heat-generating plants. At about $4 a barrel, this heavy-grade residual could be upgraded to high-grade distillates. The Soviet Union has very significant reserves of natural gas, some of which are just starting to come on line. And the development of nuclear power, which is by far the cheapest form of electricity when correctly calculated, is not subject to the political constraints present in democratic countries. Indeed, the Soviet Union is proceeding with a very ambitious nuclear program. Soviet coal is abundant even if its quality and location sometimes represent problems and the Soviet transportation system already handles more coal than any other country. My feeling is that the "energy crisis" is perhaps not going to represent a significant drag on its industrial production, especially once the Soviet Union starts to get its act together about national priorities, and industry comes out near the top of the list as usual. A formal study of the possibilities of substitution between energy and other inputs would be useful, but is beyond the scope of the present paper.

The issue of technology transfer is potentially an important one for Soviet industry. Several case studies have been performed, but opinions differ on the overall impact of technology transfer on Soviet industry. I have undertaken a production-function study that in principle could estimate the marginal productivity of machinery imported from the West for Soviet industry, and for the subsectors of chemicals, petroleum, and machine building and metal working during the period 1960–75 (Weitzman, 1979).

The conclusion seems to be that the marginal productivity of imported Western capital is not significantly different from that of capital of non-Western origin. Without in any other way trying to prejudge the issue, I believe a fair summary statement is that we are unable to detect any influence of Western technology on the Soviet economy from the aggregate time-series data we currently have available. This is not to say that new information may not appear, but at the moment there seems to be no evidence on the aggregate level that technology transfer is a significant contributor to Soviet growth.

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