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USSR: Seasonality in Energy Production and Foreign Trade

A Research Paper

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National Foreign Assessment Center

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A Research Paper

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USSR: Seasonality in Energy Production and Foreign Trade

Summary

Soviet economic activity exhibits a seasonal pattern that reflects a number of separate influences, the most important being weather and the end-of-year rush (storming) to plan fulfillment. These seasonal forces complicate interpretation of monthly, quarterly, and semiannual data because longer term trends are confounded with seasonal variations. Most interest focuses on production trends—how fast is growth? has output fallen? Reliable inferences about trends often cannot be drawn based directly on the raw data, however, especially if one is looking for turning points, such as a major decline in oil production.

Although the breakdown of economic series into trend and seasonal components is standard practice in short-term analysis of Western economies, it is little noted and even less frequently carried out in Soviet literature—probably because Communist economic theory associates short-term fluctuations with capitalism. The Soviet practice of basing year-to-year comparisons on the same period within the year does tend to eliminate some of the seasonal distortion. Not only is this misleading on occasion, it also uses the available data inefficiently.

This paper focuses on seasonality in several key statistical series for the Soviet economy during 1960-80, using the Bureau of Census's X-11 seasonal adjustment method. The series selected for analysis include quarterly data (1960-80) on the production of electricity, oil and gas condensate, coal, natural gas, and export and import values.

Our analysis suggests that seasonal influences are a significant determinant of quarterly fluctuations in Soviet economic activity, explaining between 35 percent and 95 percent of quarterly changes in activity in the areas examined. The importance of seasonality, however, varies considerably. Electricity and foreign trade are most sensitive to seasonal influences; oil production is relatively unaffected.

Because of storage limitations, output of electricity and natural gas is particularly responsive to short-term fluctuations in demand. Demand peaks in the first quarter when energy requirements for heating and lighting are high and again in the fourth quarter when energy needs rise to accommodate the high level of economic activity associated with yearend storming. Storage is much less a problem for oil and coal, which can be stockpiled as a

buffer against demand fluctuations. Short-term production changes, therefore, primarily reflect supply factors. In the case of coal and oil, offsetting seasonal factors tend to dampen production fluctuations.

Seasonal volatility in foreign trade exceeds that in most forms of energy. Exports are high in the second quarter and peak in the fourth quarter. The second-quarter surge probably represents a drawdown of stocks that accumulated and could not be delivered during the harsh weather of the first quarter. Storming and a desire to fulfill calendar year export commitments may explain the fourth-quarter peak. In contrast, the first two quarters are most important for imports—a relatively new phenomenon perhaps caused by the growing reliance on grain imports to sustain livestock herds until the summer-fall harvest.

As long-term growth slowed in most sectors, seasonal factors assumed a somewhat larger role in determining quarterly changes in economic activity. But the volatility of seasonal forces seems to show no general trend. Fluctuations became less marked in most of the sectors in the early 1960s. The volatility of natural gas production diminished throughout the period before leveling off in the last few years. Oil output, which had become more stable, increased in volatility in the latter 1970s as Siberian oil began to dominate national output. Fluctuations in coal output have been increasing rapidly through most of the period as strip mining became more important. While seasonal fluctuations have become less pronounced for exports, the seasonality of imports has increased—in part because of the growing importance of grain purchases.

Studies that deseasonalize basic Soviet data and also that examine this seasonal pattern are important to understanding the workings of the Soviet economy. For instance, seasonally adjusted data reveal an unusual decline in oil production in the winter of 1979 that the unadjusted data are unable to reveal. Besides locating turning points more accurately and rapidly, seasonally adjusted data permit identification of the underlying growth rate by isolating the rebound effect that occurs when a seemingly good year follows a poor year. This is feasible because seasonal adjustments validate the comparison of different quarters within the same year; without seasonal adjustment this would be a hazardous procedure.

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Introduction

Much economic analysis relies on monthly or quarterly data to draw conclusions about economic trends. Empirical research on short-term movements in Western economies generally uses data that have been adjusted to remove seasonal patterns in order to isolate the underlying economic trends and cyclical components. Yet relatively little effort has been devoted to doing the same for socialist economies. Since the Soviets report quarterly data only on a cumulative basis for that calendar year, Western and Soviet analysts usually compare the cumulative performance through a given quarter of one year only with the corresponding figure in another year. This is an inefficient and sometimes misleading procedure for removing seasonal influences. It also fails to isolate the seasonal pattern, which itself could be a source of useful information about the economy.

Removing seasonal influences from quarterly economic statistics should be an important step in the analysis of Soviet economic activity. The adjusted data provide a more reliable basis for making short-term forecasts and assessing the timing of a turning point in a certain indicator. Conversely, raw quarterly data could give a distorted picture because of seasonal factors. Annual data will not confirm the existence of a turning point until the end of the year, or even later. In addition, the seasonal pattern isolated in the adjustment process yields insights on the production rhythm within a year and shows the impact of such variables as weather and the planning cycle on economic performance.

This paper discusses case studies in which the deseasonalization of time series data is used to determine both the underlying trend and the role of seasonal influences in several key areas of Soviet economic activity—the various energy-producing sectors and foreign trade. The first part of the paper briefly surveys the literature on seasonal influences in the USSR and summarizes the theory and techniques of seasonal adjustment. Then, we analyze seasonality in energy production and foreign trade. In each area, we examine the importance of seasonal influences in explaining changes in levels of activity, explore the causes behind changes over the course of a year, and determine if those forces have become more or less significant over time. Finally, the deseasonalized activity series are presented, and examples are given to show how they can be used to improve short-term analysis.

The Literature on Soviet Seasonality

Relatively little research has focused on seasonality in Soviet economic activity. Raymond Hutchings pioneered Western analysis of seasonal influences on Soviet industry, although his work has been primarily qualitative.[1] He devoted much attention to cataloging production patterns in terms of such measures as the relative activity of each quarter and the frequency with which certain annual patterns occur.

His chief quantitative contribution is the development of a measure of seasonal variability—the degree to which economic activity over the year deviates from a steady path. Hutchings's index is computed for a given year by first expressing each quarter's activity as a ratio of the previous quarter. These ratios are then adjusted by the average quarterly variation over the year to eliminate long-run trends. The sum of the logarithms of the four adjusted ratios is used as a measure of seasonal variation independent of both trend and scale effects. He uses this index to perform both cross-sectional comparisons of the volatility of different economic aggregates and intertemporal comparisons of trends in the relative importance of seasonality.

[1] See his *Seasonal Influences in Soviet Industry*, Oxford University Press, 1971, and "Recent Trends of Seasonality in Soviet Industry and Foreign Trade," in *Jahrbuch der Wirtschaft Osteuropas*, Volume 8, 1979, pp. 247-285.

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Hutchings's indexes are a useful step in isolating seasonal factors in Soviet economic data but have some inherent conceptual problems:

- Extracting trends based on a single year's growth rate leaves the procedure unnecessarily susceptible to distortions from an atypical quarter.

- Irregularities that develop within the course of a year because of extraneous nonseasonal variables are not considered; rather such aperiodic events are counted as seasonal fluctuations in his indexes.

- The procedure, moreover, does not extract the pattern of variability over the year; because it merely measures the average degree of deviation from smooth growth, insights into the ebb and flow of yearly economic activity are quite limited.

Soviet research in this area has been sparse. A theoretical article published a few years ago, typical of Soviet technical discussions on seasonality, simply reviewed the statistical properties of several alternative measures of seasonal volatility.[2] The article indicated that at least one research institute used a simple index based on the coefficient of variation to analyze short-term activity. The lack of more sophisticated approaches undoubtedly lies in the very severe constraint on computer access at most research facilities and on the low priority given to seasonality studies.

Soviet references to seasonality are usually political rhetoric calling for a smoother rhythm of production. This theme has been expressed at the highest levels, for example, President Brezhnev declared at the 25th Party Congress that "such shortcomings as losses of working time, idling, and lack of regularity in work are especially intolerable."[3] What Brezhnev and others have foremost in mind are the losses in efficiency and production caused by the rush (storming) at the end of planning periods to earn bonuses or escape penalties.

[2] A. I. Tarasov, "Indicators of Seasonal Unevenness," *Ekonomika i matematicheskiye metody*, No. 4, 1975 (translated in JPRS 1820/72, April 1975).
[3] N. Fontalin, "Smoothness—A Condition of Efficiency," *Promyshlennost' Belorussii*, No. 12, 1977 (translated in JPRS 70809, March 1978).

Soviet literature generally does not distinguish between this storming and seasonal phenomena, which are natural and not necessarily counterproductive.

Soviet empirical work on the rhythm of production has generally concentrated on patterns within a month.[4] These articles usually divide the month into halves or thirds and compare output in the different periods. While this research on very short-term variations in economic activity could be useful, only average breakdowns of the rhythm within a month are usually given, limiting the usefulness of the data for examining variations in seasonality over the full year.

Soviet research on seasonality that is useful to Western scholars for the most part is found in occasional articles in technical journals that report on industry case studies in sectors such as electricity generation and meat production.[5] But even these analyses are generally confined to questions of the average share of annual output accounted for by a given month or quarter.

The best Soviet study of seasonality seems to be Zorkal'tsev's.[6] He computed average monthly deviations of production from trend for a large number of industrial products for the period 1965-72 and stressed the need for more research on seasonal phenomena,

[4] Examples are: P. Galkin, "Rhythm in Production," *Ekonomicheskaya gazeta*, No. 1, 1976; R. Gareyev, "In the Struggle for Rhythm of Production," *Ekonomicheskaya gazeta*, No. 39, 1976; V. Virkunen, "A Clear Rhythm Through Tens of Days and Days," *Ekonomicheskaya gazeta*, No. 4, 1978; Ya. Arloff, "Heavy Industry and Consumer Goods," *Ekonomika i organizatsiya promyshlennogo proizvodstvo*, No. 5, 1978; Fontalin, *op. cit.*, and Ya. Kvasha, "Methods of Cost Computation in Setting Up Production," *Voprosy ekonomiki*, No. 1, 1976 (translated in *Problems of Economics*, August 1977).
[5] S. P. Gladkova, "Seasonal and Annual Fluctuations in Electric Power Output Analyzed," *Gidrotekhnicheskoye stroitel'stvo*, No. 11, 1975, pp. 18-21 (translated in JPRS 66544, January 1976), and L. B. Dekel'man, R. G. Tumanova, and V. D. Filippov, "Methods of Studying the Seasonal Nature of Production," *Myasnaya industriya SSSR*, No. 1, 1978, pp. 5-9 (translated in JPRS 70828, March 1978).
[6] V. I. Zorkal'tsev, "Seasonal Impact on Industrial Production," *Izvestiya sibirskogo otdeleniya akademii nauk SSSR, seriya obshchestvennykh nauk*, No. 6, 1978 (translated in JPRS 72434, December 1978).

arguing that they are significant determinants of short-term output variations and must be considered in designing policies for reserve capacity, inventory control, and product interchangeability.[7]

Techniques of Seasonal Adjustment

The seasonal adjustment techniques now in use include the calculation of quarterly means, link relatives, and ratios-to-moving averages. With many issues of deseasonalization still unresolved, spectral analysis and regression techniques are also being employed to deseasonalize data.[8]

Almost all of these techniques assume that economic activity in any period is the combined result of random events, seasonal influences, cyclical fluctuations, and secular trends. Statistical series are deseasonalized by filtering out seasonal influences to derive a time series that reflects primarily cyclical and trend components.[9] The various techniques differ in how they accomplish the filtration. In particular, before any technique can be applied, a critical assumption must be made. Do the seasonal factors have an additive or multiplicative effect on economic processes? [10]

Of the many methods for deseasonalizing data, we have selected the X-11 approach developed by the Bureau of the Census. This is the most commonly used method, primarily because of its great flexibility. It provides an analysis of variance to determine the shares of variation in output over different timespans that can be attributed to random events, trend, and seasonal factors. It also permits changes in the seasonal pattern over time rather than holding the pattern fixed as most other methods require. In addition, the X-11 method allows for either additive or multiplicative seasonal influence assumptions. Finally, one of the chief advantages of the X-11 is its flexibility in treating extreme observations so that the deseasonalization process is not distorted.[11]

Analysis of Seasonal Influences in Energy Production and Foreign Trade

The Data

We analyzed quarterly data on production of coal, oil (including gas condensate), natural gas, and electricity, and commodity exports and imports to identify seasonal behavior. (The raw data are presented in the appendix.) We compiled the energy data from *Ekonomicheskaya gazeta* from first-quarter 1960 to second-quarter 1980; approximately a month after the end of each quarter, the Central Statistical Agency in Moscow issues reports on the cumulative energy production through that quarter. Quarterly production data are derived by subtracting from each quarter's cumulative output the previous total, except for the first quarter, which is given directly. Since published Soviet statistics are often highly rounded, some error may be introduced into a particular quarterly total derived in this manner.

Development of the series for electricity generation is complicated by the reporting practices employed before third-quarter 1971. As Hutchings has pointed out,

[7] In another article Zorkal'tsev urges the use of regression techniques that account for seasonal influences as well as trend during the plan formation process. See "The Basis of Choice of a Regression Model for the Analysis and Forecasting of Processes of Fuel Supply With a Seasonal Component," *Izvestiya akademii nauk SSSR, energetika i transport*, No. 3, 1978, pp. 135-143.

[8] See Harry M. Rosenblatt, "A New Look Into and Beyond Traditional Methods of Seasonal Adjustment," *X-11 Information for the User*, 1969. Also see the papers in *Seasonal Analysis of Economic Time Series*, US Department of Commerce, Economic Research Report, ER-1, 1978. An example of the complex modeling techniques currently under investigation can be found in Charles I. Plosser, "The Analysis of Seasonal Economic Models," *Journal of Econometrics*, October 1979.

[9] In seasonal adjustment terminology, that part of fluctuation explainable by the business cycle and secular trend is combined into a single component known as the trend-cycle. Because the Soviet Union is not exposed to a Western-style business cycle, henceforth, we refer to this component purely as trend.

[10] The choice itself is an oversimplification as the considerable controversy on this issue demonstrates. Seasonal factors could impact in combined additive and multiplicative forms in some nonlinear fashion.

[11] All of the X-11 calculations in this paper were based on the multiplicative assumption regarding seasonal influences. Experiments were also conducted using the alternate assumption of additive seasonality. This gave less stable seasonal patterns and was therefore rejected in favor of the multiplicative adjustment. The influence of extreme observations on the seasonality calculations was moderated by discarding data points that were more than 2.5 standard deviations beyond a moving average mean and reducing the weight given to points within the band defined by 1.5 and 2.5 standard deviations from the mean.

power generation output before 1971 was only reported for the first and third quarters as output "of electric power stations of general utilization and block stations" while the second- and fourth-quarter cumulative figures presumably represented the national total.[12] To overcome this difficulty, we have used regression techniques to determine historical relationships between quarterly and cumulative semiannual totals. With the help of these relationships, we interpolated values for first- and third-quarter national totals before 1971. This procedure obviously introduces some additional error into the pre-1971 data and, therefore, into the estimates of seasonality for electricity in this period.

The foreign trade data in current prices are obtained from several sources. Hutchings constructed quarterly data for imports and exports for the period 1960-67 and 1968-74 in his studies.[13] Post-1974 data were obtained in cumulative form from the journal, *Vneshnyaya torgovlya*, current through second-quarter 1980. We derive the quarterly figures by the same procedure used for energy.

Since these trade figures are ruble values in current prices, they do not measure the actual volume of trade. Soviet official data permit a crude adjustment of these data to a constant price base by the publication of an annual index series of the volume of exports and imports in comparable prices. By comparing these indexes with the annual trade figures in current prices, implicit price deflators for the year are derived. Because we have no information about how prices change during the course of a year, the same price deflator is applied to every quarter within a given year.[14] The result is that the X-11 procedure will mix together the seasonal effects that result from both trade volume and price fluctuation.

[12] Hutchings, "Recent Trends," *op. cit.*, p. 259. The designation of block electric power stations probably excludes captive power stations belonging to specific production facilities.
[13] Hutchings, *Seasonal Influences*, pp. 309-310, and "Recent Trends," pp. 247-285.
[14] If prices rise uninterrupted during the year, this procedure will understate the values of the earlier quarters and overstate the values of the latter quarters. If prices rise and fall during a year, the direction and degree of bias are indeterminate.

Components of Change in Activity Levels

The deseasonalization process decomposes the change in a particular time series into shares that may be attributed to random events, trend growth, and seasonal factors. In a seasonally stable series, the relative importance of each component depends on the unit of time used to measure change. Table 1 summarizes the results for each of the six series examined; we calculated change from period to period, where the period varied from one to four quarters.

As expected, in all cases the dominance of the seasonal component diminishes as the unit of time increases. Seasonal factors are short-term phenomena whose influence essentially vanishes when year-to-year comparisons are made. Conversely, the significance of the trend factor increases as the unit of time lengthens; in no case does the trend factor account for less than 86 percent of the annual variation in the series examined. Except for coal, the importance of the random component for the energy products either drifts downward over longer time periods or remains steady.

Seasonal volatility seems most important in explaining short-term fluctuations in electricity generation and least important for oil and gas condensate. Coal and natural gas fall in an intermediate position. The growth trend is relatively unimportant in explaining quarter-to-quarter changes in electricity, coal, and natural gas, but it is very important for oil. Coal is the only fuel that has a consistently high irregular component (from 8 to 18 percent), suggesting that variations in coal output are to a large extent the result of factors having nothing to do with trend or seasonal factors. For example, irregular deliveries of equipment, abrupt changes in manpower availability, and extreme weather in certain years could be more important in coal than in the other sectors.

Foreign trade is much like electricity in that a heavy seasonal component dominates short-term trade movements. Indeed, the growth trend is not important in determining changes for periods of less than a year. Seasonal factors seem to have equally important roles in both imports and exports, while the influence of random events is small in both.

Table 1 Percent

Relative Importance of Three Components in Explaining Variation in Energy Production and Foreign Trade [a]

Periods [b]	Random Events	Trend Growth	Seasonal Factors
Oil and gas condensate			
1	5.1	57.6	37.3
2	0.9	76.2	22.9
3	0.6	92.6	6.8
4	0.4	99.6	NEGL
Natural gas			
1	13.8	18.9	67.2
2	3.0	28.5	68.6
3	4.4	70.3	25.3
4	4.0	95.9	NEGL
Coal			
1	18.4	8.3	73.3
2	8.2	27.2	64.6
3	9.1	39.8	51.1
4	13.1	86.8	0.2
Electricity			
1	0.6	4.3	95.1
2	0.1	5.9	94.0
3	0.3	31.8	67.9
4	0.4	99.6	0.1
Exports			
1	3.9	3.4	92.8
2	4.4	18.7	76.9
3	2.1	18.1	79.8
4	7.6	92.3	0.2
Imports			
1	6.4	4.4	89.2
2	7.9	25.3	66.8
3	3.2	20.2	76.7
4	13.0	86.3	0.6

[a] Because of rounding, components may not add to the totals shown.
[b] Period length is three months.

Annual Activity Profiles

An activity profile shows how economic activity varies from quarter to quarter during an average year. It is not necessarily the pattern recorded in any particular year because changes in trend and extraneous events can also affect the distribution of activity within a given year. Seasonal influences can also change over time for a host of reasons—changes in production technology, output mix, or the location of production, for example.

Activity profiles can be computed from a series of link relatives: activity in each quarter is expressed as a ratio of the previous quarter. The mean link relative for a given quarter is the average of all of the link relatives for that quarter. Activity profiles are created by chain linking the quarterly mean link relatives, treating the first quarter as the base.

The quarterly activity profiles for energy (figure 1) and foreign trade (figure 2) show the average activity variations over the year. Because they are not trend adjusted and because activity has increased over time, the data show some net growth on a first-quarter to first-quarter basis. The quarterly patterns, however, are by no means identical. Generation of electricity falls in the second quarter, remains low in the third quarter, and approaches a peak in the fourth and first quarters. Extraction of oil and gas condensate rises throughout the year before falling somewhat in the first quarter. Production of natural gas follows a pattern similar to that of electricity except that it does not fall by nearly as much in the second and third quarters and rises by more in the fourth and first quarters—reflecting the high growth trend in gas extraction. Coal dips in the second quarter and gradually climbs back until it peaks in the following first quarter.

Exports and imports generally move together. Values for the second quarter are nearly 20 percent above first-quarter values; exports and imports then fall slightly in the third quarter, although the decline is steeper for imports. Both series peak in the fourth quarter with exports climbing most. Finally, both series fall back to about the same relative level in the following first quarter—about 10 percent more than the same quarter a year earlier.

Seasonality Patterns

While activity indexes are useful general measures of the time patterns of production or trade, they can distort seasonal influences because growth trends and random disturbances are mixed in with seasonal factors. In the Soviet economy, where most indicators of

Figure 1

Activity Profile for Energy Production, 1960-79

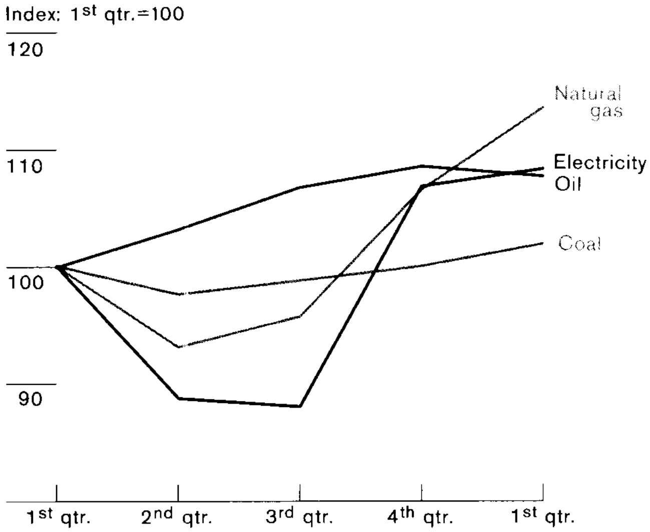

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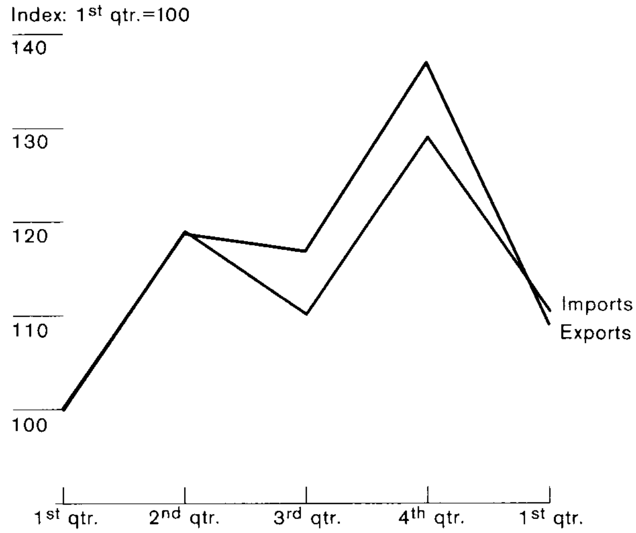
Figure 2

Activity Profile for Foreign Trade, 1960-79



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economic activity grow over time, we must especially remove the trend elements to discern the true seasonal pattern.

Seasonal indexes computed by the X-11 procedure convey a clearer impression of the annual pattern of activity independent of trend and irregular disturbances. If there were no seasonal rhythm, these indexes would record a value of 100 in every quarter. An index greater than the base indicates that the quarter in question is more active than average and a value less than 100 means just the reverse. Since the X-11 deseasonalization procedure generates different seasonal indexes over time, we will focus on those for 1979. (We defer discussion of historical changes in seasonality to a later section.)

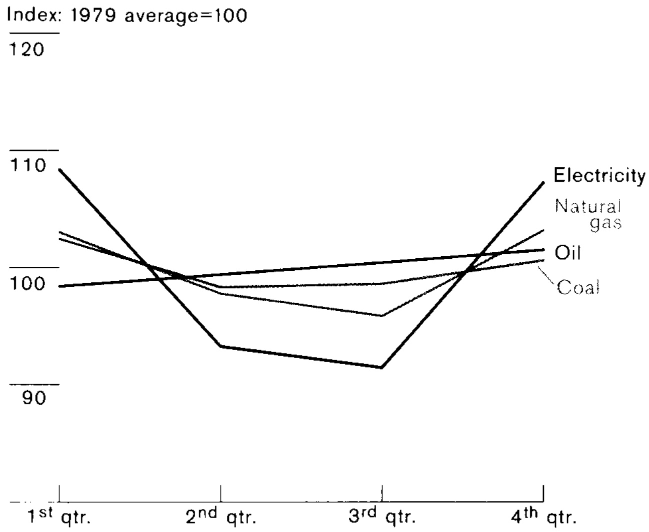
Seasonal indexes for energy for 1979 (figure 3) show a slightly different pattern than link relatives by removing trend. Because electricity cannot be stored, the seasonal pattern of electricity generation reflects demand considerations much more than supply. Based on Zorkal'tsev's finding that "the amplitudes of the seasonal fluctuations are greater for fuel consumption than for production," we would expect that electricity generation would be the most volatile of energy forms.[15] Indeed, a comparison of the seasonal indexes for different kinds of energy shows this to be true. Electricity generation peaks in the first and fourth quarters when we would anticipate demand to be highest. In the first or winter quarter, household and municipal demand for lighting, ventilation, hot water, and heating purposes would be at a maximum.[16] Since Robert Campbell has shown that household and municipal sources consumed more than 16 percent of

[15] Zorkal'tsev, "Seasonal Impact." The next few paragraphs borrow from this article to help explain the seasonal phenomena we have witnessed.

[16] S. L. Pruzner, A. N. Zlatonol'skiy, and A. M. Nekrasov, *Ekonomika energetki SSSR* (Moscow: Vyshaya Shkola, 1978) pp. 26-27.

Figure 3

Seasonal Indexes for Energy Production, 1979



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electricity available for distribution during 1975, we would expect the first-quarter share to be substantially higher than average.[17] With the well-known phenomenon of end-of-year storming by industry, the chief consumer of electricity, the shorter days of fall, and the advent of cold weather, we would also expect fourth-quarter demand for electricity to be relatively high.

Peak periods of electricity demand, however, do not coincide with peaks in hydroelectricity generation. Hydro potential is at its maximum in the second and, perhaps, third quarters—periods of rather low electricity demand. Hydroelectricity generation cannot be used to augment seasonal peak loads; rather it serves the function of expanding the underlying capacity of the entire network. This inability to rely on hydroelectricity in periods of peak seasonal demand must force increased reliance on thermoelectric stations and increase the demand for fuel during the winter.[18]

Seasonality is next strongest in natural gas production. While production does not follow current demand as closely in gas as in electricity, the amount of gas that can be stored at any one time is limited. Thus, gas production also peaks in the fall (fourth quarter) and winter (first quarter). Space heating requirements and heat losses in industrial processes peak in those quarters. For example, in urban locations, where private and communal consumption is a large share of local fuel consumption, the use of fuel in January is three to five times higher than the monthly average for the year.[19] Moreover, the energy required for heat in industrial processes in the winter is often 40 to 100 percent more than in the summer.[20] Storming in industry, which accounts for about half of domestic gas consumption, undoubtedly contributes to the fourth-quarter surge in gas demand. Despite the increased production during cold weather, gas shortages occur because demand rises more than production. To compensate, the shortages are rationed by drawing on underground storage, by converting to alternative fuels, and disconnecting some users.[21]

The seasonal profile for coal production is similar to that for natural gas except that it has a smaller amplitude. Because coal can be stored more readily than electricity or gas, we would expect supply considerations to dominate the seasonal rhythm in coal output. One reason for the relatively stable seasonal pattern is the operation of offsetting supply influences. Winter weather impedes strip mining and summer weather hinders shaft mining.[22] Summer vacations and the tendency to do repair work then both serve to hold down third-quarter output.[23]

[17] Robert Campbell, *Soviet Energy Balances* (Santa Monica: Rand R-2257-DOE, Part II, December 1978). Most of the energy consumption statistics in this section are taken from Campbell's work.

[18] V. D. Bel'kin and A. F. Tret'yakova, "Optimization of the Branch Complexes in the System of Interbranch Balance, Calculating Prices and Rents," I. Ya. Birman, ed., *Optimalniy plan otrasli* (Moscow: Ekonomika, 1970) p. 93.
[19] *Ibid.*, 93.
[20] Ye. N. Il'ina and L. D. Utkina, "Unevenness of Gas Consumption," *Ekonomika gasovoy promyshlennosti*, No. 9, 1978, pp. 3-15.
[21] *Ibid.*
[22] B. Pichugin, "Prepare Coal During Summer," *Sotsialisticheskaya industriya*, 17 July 1980, p. 3.
[23] Zorkal'tsev, "The Basis of Choice," p. 135.

Demand does play some role in coal's seasonality, albeit a reduced one. Coal production is at a peak in the first and fourth quarters when energy demand is also highest. Undoubtedly, this extra coal output is used for the generation of electricity in thermal stations and power and heat in cogeneration facilities, which together accounted for nearly two-thirds of noncoking coal consumed in the economy in 1975. This increased demand for coal for electricity is not only due to greater energy requirements during cold weather, but also because many thermal plants substitute coal for natural gas during this period of tight gas supply.[24] Industrial storming associated with the fourth quarter would exert a ripple effect on coal demand both as a fuel and for coking purposes. Also, the relatively low level of demand in the second and third quarters, especially as thermal plants return to gas usage, permits inventory accumulation, so there would be less need to greatly accelerate production in the fourth quarter.[25]

Oil production is seasonally the least volatile energy indicator examined. In no quarter does output diverge from the quarterly average by more than 2 percent. While storage theoretically could be a limiting factor, in reality potential drilling and pumping rates are the operative constraints to production. Thus, quarterly oil output seems more sensitive to fluctuations in supply than demand. Like coal, offsetting factors limit the seasonal volatility: drilling conditions in moderate locations are the worst in the winter, but in Central Asia and Tyumen they are the worst in the summer.

Here again, demand exerts a limited influence on the seasonal pattern. Petroleum products have more alternative uses than other forms of energy, so the heating needs of winter do not play a dominant role in the first-quarter demand for oil. Oil output instead peaks in the third and fourth quarters, when the economic sectors most dependent on oil are most active. A surge in the demand for petroleum products in agriculture, transportation, and industry plays a key role in boosting oil demand in those particular quarters. A factor limiting the volatility of oil demand is that mazut, like coal, is used as a partial substitute to alleviate the natural gas shortage during the winter.

In summary, electricity and natural gas output are the most volatile energy series on a quarterly basis because storage limitations make them reflect quite directly the volatile demand for energy in the Soviet economy. Coal and oil are more stable because production possibilities rather than storage capacities are limiting; hence, these fuels may be stockpiled in advance of demand. Also, offsetting technical factors contribute to reduced volatility in oil and coal production. Demand and consequently production of energy tends to be highest in the first quarter because of heating needs and lower energy efficiency in industrial processes, and in the fourth quarter because of the rapid pace of economic activity.

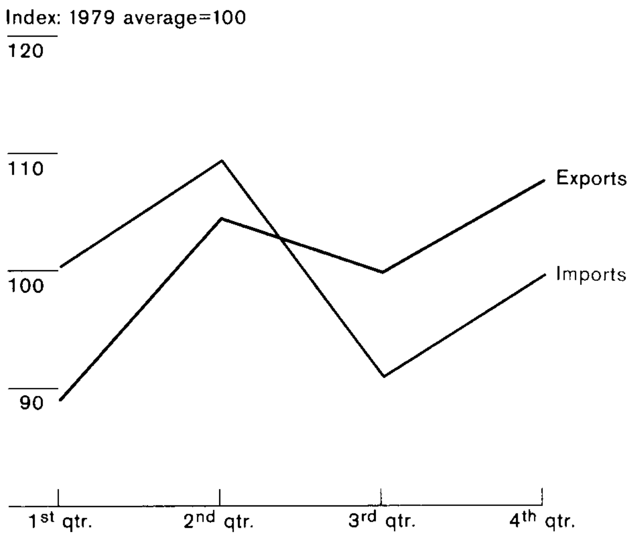
Foreign trade also shows a distinct seasonal pattern (figure 4). Weak export activity in the first quarter probably reflects problems in the transportation sector—inclement weather and closed ports and/or a need to divert limited transportation resources to higher priority activities. The rebound in the second quarter could represent a reduction in the backlog of undelivered goods held over from the previous quarter. The high export activity in the final quarter is a likely sign of storming to meet plan targets and export commitments.

The import pattern is somewhat different from exports. First-quarter activity is about average, the second quarter is the most active, the third quarter is relatively inactive, and the last quarter is about average. The first two quarters may dominate imports because of the increased reliance on imported grain. Grain must be imported early in the year to compensate for any crop shortfalls in the previous year and to sustain livestock herds until the winter grain crop is harvested and spring pastures are available. Likewise, other imports may fall off toward the end of the year as planned foreign currency allocations become tight and some new purchases must be deferred until the following calendar year.

[24] Ilina and Utkina. Pruzner, et al., p. 50. Also see N. S. Neporozhnego, ed., *Elektrifikatsiya SSSR* (Moscow: Energiya 1970), p. 541.
[25] *Ibid.*

Figure 4

Seasonal Indexes for Foreign Trade, 1979



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Price effects may also have a role here. If prices tend to rise during the year, this would mean that for exports the low activity of the first quarter and the high activity of the fourth quarter would be exaggerated; rather both would approach somewhat closer to average activity. The net effect of price changes on imports is harder to assess because of the high share of food and agricultural raw material imports, about one-fifth in 1978. We suspect that food prices have a high seasonal component and that they do not rise in an uninterrupted manner, as most other products.

Trends in Seasonal Influences

Seasonality patterns are not necessarily stable over time. Long-term changes in location, resource availability, labor supply, technology, industrial structure, and even weather could affect the balance of seasonal forces and therefore the variation in activity over the year. Trends in seasonal patterns can be measured in three ways: (1) changes in the role of seasonal influences in explaining quarterly variations in economic activity, (2) changes in seasonal volatility over time, and (3) changes in the seasonal profile itself.

No clear relationship exists between economic development and the relative importance of seasonal influences. Development can reduce the importance of factors like weather that are highly seasonal; it can also increase the importance of budgetary and financial systems that have strong seasonal rhythms. To see whether the role of seasonal forces in Soviet economic activity is changing, we divided the 1960-79 period into four five-year subperiods. The activity levels of each shorter period can then be analyzed separately to determine the shares of the variations attributable to irregular disturbances, the growth trend, and seasonal influences. The analysis here is limited to activity changes over one- and two-quarter spans since seasonal influences generally are most important in explaining variations over short periods.

Summary results for the six series (table 2) allow few generalizations about the changing strength of seasonal forces over time. The importance of seasonal factors varies considerably for most of the series, but there has been no general tendency toward a reduction in seasonal influences. There is some suggestion of a connection between the relative growth over the period and the explanatory power of seasonal influence—seasonal factors become important as the annual growth rate falls. Oil and coal output have shown stronger seasonality in recent periods, probably because long-term growth has been slowing in both cases. The importance of seasonal forces in the rapidly growing but slowly decelerating natural gas sector has decreased somewhat in recent periods. No pattern emerges in electricity, although its seasonal component has consistently been among the highest of the series studied. The significance of the seasonal component in export activity has been relatively stable but has become somewhat less important in explaining change over two quarters. There has been some shift to less seasonal influence in quarter-to-quarter changes in imports, but seasonal factors still dominate in these comparisons.

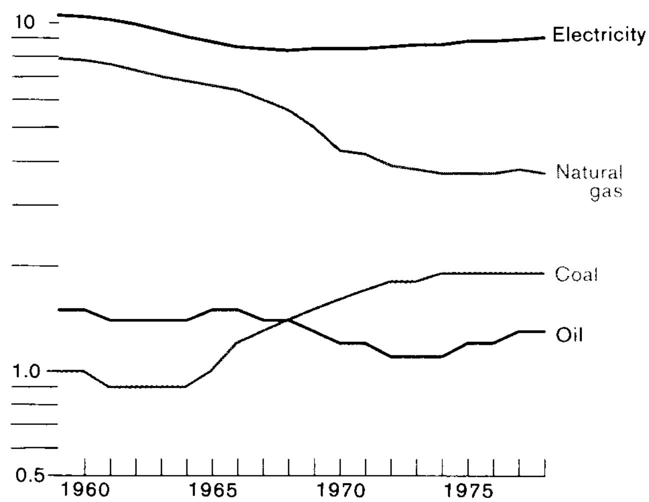
Table 2 Percent

Relative Importance of Seasonal Factors in Explaining Variation in Activity Over Selected Periods

	One-Quarter Span	Two-Quarter Span
Oil and gas condensate		
1960-64	26.2	19.8
1965-69	46.4	26.5
1970-74	32.5	24.9
1975-79	59.3	43.4
Natural gas		
1960-64	51.4	54.5
1965-69	89.5	86.1
1970-74	80.0	73.0
1975-79	77.5	68.6
Coal		
1960-64	75.9	1.5
1965-69	71.6	54.1
1970-74	60.6	71.3
1975-79	90.9	90.4
Electricity		
1960-64	95.9	89.4
1965-69	87.3	92.9
1970-74	90.2	94.6
1975-79	88.2	98.0
Exports		
1960-64	96.0	82.8
1965-69	86.6	81.6
1970-74	94.8	74.2
1975-79	93.5	65.0
Imports		
1960-64	93.7	91.9
1965-69	87.8	72.9
1970-74	88.5	11.3
1975-79	82.9	79.8

To test for changes in seasonal volatility, we computed the standard deviation of each year's seasonal adjustment indexes. If there were no seasonal volatility in a given year, the standard deviation would be zero. A large standard deviation indicates that the series is subject to extreme seasonal fluctuations, whereas variations in the standard deviation over time measure the shift in seasonal volatility. The standard deviations are

Figure 5
Annual Standard Deviations of Indexes of Seasonality for Energy Production



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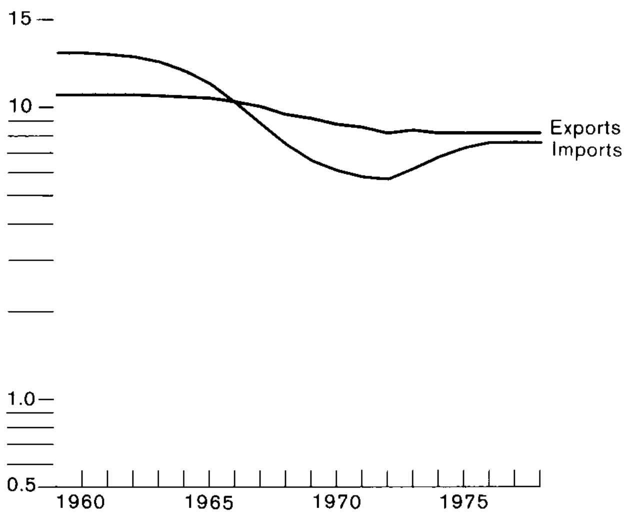
shown in figures 5 and 6 for 1960-79, using a logarithmic scale so that equal vertical movements represent equal percentage changes in volatility.

Figure 5 confirms that seasonal fluctuations are more intense in electricity and natural gas than in coal and oil. While the volatility of electricity has been high, it also has shown the most stable seasonal pattern. Some of this stability, however, may reflect the statistical procedures used to complete the raw data series that we have discussed above.

Natural gas production has shown a considerable decline in volatility, although seasonal variations are still large. The seasonal volatility of oil production has been relatively stable over the two decades. But after declining for a time, volatility has risen slightly since 1975. The growing share of Siberian oil in the national total and the declining production in regions with a less

Figure 6
Annual Standard Deviations of Indexes of Seasonality for Foreign Trade



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severe climate may account for the turnaround. Coal output has become more seasonal over the last 10 years. This probably reflects the expansion of strip mining at the expense of shaft mining.

Both exports and imports were more volatile than any of the energy series during the early 1960s. With the growing importance of foreign trade in Soviet plans, exports and imports have become less volatile and are now less affected by seasonal factors than electricity. Nonetheless, seasonal variations in trade activity are still high. In fact, the volatility of imports has risen in the last five years as a probable reflection of the growing importance of grain and other food imports. Of the two series, the seasonal volatility of imports has changed more than export volatility.

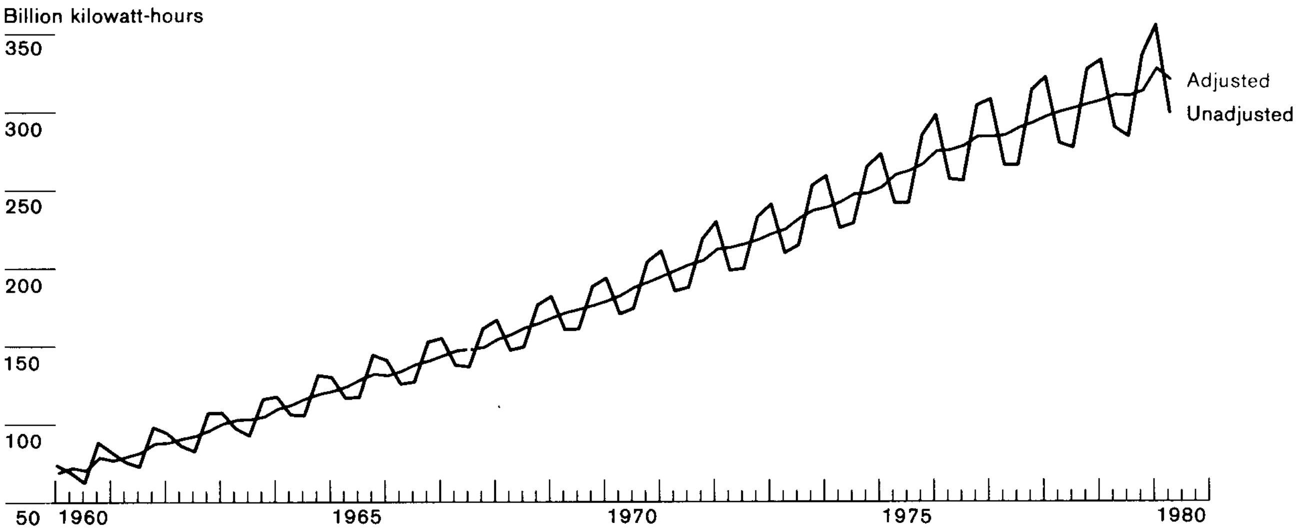
The standard deviations of the seasonality indexes show shifts in the degree of fluctuation over time but do not indicate how patterns have changed within a year. Only by examining the seasonal indexes directly can such shifts be tracked. The quarterly seasonal indexes for electricity output have been stable throughout the period, although some changes in individual seasonal indexes can be observed. Synthetic procedures used to reconstruct part of the raw power series may be a source of some of this stability. First-quarter activity—always higher than average—has increased in relative terms. The below-average activity of the second and third quarters has remained unchanged, while the fourth quarter has fallen from a pronounced peak to a level similar to that of the first quarter. The seasonal indexes for oil exhibit a marked stability throughout the 1960s and 1970s. The only discernible change is a slight weakening of the third quarter and a concomitant strengthening of the fourth quarter.

The decreasing amplitude of the seasonality of natural gas is reflected in the seasonal indexes, with each quarter trending toward the average rate of activity. The first and fourth quarters remain the peak periods for gas production, although the peak quarterly rates exceed the yearly average by smaller amounts now than earlier. The coal quarterly profile has changed slightly as seasonality has increased. The first quarter has remained the most active period on a seasonal basis and has accounted for an increasing share of annual output. The fourth quarter displayed below-average activity early in the 1960s, but now rivals the first quarter in terms of seasonal output activity. Similarities in the seasonality shifts of coal and electricity illustrate the importance of coal to much of electricity capacity.

The shifts in seasonal indexes of foreign trade have been minimal for exports and most dramatic for imports. With decreasing export volatility, some of the seasonal indexes have moved closer to the quarterly average. The fourth quarter remains the strongest period, but less than formerly. In recent years, the second quarter has become stronger and remains only slightly below the annual peak. The seasonal indexes for imports have changed radically. First-quarter activity has gone from 20 percent below average to about average. The second quarter has become the most active period, while the fourth quarter—which once dominated import activity—has fallen to slightly below average. The weakest import period is now the third quarter after having supplanted the first quarter from this position.

Figure 7

USSR: Electricity Generation



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The Deseasonalized Results

Seasonally adjusted time series are derived by applying indexes of seasonality to the official Soviet data. The adjusted series, purged of seasonal influences, reflect trend growth and random factors. The deseasonalized and official series for energy production and foreign trade are compared in figures 7 through 12. (The appendix presents the adjusted values for each quarter in 1960-80.) The deseasonalized figures provide a different view of Soviet economic growth. The contrast between the unadjusted and adjusted series shows that economic activity in these areas of the Soviet economy are subject to distinct annual rhythms.

The use of deseasonalized data is especially important in judging the intensity of random events or the timing of turning points—for example, the possible peaking of Soviet oil production. Oil production measured by the quarterly unadjusted series has fallen below the level of the previous quarter 10 times in the 80 observations in this study. Thus, the drop in oil production between fourth-quarter 1978 and first-quarter 1979 was not unusual. Analysis of seasonally adjusted oil production, however, reveals that the first-quarter 1979 drop in deseasonalized production had happened only twice before—in first-quarter 1969 and in second-quarter 1976. Moreover, the failure of seasonally adjusted oil production to turn upward in second-quarter 1979 was unprecedented in the 20 years covered by this analysis—a development that went unnoticed in the raw data that reported a rise in output in the second quarter. Adjusted oil production later turned upward again, demonstrating the severity of the winter of 1979 and its intense and unusual impact on the Soviet economy. It could also suggest that oil production is nearing its long-run peak. In reality, it is unlikely that an economic variable will smoothly approach a peak from which it begins a monotonic decline; rather we would expect that as the peak is approached there will be more frequent occurrences of short-term production declines such as have happened since 1979. Regardless of the cause of the 1979 winter production

Figure 8

USSR: Natural Gas Production

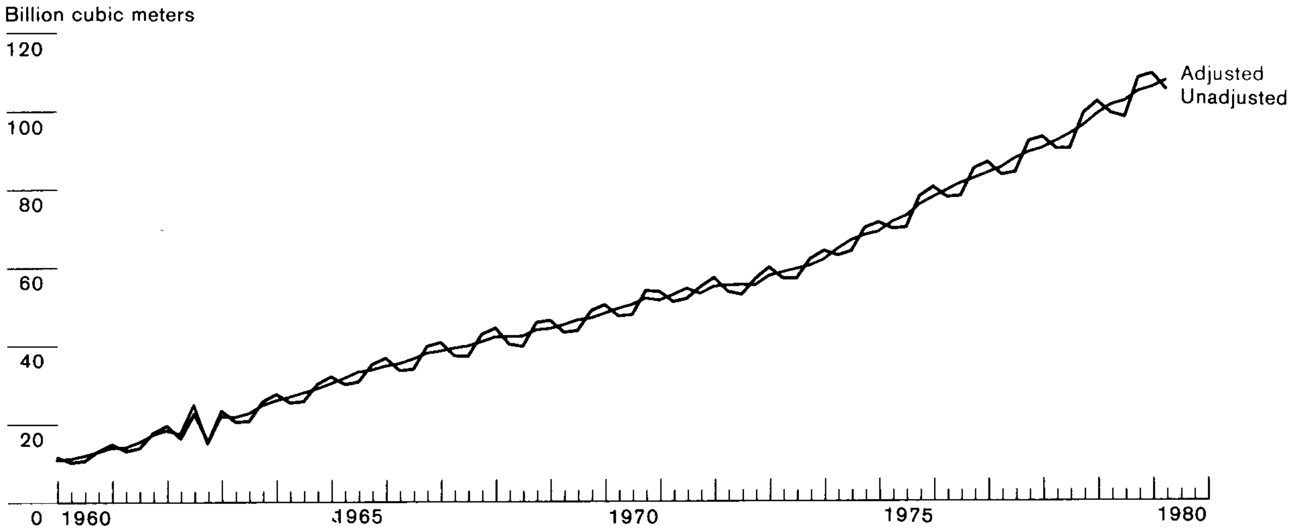

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Figure 9

USSR: Oil and Gas Condensate Production

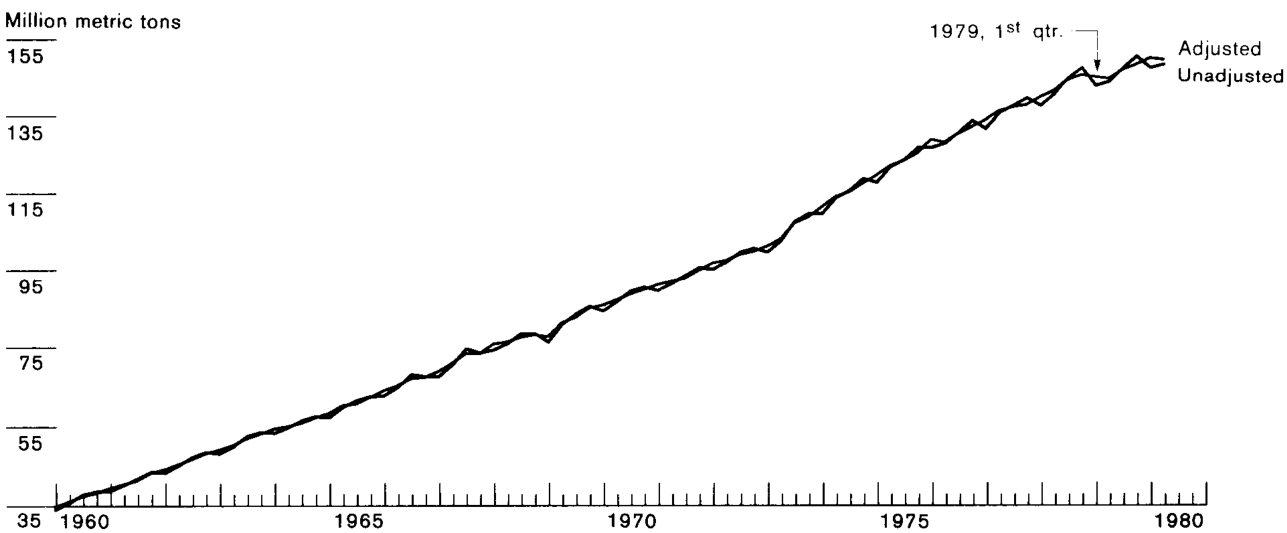

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Figure 10

USSR: Coal Production

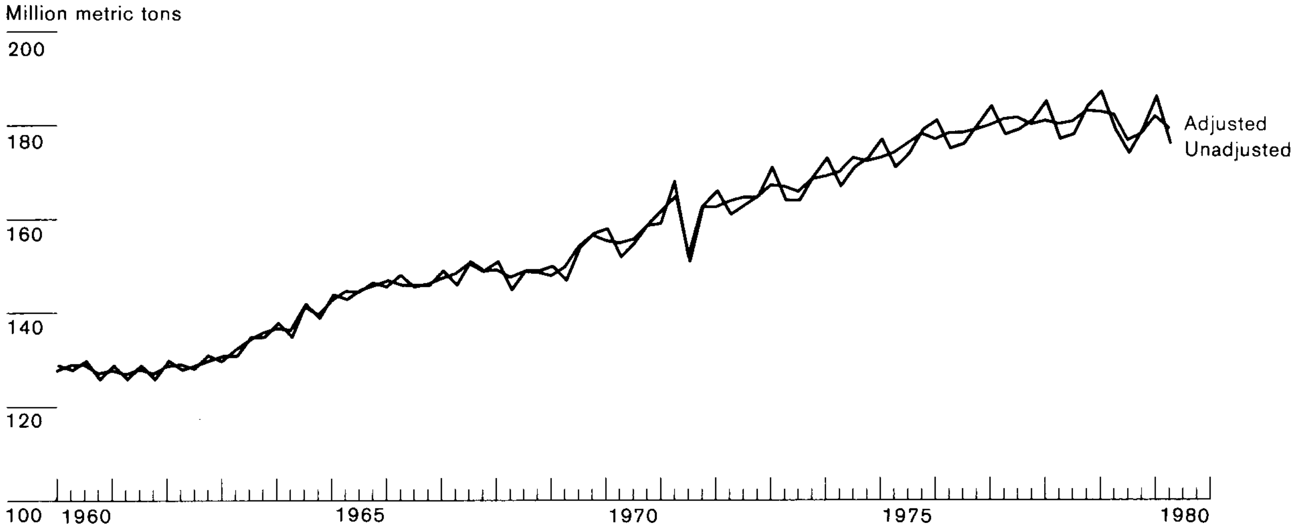

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Figure 11

USSR: Exports

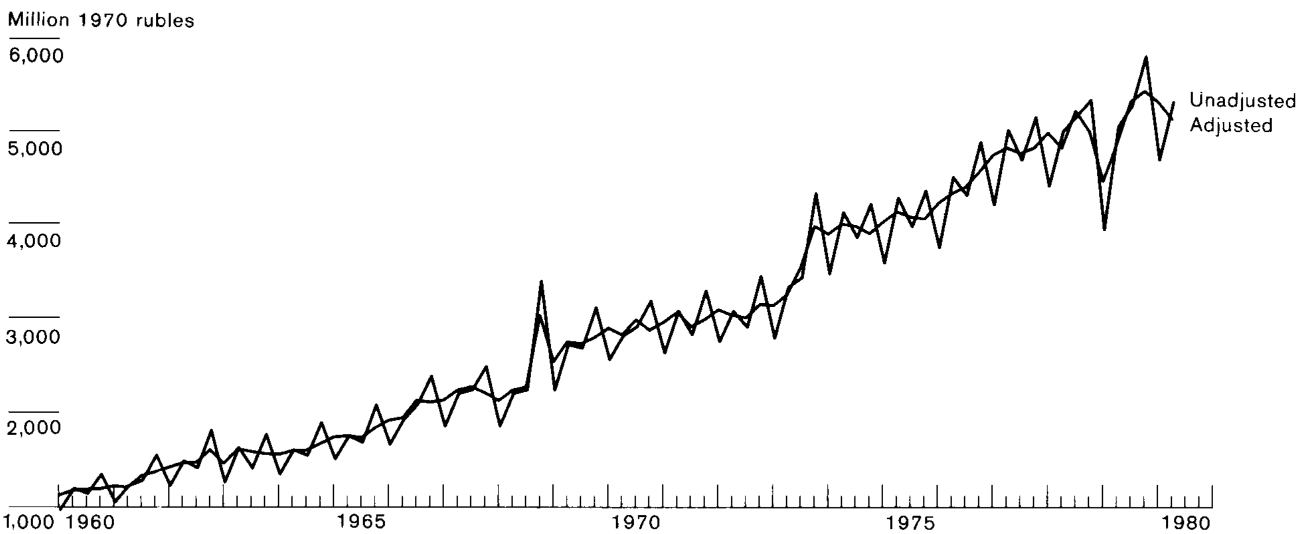

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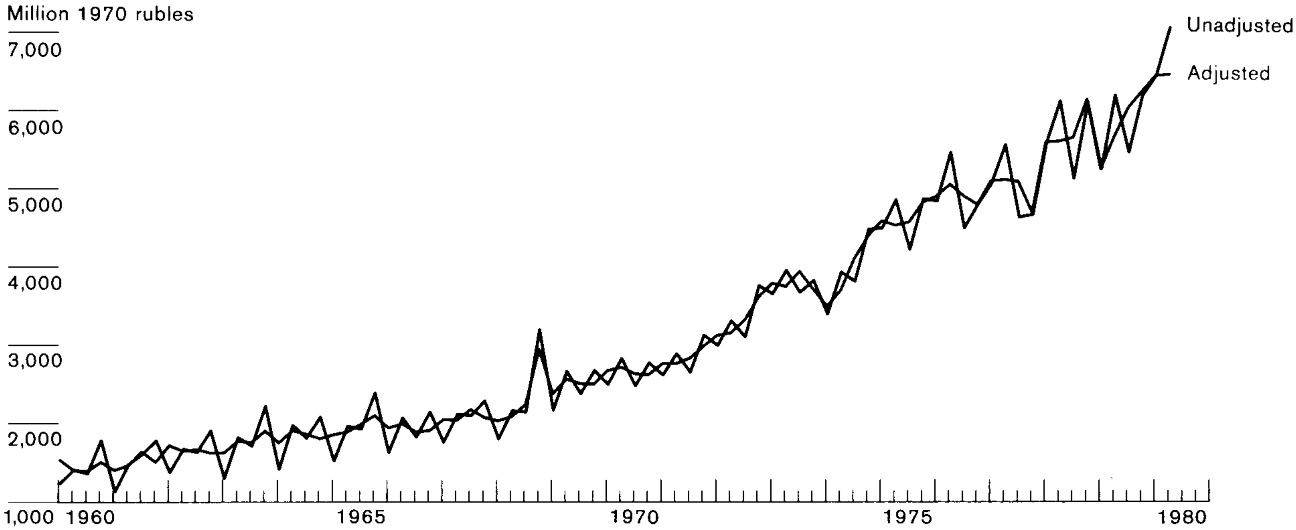
Figure 12

USSR: Imports



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decline—weather related or nearing a long-term peak—the seasonally adjusted data provide a better framework for the analysis of oil production than the unadjusted data.

Another possible value of seasonally adjusted data is to isolate the "echo effect" from the quarterly data. This effect may be defined as the statistical anomalies that appear in Soviet data during a year subsequent to a poor one. For example, in first-quarter 1980, the Soviet press reported that industrial production had grown 5 percent over the corresponding period in the previous year, a respectable rate of growth by anyone's standards. The real reason for the high growth rate was not industrial expansion, however; rather the harsh winter of 1979 brought growth to a virtual standstill with output of many products far below the 1978 level. By merely recouping those production losses, the echo effect virtually guaranteed a high rate of apparent growth for 1980 with minimal expansion of industrial capacity.

By seasonally adjusting the series examined in this paper and others, it becomes possible to compare disparate quarters on an identical basis. For example, we need not always compare the *first* quarter of one year with the *first* quarter of another year; now we can validly compare *any* quarter with *any* quarter in another year or the same year. In this way it is possible to more easily remove the echo effect. Since the second, third, and fourth quarters of 1979 were only indirectly affected by the harsh winter that year, we can compare the first quarter of 1980 to these latter quarters to discover the true rate of growth that is not biased upwards by comparison with an abnormal period.

Exports are a case in point. The dislocations of the 1979 troubles caused exports in the first quarter to drop 11 percent below 1978. If 1980 exports in the first quarter are compared with this unusual 1979 quarter, the impression is created that exports have risen dramatically by 19 percent. When a comparison is made with the seasonally adjusted third or fourth quarters of 1979, it becomes apparent that exports in constant prices have risen much more slowly and may even have declined. Thus, the echo effect is neutralized in our interpretation of economic events.

Appendix

USSR: Quarterly Statistics on Energy Production and Foreign Trade

Official energy data (tables A-1 through A-4) were compiled from various issues of *Ekonomicheskaya gazeta*. Because of a change in reporting practices, data for electricity generation through second-quarter 1971 had to be reconstructed through a combination of partial official data and historical relationships. Foreign trade data (tables A-5 and A-6) were obtained from Hutchings[26] and *Vneshnaya torgovlya*. The trade data are reported in current rubles, but we have used this basic data and its relationship with Soviet indexes of trade in constant prices to derive an implicit price deflator to convert the data to 1970 rubles. In all cases, quarterly values were derived from published cumulative totals.

The seasonally adjusted data were computed by using the X-11 statistical routine of the Bureau of the Census. The assumption of multiplicative seasonality was used throughout. To limit the influence of extreme observations, the standard default criterion of 1.5 and 2.5 standard deviations was used. This means observations more than 2.5 standard deviations beyond the norm were discarded for purposes of deriving the indexes of seasonality. Observations from 1.5 to 2.5 standard deviations received a reduced weight as they approached 2.5 standard deviations. All other observations received a full weight.

[26] Hutchings, *Seasonal Influences*, pp. 309-310, and "Recent Trends," pp. 247-285.

Table A-1 Billion Kilowatt-hours

Electricity Production

	Official Data				Adjusted Data			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1960	73.4	68.6	62.1	87.9	69.4	72.3	70.6	79.0
1961	81.6	75.4	72.4	97.6	77.1	79.6	82.1	87.9
1962	94.0	86.0	82.3	106.7	88.6	91.0	92.9	96.4
1963	107.0	97.0	92.3	115.7	100.7	103.0	103.4	105.1
1964	117.3	105.7	105.1	130.9	110.1	112.6	116.8	119.6
1965	129.7	116.3	117.0	144.0	121.5	124.3	128.9	132.4
1966	140.6	125.4	126.7	152.3	131.5	134.3	138.6	140.9
1967	154.6	137.4	136.3	160.7	144.3	147.3	148.3	149.5
1968	166.0	147.0	149.1	175.9	154.6	157.6	161.8	164.5
1969	181.2	159.8	160.4	187.6	168.3	171.5	173.7	176.0
1970	193.1	169.9	173.6	203.4	179.0	182.5	187.8	191.0
1971	210.4	184.6	187.0	218.0	194.7	198.5	202.2	204.8
1972	229.0	198.0	199.0	232.0	211.9	213.0	215.2	218.0
1973	240.0	209.0	214.0	252.0	221.9	224.8	231.6	236.6
1974	258.0	225.0	228.0	264.0	238.5	242.0	247.2	247.7
1975	272.0	241.0	241.0	284.0	251.4	259.1	261.8	266.1
1976	297.0	256.0	255.0	303.0	274.4	275.0	277.7	283.6
1977	307.0	265.0	265.0	313.0	283.6	284.5	289.3	292.5
1978	321.0	279.0	276.0	326.0	296.5	299.4	301.8	304.3
1979	332.0	289.0	283.0	335.0	306.7	310.2	309.6	312.6
1980	354.0	298.0	NA	NA	326.9	319.7	NA	NA

Table A-2 Million Metric Tons

Coal Production

	Official Data				Adjusted Data			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1960	129.0	128.0	130.0	126.0	127.8	129.0	129.0	127.2
1961	129.0	126.0	129.0	126.0	127.8	127.0	128.0	127.1
1962	130.0	128.0	129.0	130.0	128.7	129.1	128.1	131.0
1963	131.0	131.0	135.0	135.0	129.7	132.2	134.2	135.8
1964	138.0	135.0	142.0	139.0	136.7	136.3	141.3	139.6
1965	144.0	143.0	145.0	146.0	142.6	144.6	144.4	146.4
1966	147.0	146.0	146.0	146.0	145.5	148.0	145.4	146.1
1967	149.0	146.0	151.0	149.0	147.3	148.3	150.5	148.8
1968	151.0	145.0	149.0	149.0	149.1	147.5	148.7	148.6
1969	150.0	147.0	154.0	157.0	147.8	149.7	154.1	156.5
1970	158.0	152.0	155.0	159.0	155.3	154.8	155.6	158.5
1971	162.0	165.0	151.0	163.0	158.9	167.9	152.0	162.5
1972	166.0	161.0	163.0	165.0	162.4	163.7	164.5	164.5
1973	171.0	164.0	164.0	169.0	167.1	166.8	165.7	168.4
1974	173.0	167.0	171.0	173.0	169.0	169.9	172.9	172.2
1975	177.0	171.0	174.0	179.0	172.9	174.0	176.0	178.0
1976	181.0	175.0	176.0	180.0	176.8	178.1	178.2	178.9
1977	184.0	178.0	179.0	181.0	179.8	181.1	181.4	179.9
1978	185.0	177.0	178.0	184.0	180.7	180.0	180.5	182.8
1979	187.0	179.0	174.0	179.0	182.6	182.0	176.5	177.9
1980	186.0	176.0	NA	NA	181.6	179.0	NA	NA

Table A-3

Billion Cubic Meters

Natural Gas Production

	Official Data				Adjusted Data			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1960	11.9	10.6	11.0	13.5	10.9	11.2	12.0	12.9
1961	15.2	13.4	14.2	18.1	14.0	14.1	15.4	17.3
1962	19.9	16.6	23.0	15.7	18.4	17.4	25.0	15.0
1963	23.7	20.8	21.0	26.0	22.0	21.8	22.7	24.8
1964	27.9	25.7	26.0	30.4	26.0	26.9	28.0	29.0
1965	32.3	30.3	31.0	35.4	30.3	31.7	33.3	33.8
1966	37.0	33.8	34.2	40.0	34.8	35.4	36.6	38.1
1967	41.0	37.6	37.4	43.0	38.6	39.4	39.9	41.0
1968	44.6	40.5	39.9	46.0	42.2	42.3	42.4	44.0
1969	46.6	43.5	43.9	49.0	44.3	45.3	46.5	47.0
1970	50.5	47.6	47.9	54.0	48.2	49.4	50.4	52.0
1971	53.8	51.2	52.0	55.0	51.5	52.9	54.5	53.2
1972	57.3	53.7	53.0	57.0	55.0	55.3	55.4	55.3
1973	59.9	57.1	57.0	62.0	57.7	58.6	59.5	60.3
1974	64.1	62.9	64.0	70.0	61.8	64.5	66.7	68.1
1975	71.3	69.7	70.0	78.0	68.9	71.4	72.9	75.8
1976	80.3	77.7	78.0	85.0	77.7	79.5	81.3	82.5
1977	86.6	83.4	84.0	92.0	83.9	85.3	87.6	89.2
1978	93.0	90.0	90.0	99.0	90.2	92.0	93.8	96.0
1979	102.0	99.0	98.0	108.0	98.9	101.2	102.2	104.7
1980	109.0	105.0	NA	NA	105.7	107.4	NA	NA

Table A-4 Million Metric Tons

Oil and Gas Condensate Production

	Official Data				Adjusted Data			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1960	34.5	36.2	38.3	39.0	35.2	36.4	37.8	38.6
1961	39.1	40.6	42.3	44.0	39.8	40.8	41.7	43.6
1962	43.7	45.6	47.7	49.0	44.5	45.8	47.1	48.5
1963	48.6	50.4	53.0	54.0	49.5	50.6	52.3	53.5
1964	53.8	55.2	57.0	58.0	54.8	55.4	56.2	57.6
1965	57.7	60.3	62.0	63.0	58.7	60.6	61.0	62.7
1966	63.2	65.3	68.5	68.0	64.4	65.6	67.4	67.7
1967	68.0	71.0	75.0	74.0	69.2	71.3	73.7	73.6
1968	74.7	76.3	79.0	79.0	76.1	76.6	77.8	78.5
1969	76.7	81.3	84.0	86.0	78.0	81.6	82.9	85.4
1970	84.8	87.2	90.0	91.0	86.2	87.6	89.0	90.2
1971	90.1	91.9	94.0	96.0	91.5	92.3	93.1	95.1
1972	95.6	97.4	100.0	101.0	97.0	97.7	99.2	100.0
1973	100.0	103.0	108.0	110.0	101.4	103.3	107.3	108.9
1974	110.0	114.0	116.0	119.0	111.6	114.2	115.4	117.7
1975	118.0	122.0	124.0	127.0	119.7	122.2	123.5	125.5
1976	127.0	128.0	131.0	134.0	128.9	128.2	130.5	132.3
1977	132.0	136.0	138.0	140.0	134.0	136.4	137.4	138.0
1978	138.0	141.0	145.0	148.0	140.1	141.6	144.3	145.8
1979	143.0	144.0	148.0	151.0	145.2	144.7	147.2	148.7
1980	148.0	149.0	NA	NA	150.3	149.9	NA	NA

Table A-5 Million 1970 Rubles

Exports

	Official Data				Adjusted Data			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1960	986	1,212	1,161	1,361	1,134	1,184	1,195	1,199
1961	1,071	1,243	1,296	1,564	1,231	1,214	1,335	1,378
1962	1,243	1,504	1,431	1,827	1,426	1,472	1,477	1,608
1963	1,280	1,646	1,545	1,782	1,464	1,616	1,592	1,567
1964	1,366	1,620	1,562	1,907	1,560	1,600	1,602	1,674
1965	1,527	1,765	1,701	2,095	1,743	1,756	1,734	1,840
1966	1,682	1,943	2,099	2,397	1,919	1,945	2,126	2,108
1967	1,872	2,215	2,255	2,499	2,130	2,232	2,270	2,207
1968	1,873	2,217	2,255	3,400	2,122	2,233	2,268	3,021
1969	2,249	2,733	2,696	3,121	2,533	2,742	2,721	2,790
1970	2,578	2,827	2,924	3,191	2,886	2,815	2,974	2,865
1971	2,646	3,086	2,840	3,298	2,947	3,053	2,902	2,975
1972	2,767	3,084	2,918	3,454	3,079	3,021	2,994	3,134
1973	2,802	3,334	3,439	4,341	3,121	3,238	3,531	3,962
1974	3,478	4,138	3,866	4,226	3,882	3,986	3,965	3,883
1975	3,591	4,295	3,982	4,370	4,013	4,119	4,064	4,043
1976	3,759	4,517	4,323	4,896	4,210	4,319	4,387	4,551
1977	4,220	5,029	4,706	5,167	4,734	4,810	4,753	4,810
1978	4,425	5,017	5,180	5,355	4,975	4,807	5,211	4,985
1979	3,952	5,070	5,292	5,824	4,450	4,864	5,314	5,421
1980 [a]	4,707	5,333	NA	NA	5,307	5,118	NA	NA

[a] Preliminary.

Table A-6 Million 1970 Rubles

Imports

	Official Data				Adjusted Data			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1960	1,238	1,407	1,365	1,782	1,526	1,395	1,379	1,496
1961	1,128	1,475	1,607	1,778	1,395	1,455	1,626	1,496
1962	1,376	1,672	1,631	1,904	1,706	1,635	1,655	1,612
1963	1,303	1,818	1,713	2,215	1,613	1,761	1,744	1,892
1964	1,416	1,972	1,811	2,076	1,741	1,895	1,851	1,792
1965	1,521	1,960	1,927	2,387	1,843	1,877	1,978	2,086
1966	1,626	2,065	1,824	2,140	1,929	1,981	1,877	1,897
1967	1,760	2,112	2,095	2,282	2,035	2,027	2,165	2,060
1968	1,800	2,160	2,142	3,196	2,020	2,073	2,229	2,934
1969	2,165	2,663	2,373	2,671	2,366	2,551	2,491	2,488
1970	2,491	2,826	2,475	2,767	2,661	2,702	2,618	2,607
1971	2,610	2,884	2,648	3,125	2,748	2,747	2,818	2,972
1972	2,990	3,309	3,100	3,754	3,112	3,144	3,308	3,601
1973	3,652	3,951	3,669	3,823	3,775	3,735	3,927	3,700
1974	3,393	3,927	3,811	4,475	3,484	3,686	4,096	4,381
1975	4,490	4,853	4,218	4,863	4,575	4,516	4,561	4,815
1976	4,838	5,462	4,491	4,793	4,888	5,044	4,891	4,784
1977	5,064	5,563	4,632	4,664	5,084	5,104	5,077	4,677
1978	5,584	6,119	5,129	6,099	5,583	5,596	5,642	6,129
1979	5,250	6,194	5,464	6,190	5,238	5,658	6,018	6,226
1980 [a]	6,447	7,056	NA	NA	6,428	6,443	NA	NA

[a] Preliminary.