economic review

AUGUST 1965

IN THIS ISSUE

FEDERAL RESERVE BANK OF CLEVELAND

SUMMARY OF STEEL STATISTICS

	Average Annual Rate of Change			Iron and Steel as Proportion of Total Industry		
	1947-64	1947-54	1954-64	1947	1954	1964
Industrial Production Index						
All Products on	4.0%	5.1%	3.7%			
Iron and Steel	0.7	1.7	0.6	7.8%	5.0%	5.2%
Imports (a)						
All Merchandise			5.2			
Iron and Steel			20.3		1.2	4.4
Exports (a)						
All Exports Less Military			5.5			
Iron and Steel			—0.7		4.1	3.5
Plant and Equipment Expenditures						
Manufacturing	4.3	5.9	3.5			
Iron and Steel	4.4	8.8	4.3	7.2	6.9	9.1
Employment						
Manufacturing	0.6	1.7	0.2			
Iron and Steel	—0.7	0.5	—1.5	4.2	4.0	3.6
Average Hourly Earnings						
Manufacturing	4.3	5.7	3.5			
Iron and Steel	5.4	6.7	4.2	118	125	135
Wholesale Price Index						
All Industrial Prices	1.7	2.7	1.0			
Steel Mill Products	4.5	6.7	2.5			
Corporate Profits After Taxes						
Manufacturing	4.1	1.3	4.7			
Iron and Steel	1.6	1.3	—1.4	6.4	6.5	5.3
Corporate Profits as a Percent of Total Assets						
Manufacturing	—2.7	—7.7	—1.2			
Iron and Steel	—4.3	—7.7	—5.3			
Depreciation as a Percent (b) of Sales						
Manufacturing	3.1	3.0	2.1			
Iron and Steel	4.1	11.7	1.8			

(a) Early postwar import and export figures are not meaningful.

(b) Depreciation series are for the years 1949-64; figures for earlier years are not available.

Sources: Board of Governors of the Federal Reserve System; U.S. Department of Labor; U.S. Department of Commerce

Note: The reader may be confused by the fact that some of the proportion figures on the table do not seem to be consistent with the growth figures. For example, the proportion of iron and steel to the total industrial production index was higher in 1964 than in 1954 although the industrial production index grew at a greater rate than did the iron and steel component during that period. Such seeming inconsistencies are explained by the fact that the average annual rate of change is based on a number of years, whereas the proportion represents a single year which may be above or below the growth line.

The reader should also note that due to the method of calculating the average annual rate of change, using a "least squares" approach, subperiods are not additive with respect to the period as a whole. For example, in the case of profits after taxes for the iron and steel industry, the average annual rate of change for the 1947-64 period was greater than for either subperiod.

SOME PERSPECTIVE ON STEEL

An article in an earlier issue of the *Review* discussed the importance of the auto industry to the total economy.[1] In that article, the main focus was on the contribution of autos during the past several years of high production and sales.

In this article on steel, the perspective has been broadened and deepened to cover the full postwar period, specifically the years 1947 to 1964. The pattern of steel production, which is compared with that of total industrial production in Chart 1, clearly indicates the need for long-term analysis. On balance, the iron and steel industry has been losing ground since World War II in its relative importance in the economy. The deterioration has not been steady, however; as the chart shows, strong and sometimes protracted bursts of expansion in output have been intermingled with steep declines. Under such circumstances, when a few years can be too short for ordinary imbalances to wash out, a short-run view runs the risk of leading to erroneous and inequitable conclusions.

A number of pertinent statistical measurements comparing the steel industry with the total economy are summarized in an adjacent table.[2] The data are consistent to a significant degree in their implication that steel is becoming relatively less important in most economic sectors and has not exhibited the vigor that has characterized other industry since 1947.

[1] See "Some Perspective on Autos," *Economic Review*, Federal Reserve Bank of Cleveland, January 1965.

[2] In the table and in the text, all series are considered over the full postwar period, or over as much of it as possible where data are incomplete.

Two approaches have been taken. The first is the calculation of the iron and steel proportion of the total series for selected years, 1947, 1954, and 1964. The second approach is the comparison of average annual rates of change in iron and steel with those of all industry. The average annual rate of change is derived by using the compound interest formula based on logarithms of the data (log $Y = \log A + [\log B]\, X$).

Average annual rates of change have been calculated for the 17-year period, 1947 to 1964, and also two interim periods, 1947 to 1954, and 1954 to 1964. The year 1954 was selected as the dividing point primarily because the years from 1954 to 1964 form a period free of major wars and comparatively free of the pent-up demands of consumers following World War II. The fact that 1954 was a recession year makes it less than an ideal year in which to break the series. This disadvantage is partly offset by the use of average annual rates of change, whereby the data for the first and final years of any given period influence the result the same as any interim year; they do not, by virtue of their position as the beginning or end, determine either the rate of change or the direction of the trend.

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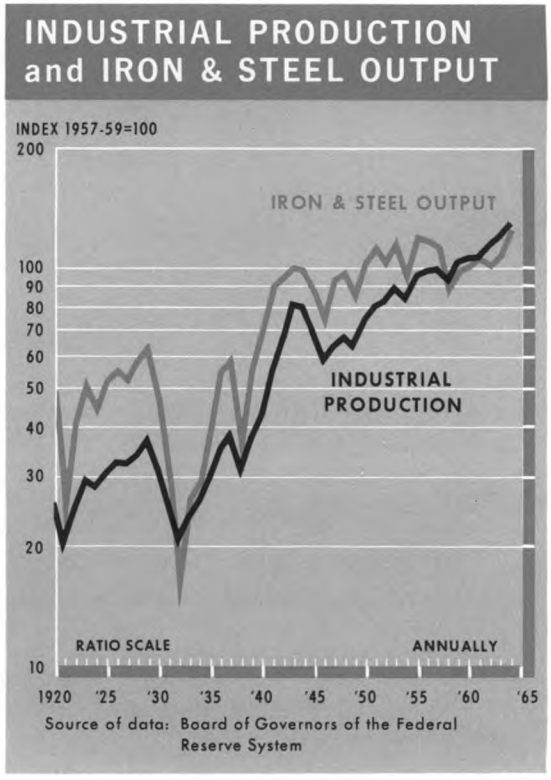

The statistics in the table not only measure results but they open the door to an exploration of the web of economic influences that have had a bearing on the course of the iron and steel industry. Starting with the industrial production index, each statistical series is taken up in turn. Where appropriate, the interaction of the basic facts represented by the various economic measurements is discussed.

INDUSTRIAL PRODUCTION INDEX

So far as productive volume is concerned, iron and steel were only about two-thirds as important to total industrial production[3] in 1964 as in 1947. In 1964, the iron and steel component[4] of the industrial production index accounted for 5.2 percent of the total index, down from 7.8 percent 17 years earlier in 1947, and up only slightly from 1954, a recession year when steel production was more depressed than industry in general. The loss of relative position since 1947 and the limited recovery since 1954 are the more significant in view of the fact that steel production was at an all-time high in 1964.

Turning to the figures on average annual growth rates, the following observations can be made: (1) steel production grew less than other industrial output in the entire 1947-64 period, (2) its rate of growth has slowed within the 17-year period, and (3) the slowdown in steel's growth rate is more pronounced than the corresponding postwar slowdown in all industry.

The iron and steel index rose at an average annual rate of only 0.7 percent over the entire 17-year period from 1947 to 1964 as compared with an average annual rate of growth of 4.0 percent for the total industrial production index. If iron and steel are removed from the industrial production index, the average annual rate of change increases to 4.2 percent.

Both the iron and steel series and the industrial production index showed higher rates of gain in the earlier part of the postwar period (1947-54) than in recent years (1954-64). In both interim periods, however, as in the 17-year span, the total industrial production index rose at a considerably higher rate than

[3] The industrial production index measures production activity in manufacturing, mining, and utilities.

[4] The iron and steel series includes semifinished and finished steel mill products and ferrous castings and forgings.

did the iron and steel component. (As previously noted, the actual differences can be seen on the table.)

IMPORTS AND EXPORTS[5]

Imports of iron and steel have been growing at four times the rate of total merchandise imports since 1954. Nationwide steel strikes in the U.S. and favorable prices of imported steel have been the principal reasons for the sharp increase of steel imports to the U.S.

Growth of imports of steel mill products has come in sharp spurts. Although occasioned by temporary conditions, these spurts were followed by only moderate declines, leaving a substantial net rise. For example, in 1956 (a year that included a 36-day strike in the steel industry) imports of steel products jumped to $201 million, up from $127 million in 1955; volume then eased a little to $197 million in 1957. Again, in 1959 (a year that included a 116-day strike) steel imports climbed to $521 million, more than double the $211-million total of the preceding year. The following year, steel imports receded to $442 million but were still twice as high as in the year preceding the long strike.

Currently, another spurt in imports of steel mill products is taking place in the U.S. as steel consumers hedge against the possibility of a steel strike later this year. In spite of a longshoremen's strike which closed the ports for part of the period, imports of steel mill products in the first quarter of 1965 were 33 percent higher than in the same period in 1964.

[5] Comparison of the rates of change for both exports and imports has been limited to 1954-64. The 1947-54 period was marked by heavy exports from the U.S. and few imports to the U.S. as a result of World War II.

Having once learned the ropes of buying foreign steel when domestic steel was not available, steel users in the U.S. have tended to continue buying steel mill products of foreign countries when they find no difference in quality and when there is a distinct price advantage. In the past, major steel imports have been wire and wire products as well as welded pipe and tubing. During the present inventory building, imports have also included sheet steel in relatively large amounts. If buyers are sufficiently satisfied with both the price and quality of foreign sheet steel, they may continue to buy that item abroad after the present tight supply situation has eased.

At the same time that steel imports have been growing vigorously, exports of steel mill products from the United States have been declining. Between 1954 and 1964, exports of iron and steel declined at an average annual rate of 0.7 percent; in contrast, total merchandise exports (less military materials) increased at an average annual rate of 5.5 percent. Moreover, the decline in exports of iron and steel would probably have been even greater in recent years except for increased tie-ins between U.S. foreign aid and foreign purchases of American goods.

Both the increase in imports and the decline in exports of American steel mill products since 1954 have reflected the expansion of the iron and steel industry in other countries, chiefly in Japan and the Common Market nations. During the 1950's, continued growth in capacity and advancement in technology of the steel industry in both Europe and Japan made it possible for those countries not only to fulfill domestic requirements for

steel but also to seek aggressively markets outside their own borders. Moreover, relatively lower wages, newer and more efficient equipment, and more flexible export pricing policies have frequently enabled foreign mills to sell steel in the United States at lower prices than those quoted by U.S. steel companies. In short, expansion of the iron and steel industry abroad has allowed the steel industries of foreign countries to supply their domestic needs, compete against U.S. steel exporters for other foreign markets, and take an increasingly larger share of the U.S. steel market.

PLANT AND EQUIPMENT EXPENDITURES

Spending for plant and equipment is one of the few areas in which the iron and steel industry has, in relative terms, exceeded manufacturing as a whole since 1947. The sharpest contrast occurred before 1954, when capital spending in the steel industry grew at an average annual rate of 8.8 percent compared with a rate of 5.9 percent for all manufacturing. In 1954-64, the corresponding rates were 4.3 percent and 3.5 percent. Funds spent on plant and equipment by the iron and steel industry in 1964 amounted to 9.1 percent of the total amount spent for that purpose by all manufacturing, up from 7.2 percent in 1947.

Adverse developments in imports and exports of iron and steel (as well as in profits) when compared with those of all manufacturing seem to imply that the efficiency of the iron and steel industry has not kept pace with that of all manufacturing since World War II. It is, nonetheless, a fact that the steel industry has spent proportionately as much, if not more, on new plant and equipment than have other industries. This seeming paradox has lead some observers to reason that at least part of the difficulty stems from the choice of plant and equipment purchased. When replacing worn-out equipment or increasing its capacity in the early 1950's, the steel industry did not make full use of technological advances. Eventually, recognition of a problem situation prompted the steel industry to move toward improved technology. Thus, "steel, for the first time in its history, really splurged on research, starting about eight years ago" (1955), and much of the recent spending "shows an embarrassing amount of it going to rectify an unavoidable mistake steel made during the 1950's, when the industry bought 40 million tons of the wrong kind of capacity—the open hearth furnace."[6]

In the early postwar period, there seemed to be some justification for the course followed by the steel industry in the United States. Steel and steel products were in heavy demand in all industrial countries following World War II. With most of the responsibility for meeting this demand falling on the U.S. steel industry, it is not surprising that the industry concentrated on producing steel according to methods to which it was geared rather than on taking time to try out technological innovations. On the other hand, it was logical for Europe and Japan to incorporate the most modern methods and equipment when almost completely rebuilding their steel industry.

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[6] *Business Week,* November 16, 1963, pp. 144-146.

Important technological advances in recent years have applied to all stages of steelmaking: raw material, converting the raw material to steel, and finishing the steel. With respect to iron ore, a major raw material, the United States has made great strides in recent years and is well ahead of other countries in the production of taconite pellets, the most efficient of treated iron ores.

A second technological advance applies to the conversion of pig iron into steel. American steel is still produced principally in open hearth furnaces while in Japan and Western Europe the oxygen converter is used for most of the steel produced. Many American steel mills are now turning to the basic oxygen process of making steel as they replace old equipment or expand their capacity, but the number of open hearth furnaces in use continues to exceed the number of oxygen converters by a wide margin.

Ingot production in the U.S. expanded by one-third between 1950 and 1960, an achievement made possible only by an increase in basic capacity. Though new, much of the added capacity was old-style as may be seen by comparing the 1950 and 1960 figures in the following breakdown of production by type of equipment, as reported by the American Iron and Steel Institute:

	1950	1960	1964
Total Ingot Production	100.0%	100.0%	100.0%
Open Hearth	89.1	87.0	77.2
Bessemer	4.7	1.2	0.6
Basic Oxygen	—	3.4	12.2
Electric	6.2	8.4	10.0

The belated shift to the basic oxygen process is apparent when the 1960 and 1964 figures are compared.

Another technological improvement, known as the continuous casting process, eliminates several steps between the steel furnace and the final processing of steel. The steel industry in this country has begun to invest in the continuous casting process but it still lags behind Europe where the process has had widespread use for several years.

Current heavy capital spending with its emphasis on reducing costs rather than increasing capacity should be helpful to the steel industry in coming years in competing in both home and foreign markets.

EMPLOYMENT AND PAYROLLS

In 1964, employees in the iron and steel industry made up 3.6 percent of total employment in all manufacturing, down from 4.2 percent in 1947. Over the 17-year period from 1947 to 1964, employment declined in iron and steel while employment in total manufacturing showed an increase. The average annual rates of change work out to a decline of 0.7 percent for iron and steel and an increase of 0.6 percent for all manufacturing. In both cases, the trend of employment has been influenced in part by the trend of production and in part by the rate of automation. For all manufacturing, continuous gains in the volume of production apparently more than offset losses of jobs through automation. In iron and steel, however, lesser growth in production during the postwar period has been insufficient to overcome the decline in employment resulting from automation.

While average hourly earnings in the iron and steel industry increased at an average annual rate of 5:4 percent during 1947-64,

the corresponding increase for all manufacturing measured 4.3 percent. Moreover, the figures also show that in 1947 iron and steel wage rates were already 18 percent above those for all manufacturing. With the more rapid rate of increase that has characterized steel wage rates in the past 17 years, this margin widened to 35 percent by 1964.

As shown in Chart 2, rates of increase were higher in the earlier years than in the later years, both for iron and steel and for all manufacturing. In 1960, as a result of fewer hours of overtime, average hourly earnings in the iron and steel industry actually dipped although other wage rates continued to rise.

Since 1960 both sets of average hourly pay rates have grown at approximately the same pace. The similarity of the two series since 1960 may be illusory, however, since they do not reflect fringe benefits which have become increasingly important in recent years. Average hourly earnings are calculated on hours paid for rather than on hours worked, and to the extent that the iron and steel industry has more liberal policies on paid vacations and holidays than do most other manufacturers, average hourly earnings for iron and steel may be understated.

PRICES

The price index of steel mill products rose at an average annual rate of 4.5 percent during the 17 years between 1947 and 1964. The total industrial price index increased at the much slower rate of 1.7 percent during the same period and would of course show an even more moderate rate of increase if the steel component were removed.

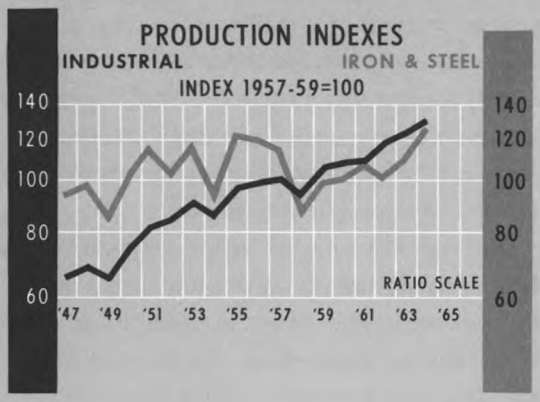
It is apparent on Chart 2 that 1959 marked the beginning of stability in iron and steel prices as well as in the industrial price index. Although the price index of steel mill products held steady from 1959 through 1963 and increased slightly in 1964, some decline in the prices of steel actually occurred.

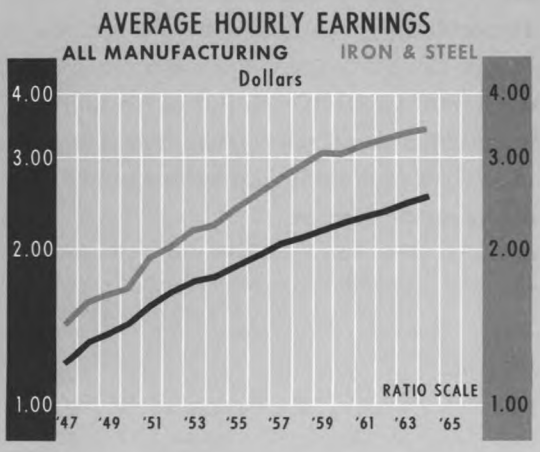
The price index of steel mill products is based on published prices and does not reflect discounts of one kind or another resulting from sharp competition in the steel industry in recent years. Revenue per ton actually reached a peak of $276 in 1959, and has been declining irregularly ever since. In 1964 revenue per ton was down to $259. The decline in revenue per ton of steel, despite the stability of the steel product price index, cannot be accounted for by a change in mix. According to steel analysts, shipments of the more expensive stainless and special steels have been increasing in proportion to total shipments, whereas the proportion of the less expensive semifinished steels has been declining. This situation would ordinarily be expected to produce a rise in revenue per ton. The fact that the opposite has occurred, and revenue per ton of steel has fallen, suggests that actual prices have been below published prices used in the steel index.

CORPORATE PROFITS

Any industry must generate profits in order to survive. Production may be sustained for a time at the break-even point; losses may even be temporarily absorbed by firms in a strong financial position. But either of these practices is successful only if profits eventually become large enough to compensate for the

PRODUCTION, COSTS, and PROFITS





Sources of data: Board of Governors of the Federal Reserve System; U.S. Department of Commerce; U.S. Department of Labor

period with no profit (or losses). The trend of profits, therefore, is an important guide to the strength of an industry.

The iron and steel industry exhibited some growth in profits during the 1947-64 period, but much less than was achieved by all manufacturing industries as a group. In dollar amount of corporate profits after taxes, the average annual rate of increase achieved by iron and steel firms was 1.6 percent for the 17-year period as compared with 4.1 percent for all manufacturing. Similarly, the trend of profits expressed as a percent of assets has been less favorable for iron and steel companies than for all manufacturing firms. For both groups the ratio of profits to assets has declined but the rate of decline has been steeper for iron and steel than for all manufacturing.

In both measurements of profits shown on the summary table, the average annual rate of change for iron and steel in the 1947-54 period matched the rate of change for all manufacturing, while divergent rates of change showed up in the 1954-64 period. However, the divergence did not actually set in until several years of the 1954-64 period had elapsed. As may be seen from Chart 2, the profit trend in iron and steel began to deviate from that of all manufacturing in 1959 and its altered course became more noticeable in succeeding years.

In seeking a reason for the change in the behavior of iron and steel profits since 1959, it is helpful to look back at some of the series that have a strong influence on profits, namely, level of production, depreciation costs, prices, and wages. It is apparent from Chart 2 that in recent years all manufacturing has had an advantage over iron and steel in several of the key factors affecting profits. Production in all manufacturing has reached a new high every year since 1958 whereas the increases in iron and steel during that period represent only a recovery of lost ground. Depreciation costs as a percent of sales have risen faster in the iron and steel industry than they have in all manufacturing. Proportionately greater investment in new plant and equipment in the iron and steel industry and changes in rules governing depreciation allowances have accounted for part of the greater increase in iron and steel depreciation costs. Relatively less growth in activity in the iron and steel industry has accounted for the remainder of the increase. Some indication of the relative role of depreciation costs in the steel industry is provided in the following figures.

Year	Steel Ingot Production (mill. of tons)	Depreciation Costs (mill. of dollars)	Depreciation Cost (per ton)
1949	78	$ 329	$ 4.22
1950	97	380	3.92
1951	105	445	4.23
1952	93	519	5.57
1953	112	699	6.26
1954	88	773	8.75
1955	117	832	7.11
1956	115	844	7.33
1957	113	875	7.76
1958	85	806	9.45
1959	93	799	8.55
1960	99	825	8.31
1961	98	863	8.80
1962	98	1,069	10.87
1963	109	1,144	10.47
1964	127	1,224	9.64

(Steel ingot production figures are those published by the American Iron and Steel Institute; depreciation costs are from the Federal Trade Commission and the Securities and Exchange Commission.)

Not apparent on Chart 2, but adversely affecting the growth of profits in the iron and steel industry, is the fact that while the price index for steel mill products has held steady in recent years, revenue realized per ton of steel has dropped since 1958. Also, as pointed out in an earlier section of this article, increases since 1960 in wage costs for the iron and steel industry have probably exceeded those for all manufacturing even though average hourly rates for both have grown at the same pace.

SUMMARY

It is not necessarily surprising when an industry, particularly one as old as iron and steel, accounts for a smaller proportion of total manufacturing activity over a period of years. New products (e.g., plastics, television, detergents) are constantly being introduced that either substitute for old ones or are a net addition to total production. Usually the greater growth rates occur in the newer products. An older industry need not necessarily decline in relative importance, however, if new uses are found for its products and if, at the same time, it retains its old markets. The steel industry has apparently lost out on both hands and, in consequence, has assumed a decreasingly important role in the economy since 1947. Not only have there been indications of a lack of innovation in finding new uses for steel, but the substitutions of materials such as aluminum, concrete, plastics, and glass have made inroads into markets for steel products.

The rapid rise in steel prices from 1947 to 1958 undoubtedly was an important factor in the poor showing of steel in the import and export sectors of the economy. How large a part prices played with respect to substitutions for steel is not easily judged, but certainly some substitutions for steel resulted from the sharp increase in prices.

During the earlier postwar years, both prices and costs rose faster in steel than in all manufacturing. With the leveling off of prices and the continuing rise in costs since 1959, profits at first declined. Gains in production in 1963 and 1964 were enough to reverse the downward plunge of profits and bring about a recovery of some of the ground lost since 1957.

During the 1947-64 period, four recessions, four strikes, and numerous possibilities of strikes perpetuated the feast and famine pattern of demand for steel that has always characterized the industry. If a semblance of stability in production could be achieved, the showing of the steel industry would improve. During periods of inventory building by steel consumers, old and inefficient steelmaking equipment is brought back into use. Later, while these high-cost steel stocks are being liquidated, the newer and more efficient equipment sits idle.

The possibility of the iron and steel industry improving its relative position in the economy appears to rest on success in holding costs and prices so as to meet competition, and success in finding new applications for steel where it can demonstrate a unique advantage.

ELECTRIC POWER—AN INDICATOR OF MANUFACTURING ACTIVITY

(Fourth District)

Demands for regional economic data from both public and private sources have virtually exploded in recent years, as evidenced by the growth of published (and unpublished) materials on regional business and financial conditions. Each of the twelve Federal Reserve banks, for example, is an important user and supplier of regional data.[1]

Regional data collected, processed, and published by this bank include those relating to banking and other financial activity, department store sales and, most recently, surveys of plans for capital spending in the Cleveland area, among others. But heretofore, this bank has published no current measure of overall manufacturing activity in the Fourth District. Moreover, there has been a sparsity of published information, apart from labor force data, on the cyclical behavior of individual Fourth District industries, as well as on cyclical patterns of major metropolitan areas.

[1] See Mann, Maurice, "Local Statistical Data, Needs and Adequacy: From the Viewpoint of a Regional Federal Reserve Bank," in *Proceedings of the Business and Economic Statistics Section, American Statistical Association, 1964,* pp. 144-149.

This article introduces a newly developed series for manufacturing activity in the Fourth District—namely, the use of electric power as a proxy for activity rates in manufacturing industries.[2] Some comparisons between manufacturing activity in the District and in the nation also are included in the discussion. Before examining the data, however, it may be helpful to consider the relevance of regional analysis and the reason for emphasis on the District's manufacturing sector.

SIGNIFICANCE OF REGIONAL ECONOMICS

The graphic representation of a regional economy by economic time series is a prerequisite for understanding the processes of economic growth and cyclical change. Because of varying degrees of similarity and interdependence among regional economies

[2] A previous article in the *Economic Review,* "Electric Power as a Regional Economic Indicator," September 1964, dealt with measures of manufacturing activity in the Cleveland area. A forthcoming article will review manufacturing developments in Cleveland and introduce weighted electric power indexes for the manufacturing sectors of other major metropolitan areas in the Fourth District.

and the national economy as a whole, there are marked differences in regional business fluctuations and growth trends, as compared with both the nation and other regions. Regional economic indicators, therefore, are useful in helping to evaluate how subnational economies react to changes in national economic activity. If selected time series can be classified as leading, coincident, or lagging indicators—with respect to either regional or national business conditions — economic understanding and business forecasting can be improved.

The foregoing obviously has implications for both public and private policy. Regional analysis helps to identify problem areas or industries, thereby assisting in the evaluation and formulation of policy measures. The various Federal Reserve banks, of course, have a responsibility for keeping posted on regional economic conditions and relating those conditions, in terms of both current standings and changes, to national developments—all with a view towards monetary policy considerations. Federal, state, and local governments also have an interest in regional economic analysis for fiscal and planning purposes. Business firms and private planning boards are also interested in regional economic data for meeting an assortment of needs.

MANUFACTURING— AN IMPORTANT SECTOR

The manufacturing sector plays an important role in determining the pace and direction of economic activity, both in the nation as a whole and in many individual regions. While only about one-third of the Gross National Product emanates directly from the manufacturing sector, effects of manufacturing activity are pervasive to the extent of influencing significantly employment and income in other sectors of the economy. In fact, the Federal Reserve Board's monthly index of industrial production, which is weighted 86.5 percent by manufacturing (the remainder being mining and utilities), largely defines the general business cycle and is one of the most carefully watched national economic indicators.

In the Fourth Federal Reserve District, which embraces a sizable chunk of the nation's heavy industrial complex, manufacturing occupies a pivotal role in major portions of the area's economy. One indication of the relatively larger role of manufacturing in the Fourth District than in the U.S. is that, in 1960, the manufacturing sector accounted for 35.5 percent of total employment in the Fourth District but only 27.1 percent of that in the nation.

Current measures of regional manufacturing activity, either in dollars or in physical terms, are difficult to derive. That is particularly the case for the highly diversified manufacturing activity in the Fourth District. In lieu of a "better" indicator, the production inputs of electric power—when properly adjusted for seasonal variations and for interindustry differences in use relative to output —can be used as a proxy for short-run changes in output or activity rates. The electric power indexes in this article were designed for that purpose.[3]

[3] See Appendix for a description of the sources and techniques of constructing the indexes.

CHARACTERISTICS OF ELECTRIC POWER AS AN ECONOMIC INDICATOR

While sole reliance on electric power as an indicator of manufacturing activity may not be appropriate for every industry, the data generally are superior to alternative labor information. The monthly flow of electric power, which embraces a major part of the production process in many industries, is reported for virtually the entire Fourth District.[4] By contrast, employment and man-hour data, which are available for only selected portions of the District, are reported for one week in the middle of the month. Moreover, the reported labor inputs include paid sick leave, paid vacations, and paid holidays.

One reason for using electric power as an indicator of regional manufacturing activity is that such data conform more closely to the amplitudes of business cycle fluctuations than do labor force data. Generally, the productivity of labor changes considerably more than the productivity of electric power over the business cycle. Adjustments for short-run fluctuations, and for long-run trends, in labor productivity are particularly difficult at the regional level. On the other hand, electric power requirements per unit of output do not vary appreciably during the short run. Seasonal variations in the overhead uses of electric power, such as lighting, heating, and air conditioning, can be minimized by adjustments on the electronic computer.

The major portion of electric energy is used for operating the instruments of production; changes in power input thus presumably reflect short-run adjustments in output. Of course, the changes may not be in equal proportion in every industry. In those industries that have been shifting to relatively more mechanized processes of production, electric power may have a long-run upward bias with respect to output. Where the electrification of industry per unit of output has been fairly stable for some time, electric power may have a long-run downward bias if there have been significant quality improvements in the products. Fortunately, these opposing biases tend to be offsetting in the composite indexes for total manufacturing, durable manufacturing, and nondurable manufacturing. Whether any long-run bias, on balance, remains in the District indexes cannot be determined. Therefore, a strict comparison of District indexes with the national Federal Reserve indexes is not necessarily valid. Despite this, however, the national production indexes shown in the following charts serve as a convenient frame of reference for examining cyclical fluctuations in the Fourth District's manufacturing sector.

TOTAL MANUFACTURING— U.S. AND FOURTH DISTRICT

Chart 1 shows annual averages of U.S. and Fourth District manufacturing activity during the 1957-64 period. The level of and year-to-year changes in the District electric power index with respect to the F.R.B. index of manufacturing are consistent with the relationships shown in the indexes of production worker man-hours.[5]

[4] Because many utilities practice "cycle billing," the power data do not cover a precise calendar month.

[5] Production worker man-hours for the Fourth District are represented by the total for Ohio and the Pittsburgh metropolitan area (approximately 90 percent of the entire District's manufacturing activity). The man-hour data are not weighted by the relative importances of major industry groups, and are not adjusted for increases in labor productivity.

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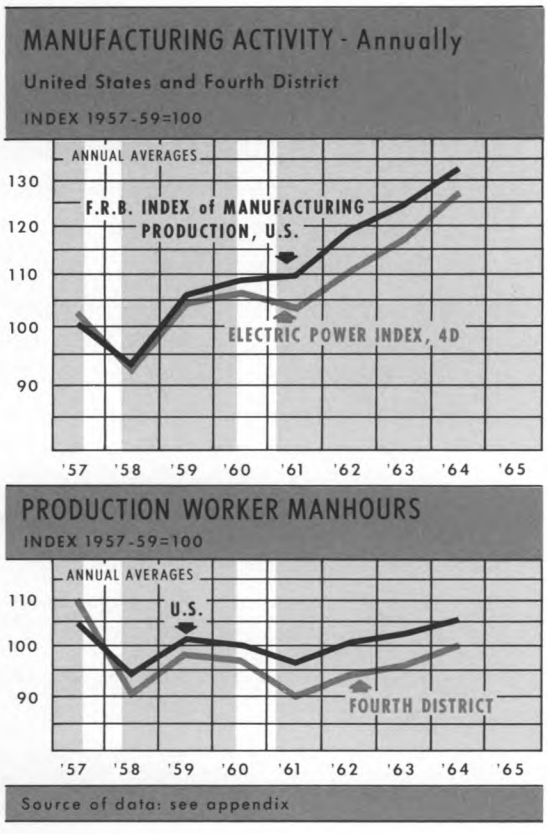

Two important points emerge from an inspection of Chart 1. First, the recessions of 1957-58 and 1960-61 affected District manufacturing more adversely than total U.S. manufacturing. Second, since the 1957-59 base period the manufacturing sector has grown relatively less in the District than in the U.S., although the gap apparently has narrowed somewhat since early 1963.

Short-run fluctuations in manufacturing activity, as illustrated in Chart 2, are more pronounced in the District than in the nation as a whole. The reason is that durable goods industries account for the major portion of cyclical swings in total manufacturing, while nondurable goods industries demonstrate a higher degree of stability over the short run. As shown in Table I, the weight of durables in total manufacturing is considerably larger in the Fourth District (73.4 percent) than in the U.S. (55.6 percent). The District's durable goods and nondurable goods industries, respectively, are listed in order of relative importance during the 1957-59 period. Note that the top five durable goods industries, both in the U.S. and in the District, belong to the metalworking group. But the primary metals industry has almost three times the weight in District manufacturing as it has in U.S. manufacturing. That fact is important in assessing this region's manufacturing activity because primary metals output encounters more volatile fluctuations than do other sectors.

To gain additional perspective on District manufacturing, the index points contributed by the primary metals industry have been deleted from the index for all manufacturing. The remaining index points, plotted in Chart 2, thus represent productive activity in all manufacturing exclusive of primary metals. It is evident that the deletion of primary metals from all manufacturing leaves a smoother series for the District — one that conforms more closely with the national F.R.B. index. During the 116-day steel strike, which began in July 1959, manufacturing activity ex primary metals declined considerably less than all manufacturing (in both the nation and the District). Shortages of steel materials caused production curtailments in other metalworking industries. (Those cutbacks are detailed in the charts for individual industry groups that appear later in this article.)

TABLE I

1957-59 Proportions of Value Added by Manufacturing

S.I.C.*		4th District	U.S.
	Manufacturing total	100.00%	100.00%
	Durable	73.38	55.61
	Nondurable	26.62	44.39
	Durable Manufactures		
33	Primary metals	22.08	8.04
35	Nonelectrical machinery	11.77	9.75
37	Transportation equipment	10.99	11.79
36	Electrical machinery	9.38	7.37
34	Fabricated metal products	9.02	6.21
32	Clay, glass, and stone products	6.07	3.46
39	Miscellaneous manufactures	1.29	1.75
25	Furniture and fixtures	1.19	1.78
38	Instruments and related products	.84	1.98
24	Lumber and wood products	.57	2.00
19	Ordnance	.18	1.48
	Nondurable Manufactures		
20	Manufactured foods and beverages	7.15	11.86
28	Chemicals and products	5.40	8.77
30	Rubber and plastics products	4.69	2.30
27	Printing and publishing	3.82	5.48
26	Paper and products	2.43	3.97
29	Petroleum products	1.06	2.28
23	Apparel products	1.04	4.15
22	Textile mill products	.47	3.35
31	Leather and products	.44	1.28
21	Tobacco products	.12	.95

*Standard Industrial Classification, U.S. Bureau of the Budget.

Source: See Appendix

Table II lists some magnitudes of change in the primary metals industry during recent years, and reveals the impact of those changes on total manufacturing. Between the first quarter of 1960 and the first quarter of 1961, sharp cutbacks in primary metals output contributed significantly to the overall declines in U.S. and District manufacturing activity. Although the F.R.B. index of manufacturing peaked in January 1960, followed by a peak in the District's index one month later, the nation's manufacturing output ex primary metals did not begin a sustained decline until July of that year.[6] In contrast, the District's manufacturing output ex primary metals began to decline in March 1960. Inclusive or exclusive of primary metals, however, manufacturing activity declined nearly twice as much in the District as in the nation during the 1960 recession.

Between the first quarter of 1961, and the first quarter of 1962, the strong recovery in

[6] Based on an examination of many economic time series, the National Bureau of Economic Research has designated May 1960 as the peak month of that phase of the business cycle.

TABLE II

Changes in Output Over Selected Periods*

Period Covered	All Manufacturing		Primary Metals		All Manufacturing ex Primary Metals	
	U.S.	4th D.	U.S.	4th D.	U.S.	4th D.
I Q '60— I Q '61	— 7.7%	—14.3%	—34.4%	—31.5%	— 5.1%	— 8.7%
I Q '61— I Q '62	+13.1	+15.8	+42.2	+36.9	+11.1	+10.7
I Q '62—III Q '62	+ 2.7	— 3.2	—14.9	—15.3	+ 4.2	+ 0.4
I Q '63— I Q '65	+16.2	+20.3	+31.4	+32.6	+15.0	+17.2

*U.S. output changes computed from F.R.B. production indexes. Fourth District output changes computed from electric power indexes.

Source: See Appendix

U.S. and Fourth District manufacturing activity was reinforced by significant gains in primary metals output. The latter was partly attributable to the stockpiling of steel inventories as a hedge against a possible strike in that industry. Following the steel labor settlement early in 1962, output of primary metals declined once again as excessive steel inventories were liquidated. The reduction in steel operations between the first and third quarters of 1962 retarded the moderate advance in the nation's manufacturing output, but caused a setback in the District's manufacturing activity. As seen in Chart 2, the District index for all manufacturing ex primary metals was on a virtual plateau during the first half of 1962.

A period of renewed expansion in manufacturing began in the first quarter of 1963, but was interrupted by another phase of steel inventory liquidation in the latter half of the year. Since the first quarter of 1963, gains in the District's manufacturing activity (including and excluding primary metals) have been slightly larger than those in the nation as a whole. In recent months, however, the expansion in manufacturing has slowed somewhat as steel production began to level off and motor vehicle production began to simmer down after the recoupment of strike-imposed losses during the fall of 1964.

DURABLE AND NONDURABLE MANUFACTURES

Chart 3 presents the contrast between the cyclically sensitive durable goods industries and the more stable nondurable goods industries. Although the general contours of the national and District indexes for durable manufactures resemble the patterns for all manufacturing, short-term fluctuations in output for the durables sector are larger than changes for all manufacturing.

The District's heavy orientation towards durable manufactures means that production, employment, and income in manufacturing are easily exposed to swings in business expenditures for producers' equipment and to the uncertainties of consumer outlays for durable goods. Conversely, the stabilizing influence of nondurable manufactures is relatively less important to District manufacturing.

Unlike durable manufacturing, the weight of the largest industry within the District's nondurables sector is not disproportionate to that industry's weight in the nation's nondurables sector. Moreover, the two largest nondurable goods industries, manufactured foods

TABLE III

1957-59 Shares of Value Added by Nondurable Manufacturing

Industry	U.S.	Fourth District
Foods	26.7%	26.9%
Chemicals	19.8	20.3
Foods and chemicals	46.5	47.2

Source: See Appendix

and chemicals, account for approximately the same shares of value added by nondurable manufacturing in both the U.S. and in the District. Accordingly, the close conformity of the District's index of nondurable manufactures to the F.R.B. index of nondurable manufactures is not surprising.

MAJOR INDUSTRIES IN THE FOURTH DISTRICT

The pace and direction of activity in the District's major durable and nondurable goods industries can be represented by fluctuations in the consumption of electric power. The

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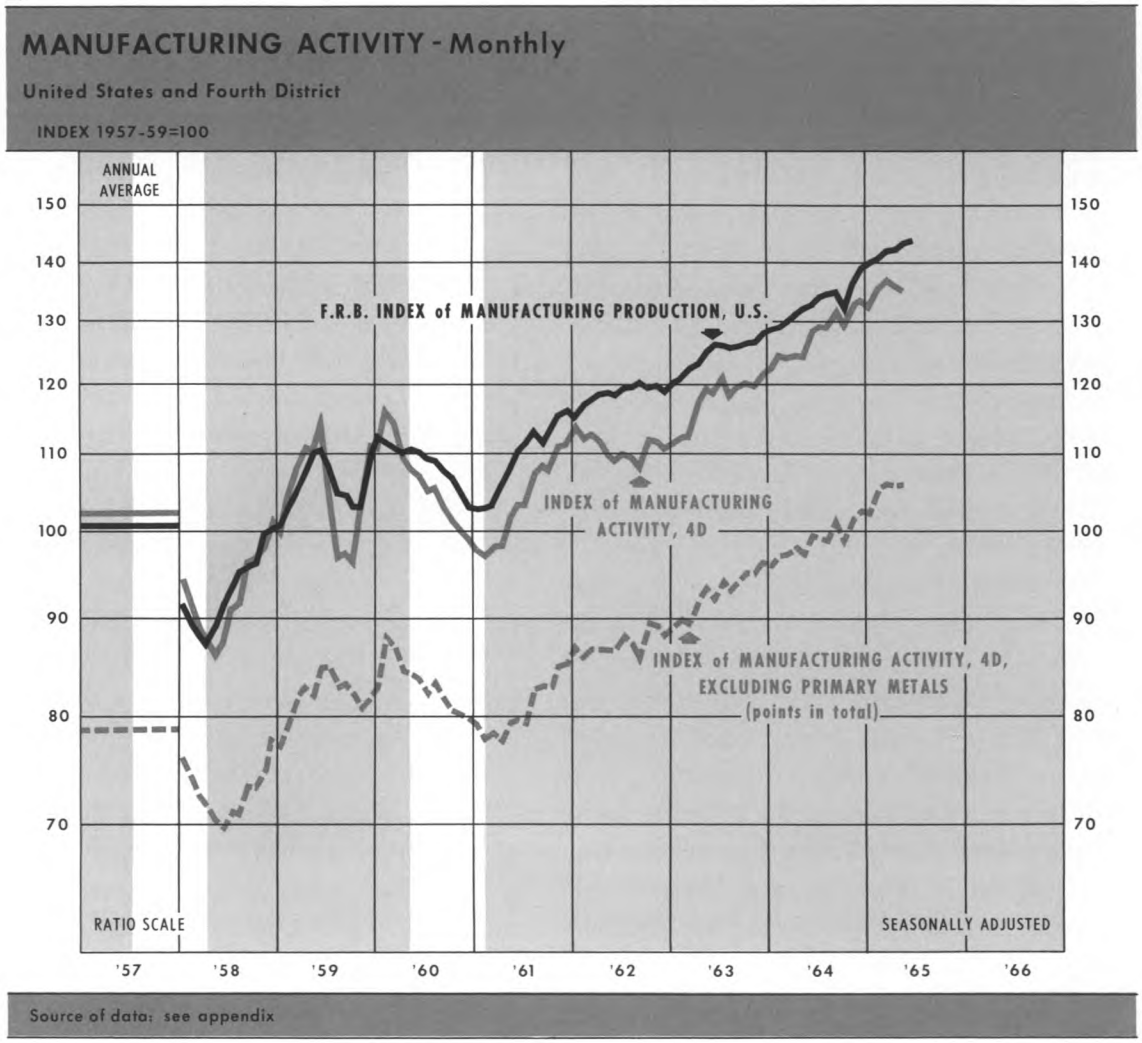

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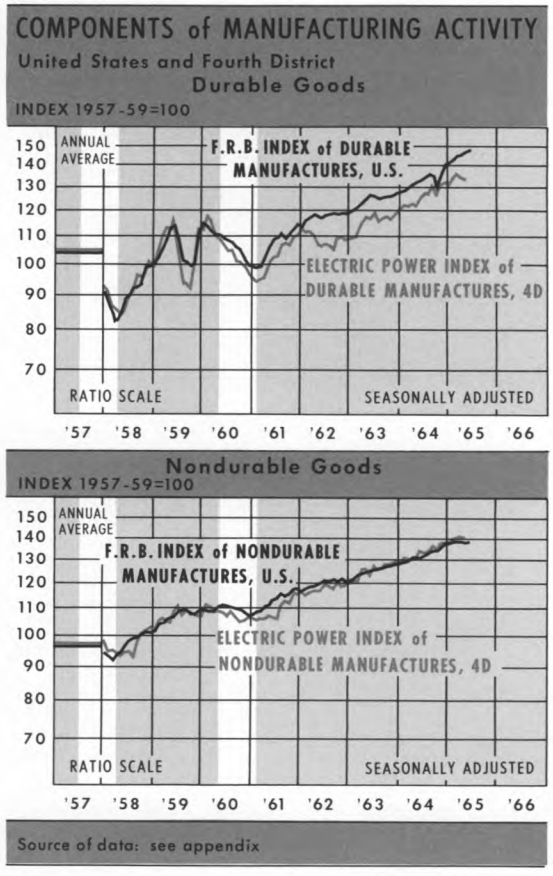

leading industry, primary metals, is subdivided into ferrous metals and nonferrous metals because of different characteristics of production. Ferrous metals production, which typically accounts for over four-fifths of the District's primary metals output, is clearly the most volatile portion of the industry. The sharp swings in the index for ferrous metals are attributable to the peculiarities of the basic iron and steel industry—namely, actual and anticipated steel strikes and alternating periods of artificially high and low output. The latter have been prompted by inventory stockpiling in anticipation of strikes and by subsequent inventory liquidations after labor settlements. The irregular use of power in electric arc furnaces also causes some erratic changes in the indexes. It should be emphasized that the foregoing factors have tended to distort the true seasonal patterns for ferrous metals during the 1958-65 period.

Operations in the District's second major industry, nonelectrical machinery, are primarily dependent upon business outlays for new equipment. From a relatively high level in 1957, activity in the nonelectrical machinery industry dropped sharply in 1958. As was the case for the nation's nonelectrical machinery industry, recovery in the District's counterpart began in the third quarter of 1958 and proceeded upward until mid-1959, when production began to ease during the steel strike. The 1960 recession in nonelectrical machinery activity began earlier and ended earlier in the District than in the nation. Although new orders for nonelectrical machinery (nationwide) began to rise late in 1960, the F.R.B. index for nonelectrical machinery did not begin to recover until April 1961. By contrast, the District's recovery appears to have been under way about one quarter earlier. After a year of sidewise movement in 1962, a sustained upswing began early in 1963 as previous business uncertainties faded and the investment climate improved.

The production of transportation equipment in the District includes not only motor vehicles and parts, but also aircraft and parts. As evidenced by the decline in electric power use from the 1957 level, activity in the industry was reduced sharply during the 1957-58 recession. The recovery that began in the third quarter of 1958 was interrupted by the

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MANUFACTURING ACTIVITY by MAJOR INDUSTRIES

Durable Goods

Fourth District

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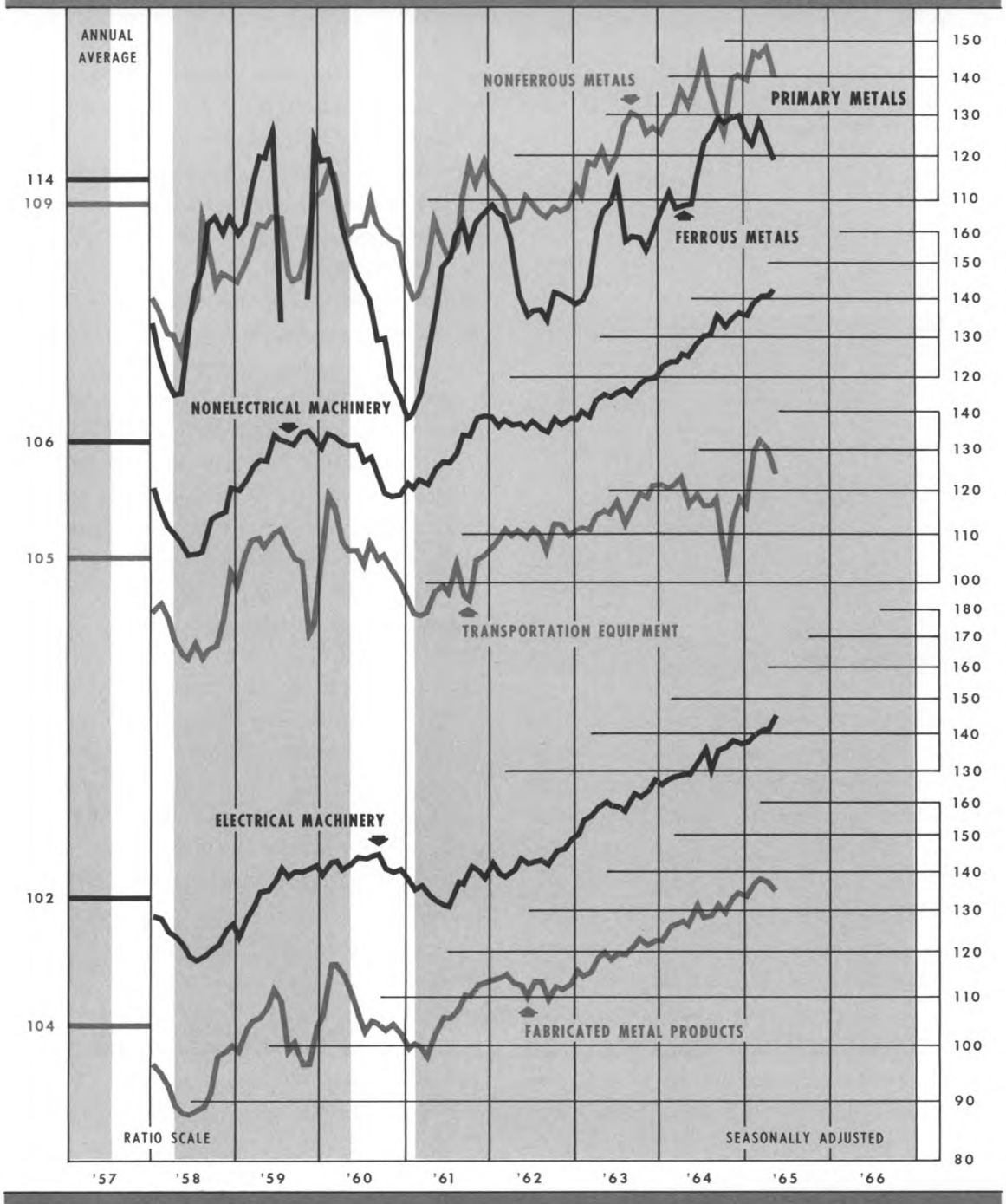


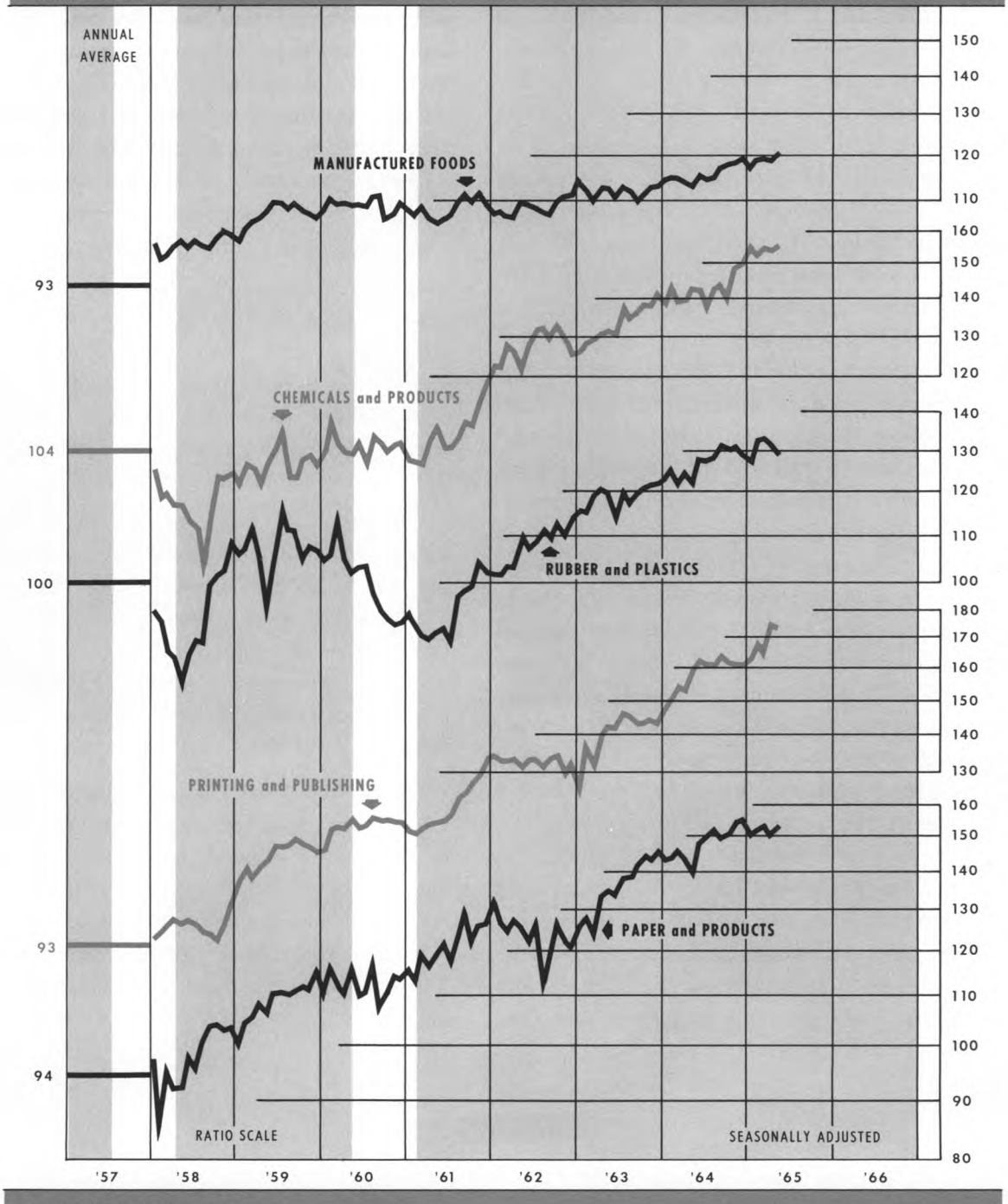
Source of data: see appendix

MANUFACTURING ACTIVITY by MAJOR INDUSTRIES

Nondurable Goods

Fourth District

INDEX 1957-59=100



Source of data: see appendix

steel strike of 1959. After output was recouped in the early months of 1960, production receded to a more sustainable pace for several months. The ensuing decline in the District index for transportation equipment, beginning in November 1960 and ending in March 1961, coincided with the decline in the F.R.B. index for transportation equipment. Since early 1961, activity in the industry generally has followed an upward trend, although there have been occasional periods of labor-management disputes causing production cut-backs. Particularly evident is the autumn 1964 strike in the auto industry and the rebound in production during the months that followed. Recent activity started to taper off in the second quarter 1965, probably reflecting largely the pace of automobile production.

Of the District's five largest durable goods industries, electrical machinery appears to be the least sensitive to short-run changes in business conditions. Compared with the performances of other metalworking industries in the District, output of electrical machinery apparently declined only moderately during each of the past two recessions. The upward course of expansion, which began in the third quarter 1961, was marked by hesitation during the first three quarters of 1962. But, beginning in October 1962, the expansion in electrical machinery activity was revived and has been maintained to date.

The pace of activity in the District's fabricated metal products industry encountered significant changes, as measured by the shifts in electric power inputs during the past two recessions and during the 1959 steel strike. In 1962, the index moved erratically downward. Beginning in early 1963, the industry recuperated from the generally unfavorable experience of the previous year and has followed a relatively steady upward course to date.

The District's most important nondurable goods industry, manufactured foods and beverages, is also the most stable industry over the business cycle, and is virtually recession-free. The moderate upward trend of electric power use in this industry, however, is below the average for all manufacturing or for nondurable manufactures.

On the other hand, growth of electric power utilization in the chemicals, paper, and printing industries is well above average. These industries also face a comparatively stable demand for their products, although the 1957-58 recession appears to have affected chemicals' activity more adversely than the other industries.

Rubber and plastics is one of the District's nondurable goods industries that is sensitive to changes in demand, partly because tire output depends largely upon the fortunes of the motor vehicle industry. Accordingly, since mid-1961, the rubber and plastics industry has enjoyed a vigorous upward phase of activity.

APPENDIX

The electric power data used to develop the series in this article were furnished by the following investor-owned utilities:

Ohio
- Cincinnati Gas & Electric Company
- Cleveland Electric Illuminating Company
- Columbus and Southern Ohio Electric Company
- Dayton Power and Light Company
- Marietta Electric Company
- Ohio Edison Company
- Ohio Power Company
- Toledo Edison Company

Western Pennsylvania
- Duquesne Light Company
- Pennsylvania Electric Company
- Pennsylvania Power Company
- West Penn Power Company

Eastern Kentucky
- Kentucky Power Company
- Kentucky Utilities Company
- Union Light, Heat, & Power Company

West Virginia (Panhandle region)
- Monongahela Power Company
- Wheeling Electric Company

The cooperation of those utilities, and of the reporting firms that generate portions of their electric power requirements, is gratefully acknowledged by the Federal Reserve Bank of Cleveland.

The electric power data for each of the 21 major industries (listed in Table I) were converted to 1957-59 index bases and seasonally adjusted by Census method X-9. The indexes for individual industries were aggregated into broader groupings with each industry weighted for importance according to its relative share of value added by manufacture, as shown in Table I. Value-added data for each Fourth District industry, derived from the *1958 Census of Manufactures,* were adjusted to 1957-59 proportions by dividing value added in 1958 by the 1958 annual average of the electric power index for the corresponding industry. This procedure assumes that the changes in value added between 1957 and 1958 and between 1958 and 1959 were proportionate to the change in electric power consumption over those periods.

The production indexes for U.S. manufacturing are computed by the Board of Governors of the Federal Reserve System. The production worker man-hour data used in Chart 1 were compiled from *Annual Surveys of Manufactures* and the *Census of Manufactures* for 1958 and 1963. The 1964 man-hour data, which were linked to the 1963 indexes, are from the Bureau of Labor Statistics, the Ohio Bureau of Unemployment Compensation, and the Pennsylvania Bureau of Employment Security.

Fourth Federal Reserve District