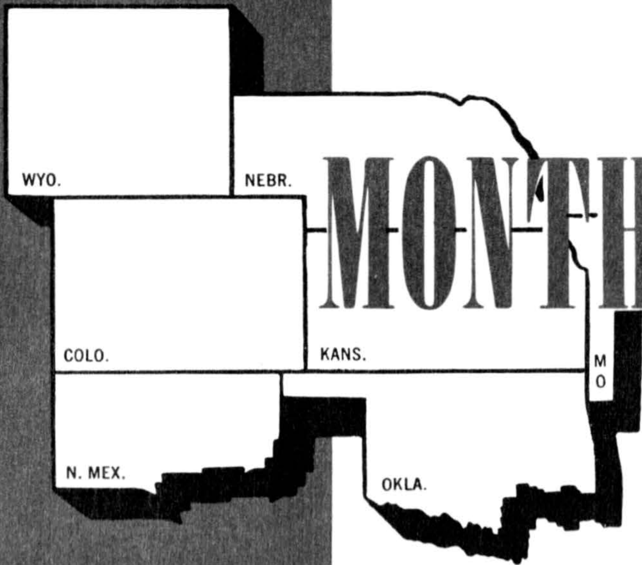
September-October 1965




# MONTHLY REVIEW

*In This Issue*



FEDERAL RESERVE BANK OF KANSAS CITY

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# INDUSTRIAL PRICES IN RECENT BUSINESS CYCLES

INDUSTRIAL PRICES are affected by such factors as costs, productivity, and demand, according to concepts and hypotheses suggested in recent economic literature. To illustrate some of these theories, this article presents statistical data taken from the three most recent business cycles (peak-to-peak, Cycle I: July 1953-July 1957; Cycle II: July 1957-May 1960; and Cycle III: May 1960 to date). Not only does this descriptive-comparative approach reveal how certain key variables have performed, but it also permits some interpretation of the behavior of those variables.

### RECENT BUSINESS CYCLES

| | Business Cycle Reference Dates | | |
|---|---|---|---|
| | Peak | Trough | Peak |
| Cycle I | July 1953 | August 1954 | July 1957 |
| Cycle II | July 1957 | April 1958 | May 1960 |
| Cycle III | May 1960 | February 1961 | — |
| | Duration in Months | | |
| | Contraction (trough from previous peak) | Expansion (trough to peak) | Cycle (peak from previous peak) |
| Cycle I | 13 | 35 | 48 |
| Cycle II | 9 | 25 | 34 |
| Cycle III | 9 | — | — |

SOURCE: National Bureau of Economic Research.

Much recent economic literature contends that the level of and changes in industrial prices largely reflect and are dependent on the costs incurred and margins received by producers of industrial commodities. For example:

> Of course prices will be influenced by costs according to every reasonable theory and empirical generalization about price formation, and the markup policy appears to be especially prevalent in oligopolistic markets which are so characteristic of U. S. industry. Demand too must enter into a complete explanation of price. When excess capacity exists, price shading and price reductions are most likely to occur for a given level of costs. Conversely, when demand is pressing against capacity, prices tend to rise for a given level of costs, although one would suppose that responses to cost changes would be greater than to demand shifts, because of primary reliance on costs in the pricing decision.[1]

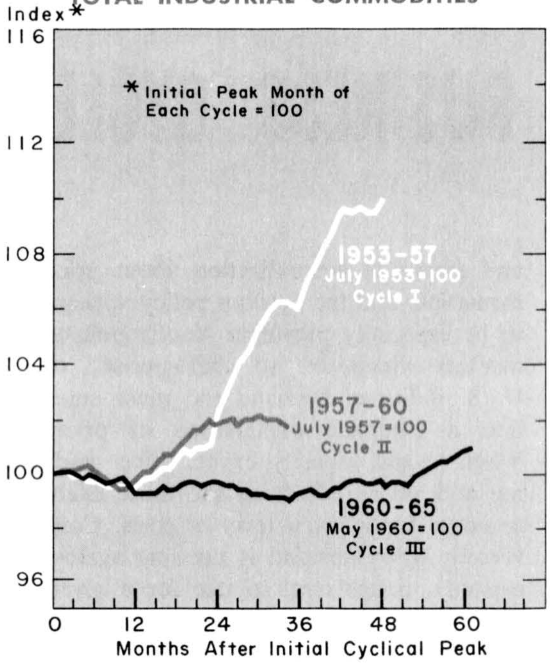
This article therefore will emphasize the comparison among cycles of data that are likely to be indicative of the behavior of industrial costs, markups, and demand.

### WHOLESALE PRICE INDEX FOR INDUSTRIAL COMMODITIES

The focal point of this discussion is the behavior of the wholesale price index for industrial commodities, shown in Chart 1, which includes both industrial products and industrial materials. In this chart, as in most other charts in this article, the initial month of each cycle is the base period for the index used for that cycle.

[1] Edwin Kuh, *Profits, Profit Markups and Productivity*, Study Paper No. 15, January 1960, Joint Economic Committee Study of Employment, Growth, and Price Levels, p. 82.

**Chart 1**
**WHOLESALE PRICE INDEX: TOTAL INDUSTRIAL COMMODITIES**




SOURCE: Board of Governors of the Federal Reserve System.

As may be seen in Chart 1, there is a sharp contrast between the stability of total industrial wholesale prices in the expansion phase of the current cycle and those of the other cycles. A more rapid steady climb occurred in the upswing of the 1957-60 cycle, and a sharp upward surge took place in the latter part of the 1953-57 cycle. A similar picture is given in Chart 2 by the behavior of the wholesale price of industrial products—consumer durable goods, consumer nondurables other than foods, and producers' finished goods.

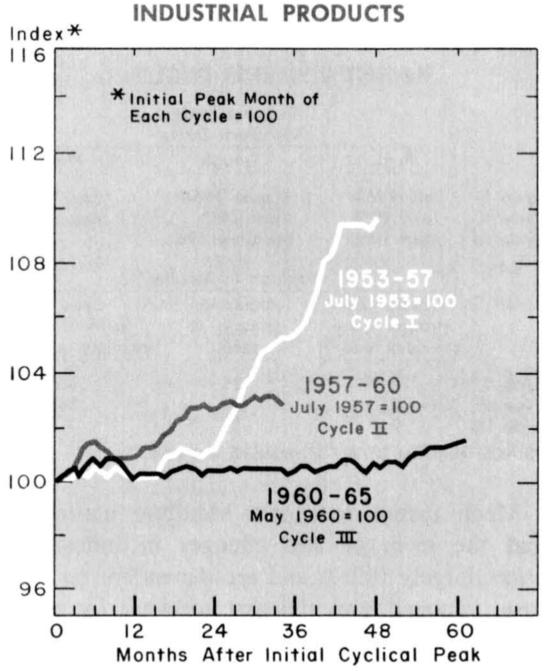
## COST OF NONLABOR INPUTS

### Sensitive Industrial Materials

Direct production costs of industrial output may be divided into materials costs and labor costs. The prices of some industrial materials are determined in markets where the forces of demand and supply are relatively free—leading to greater price flexibility than for other inputs. The wholesale price index of these sensitive industrial materials is, in fact, made up of subgroups and product classes from the overall index chosen primarily *because of* their price responsiveness to short-run changes in demands. This index series (composed of plant and animal fibers; certain textile products—cotton, wool, silk, manmade fibers, and others; leather; hides and skins; residual fuel oils; natural and reclaimed rubber; lumber; plywood; wastepaper; iron and steel scrap; and nonferrous metals) is therefore included as representative of those materials costs to industrial producers that are particularly responsive to short-run demand and supply changes.

The flexibility of these prices is evident in Chart 3. In all three cycles, prices of sensitive

**Chart 2**
**WHOLESALE PRICE INDEX: INDUSTRIAL PRODUCTS**




SOURCE: Board of Governors of the Federal Reserve System.

industrial materials declined in the recession and rose for two or three quarters after the trough. In Cycle I these prices then took off—reaching the level of the previous peak in about half a year and rising to 109 per cent of the initial peak level about a year later, at which time a rather sharp decline began. On the other hand, in Cycle III, sensitive industrial prices tended slightly downward for almost a year and a half after their recovery from the recession low. At that time, a gradual increase began, which carried these prices to the initial peak level only within the last few months. It might be suggested that the rapid increase in the costs of sensitive industrial materials from their recession low in Cycle I helped to pull up both the total industrial commodity price index (in which materials prices are included) and the index of finished goods prices, while their slight decline over the same stretch of Cycle III contributed to the relative stability of industrial prices at that time.

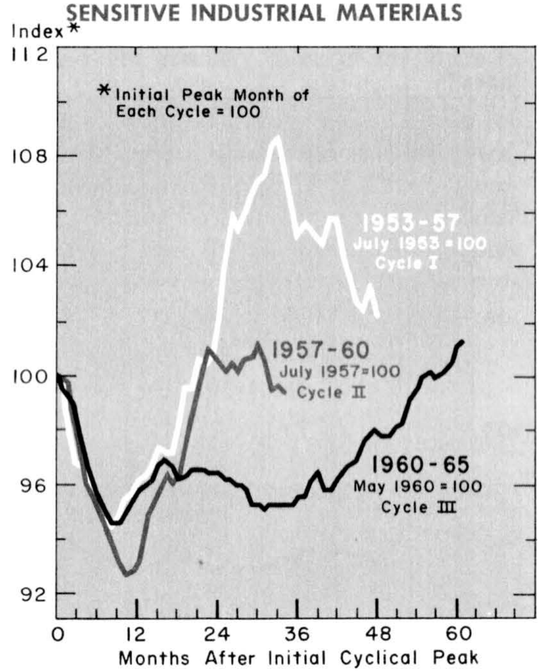
Not quite 3 years after the initial peak in both Cycle I and Cycle III, a definite change of direction occurred in the movement of sensitive industrial materials prices. In Cycle I they began a rather steep fall at that point, while in Cycle III a somewhat less steep rise commenced. Both trends continued throughout the charted periods. Total industrial and industrial product prices moved up with the sensitive materials prices in Cycle III. In Cycle I, after a brief, slight decline, total industrial prices resumed their upward path while sensitive materials prices continued to fall. On the other hand, industrial product prices continued to rise.

### Other Industrial Materials

The second kind of materials cost incurred by producers is the cost of materials not classified as sensitive—for which the wholesale price index appears in Chart 4. These goods, which in most cases involve more fabrication and

**Chart 3**

**WHOLESALE PRICE INDEX: SENSITIVE INDUSTRIAL MATERIALS**

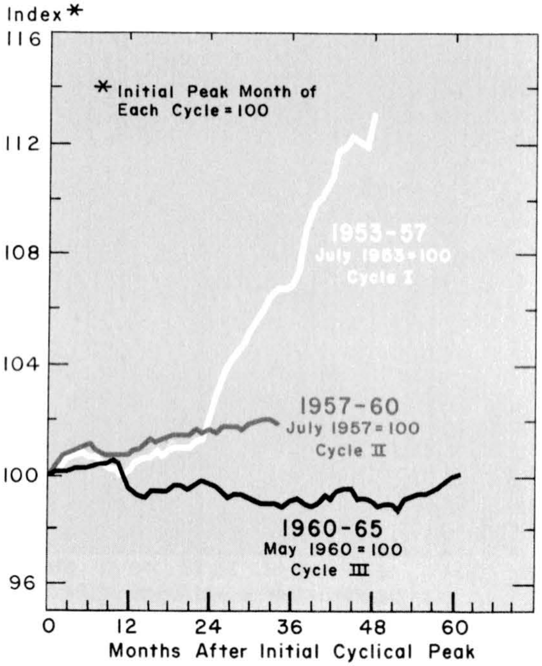



SOURCE: Board of Governors of the Federal Reserve System.

whose prices are less responsive to demand changes, generally flow between manufacturing industries. Included are a few crude materials such as crude oil, iron ore and coal; intermediate materials such as industrial chemicals, woodpulp and paper for nondurable goods manufacturing, and plastic materials, metal and metal products (other than nonferrous), and glass for durables manufacturing; components finished except for installation or assembly, such as tires and tubes, engines, wire and cable, motors, generators, and batteries, and some fabricated metal products; processed fuels and lubricants; containers—burlap, paper, metal and glass; and various supplies consumed in the course of production such as soap and light bulbs. The difference in movement of other materials prices between Cycles I and III is evident in Chart 4.

**Chart 4**

**WHOLESALE PRICE INDEX: OTHER INDUSTRIAL MATERIALS**




SOURCE: Board of Governors of the Federal Reserve System.

In Cycle I the direction, rate, and amplitude of movement of the prices of these other materials, of all industrial commodities, and of industrial products were similar throughout the cycle (Charts 1, 2, and 4). During the current cycle, industrial product prices never fell below their initial peak value, and tended to rise gently after the cycle's first year, until a somewhat more rapid increase began at the end of 1964. However, after the first year, prices of other industrial materials remained below their initial peak value until the summer of 1965—having also begun their rise at the end of 1964. This slight downward drift over more than 3 years of Cycle III's expansion period may be construed as a contribution toward the stability of both the total industrial commodities index and the industrial products index.

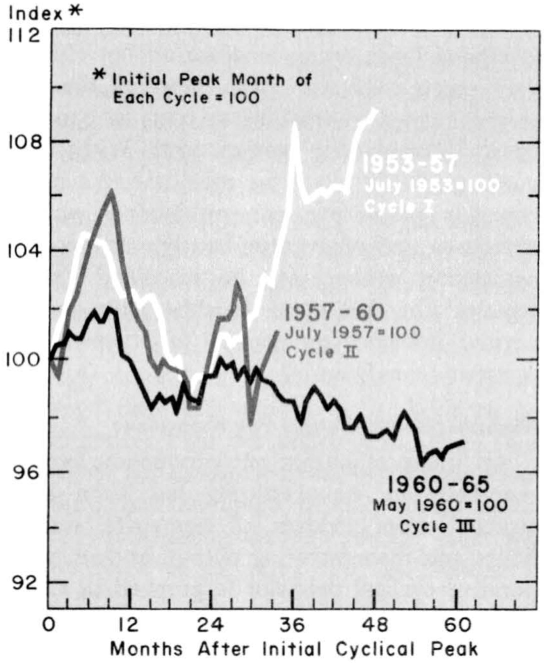
## UNIT LABOR COSTS

Unit labor costs are a very significant part of the direct costs of production in U. S. manufacturing, and their behavior is an important dynamic element in price developments.[2] The major contrast in the behavior of unit labor costs is between Cycles I and III. Throughout Cycle I, the index recorded a movement of a type sometimes characterized as expected. That is, unit labor costs rose in the early part of the contraction phase, fell in the late contraction, and continued to fall in the early months of the expansion, then rose sharply in the late expansion period. This sharp increase continued past the cyclical peak and through the contraction phase of Cycle II, as may be seen in Chart 5. The pattern traced by the index of unit labor costs in Cycle III is different in more ways than in its rise throughout the general cyclical contraction. After the reversal of their decline during the early expansion, unit labor costs moved generally upward with some monthly fluctuations—but only for about half a year. At that time, although the expansion continued and gathered strength, the index of unit labor costs in manufacturing commenced to move downward, and with some monthly fluctuations has continued to do so until the present, nearly 3 years later. As a result, unit labor costs in manufacturing in June 1965 were about 4 per cent below their May 1960 level, while at the final peak of Cycle I they were more than 9 per cent above that cycle's initial peak level.

[2] The unit labor cost series used in Chart 5 is that published in *Business Cycle Developments*, an index of a ratio whose numerator is the index of wages and salaries paid, plus supplements to wages and salaries (other monetary compensation of employees, composed mainly of employer contributions for social insurance and to private pension, health, and welfare funds), and whose denominator is the manufacturing portion of the Federal Reserve Index of Industrial Production.

**Chart 5**

INDEX OF LABOR COSTS PER UNIT OF OUTPUT: TOTAL MANUFACTURING




SOURCE: U. S. Department of Commerce, Bureau of the Census.

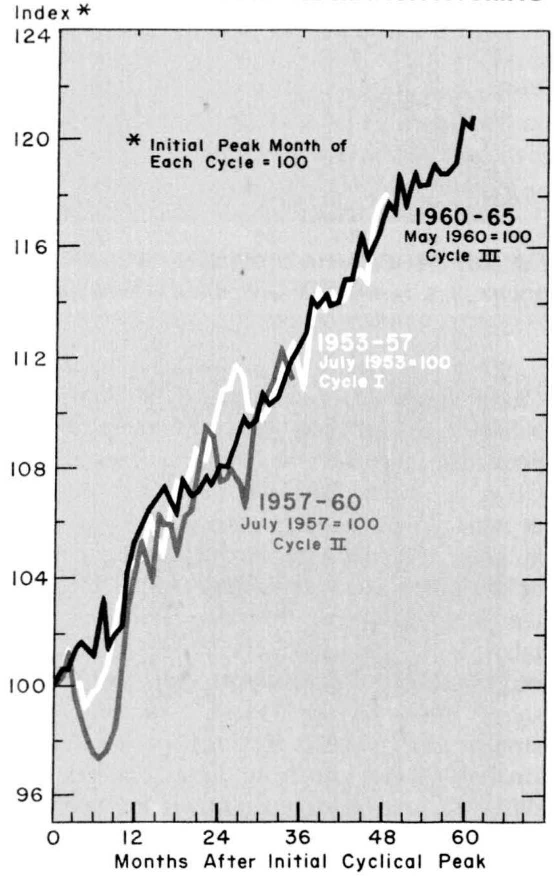
## OUTPUT PER MAN-HOUR AND AVERAGE HOURLY EARNINGS OF MANUFACTURING PRODUCTION WORKERS

The indicator of unit labor costs shown in Chart 5 is an index of aggregate wage and salary payments (including supplements) divided by total output. An alternative way of presenting this indicator is as a ratio of hourly payments to labor to output per man-hour. When the same data are used, such a formulation will give the same numerical results presented in Chart 5. However, the second formulation may be conceptually more useful and interesting because it permits a direct comparison of data on hourly earnings (or wage rates) and output per man-hour (or productivity), since the relationship between wage rates and labor productivity is deemed important in understanding price changes.

The data most readily available for formulating the wage rate-productivity relationship for the manufacturing sector on a monthly basis are not precisely those of the index in Chart 5. The differences are these. On the productivity side, the labor input data are for production workers only, not for all employees, and the productivity indicator is therefore simply the index of output per *production worker* man-hour (Chart 6). On the labor payments side, the wage rate indicator is also for production workers only (Chart 7).

**Chart 6**

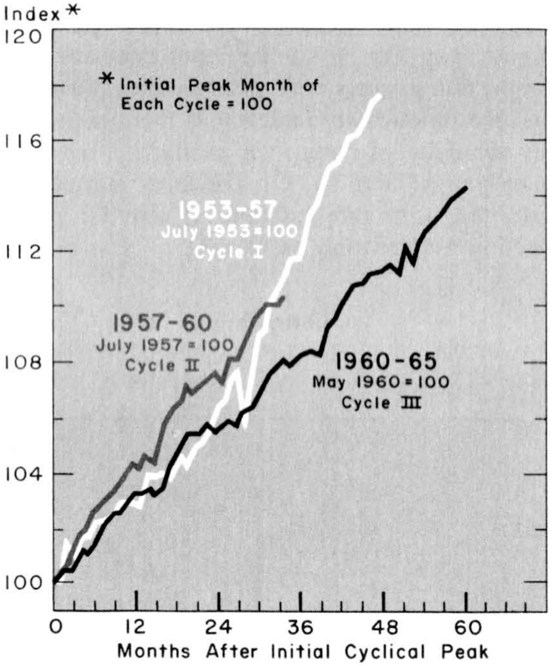
INDEX OF OUTPUT PER PRODUCTION WORKER MAN-HOUR: ALL MANUFACTURING




SOURCE: Board of Governors of the Federal Reserve System and U. S. Department of Labor, Bureau of Labor Statistics.

Chart 7

INDEX OF AVERAGE HOURLY EARNINGS OF PRODUCTION WORKERS: ALL MANUFACTURING




SOURCE: U. S. Department of Labor, Bureau of Labor Statistics.

When one looks at the series graphed in Charts 6 and 7, and attempts to relate the behavior of variables observed there to the performance of the unit labor cost indicator in Chart 5, several considerations must be kept in mind. First, the output measure is the same in both instances—the manufacturing portion of the index of industrial production. Second, the labor payments entering into the unit labor cost indicator of Chart 5 include wages, salaries, and supplements, while the series presented in Chart 7 includes only straight-time hourly earnings of production workers. Third, the labor input features also differ, for overhead (nonproduction) labor inputs are not included in Chart 6. Although the input of production worker man-hours over the cycle tends to vary directly with output, the input of overhead labor (management, clerical, and sales personnel) generally does not. During recessions the employment of nonproduction workers declines very slightly. Overhead labor costs therefore do not change very much over the cycle; most of the observed change in total labor costs is concentrated in production worker costs. With these qualifications in mind, the comparative cyclical behavior of output per production worker man-hour and of average hourly earnings per production worker may be examined, for it remains true that these variables have an important influence on over-all labor costs and prices in manufacturing.

### Manufacturing Output Per Man-Hour

An index of output per production worker man-hour in manufacturing has been constructed from indexes of aggregate weekly hours and manufacturing output, and its comparative cyclical behavior is graphed in Chart 6. From this chart, it appears that the change in output per production worker man-hour in manufacturing was quite similar in each of the three cycles.

### Wage Rate

The wage rate component of labor costs in Chart 7 is the Bureau of Labor Statistics' series entitled, "Index of Average Hourly Earnings, Excluding Overtime and Interindustry Shifts, for All Manufacturing." Average hourly earnings are not the same thing as wage rates.[3] Neither does this earnings series measure actual labor costs of employers, for wage supplements to production workers and all payments to nonproduction workers are excluded. Adjustment of the series to exclude premium overtime pay (but not holiday or other pre-

[3] "Earnings are the actual return to the worker for a stated period of time, while rates are the amounts stipulated for a given unit of work or time." U. S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings Statistics for the United States, 1909-64*, December 1964, p. 656.

mium pay) does, however, make it more like a wage rate indicator.

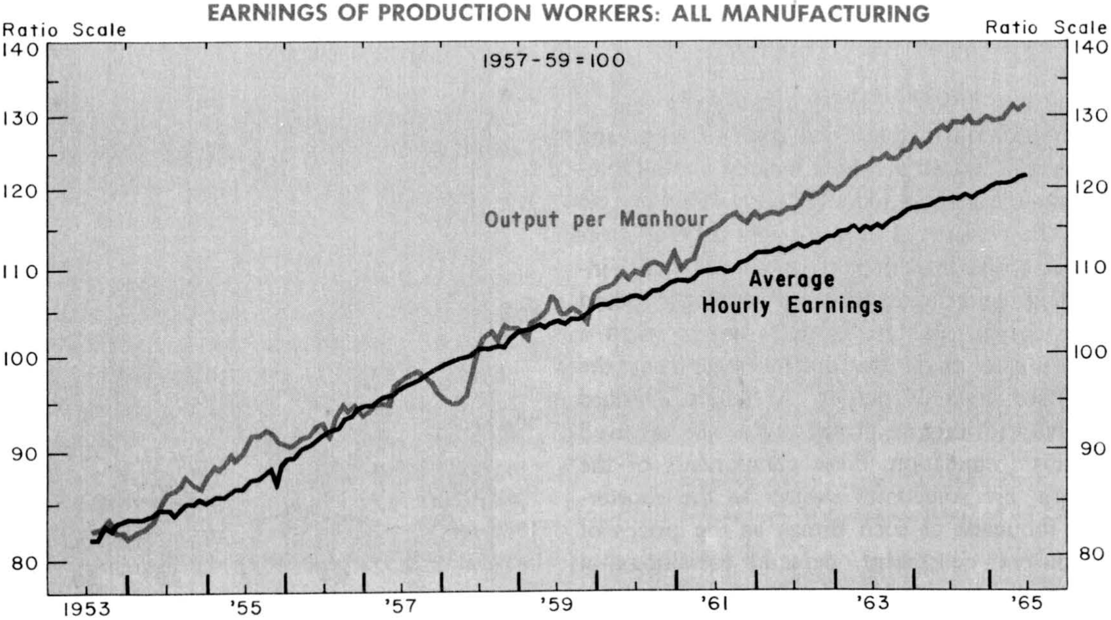
The tendency of wage rates to move steadily upward through time is evident in the behavior of the straight-time earnings series. The movement of average hourly earnings was roughly similar for about the first 2½ years of all three cycles, and for a longer time in the case of Cycles II and III. The behavior of wages in Cycle I, however, diverged markedly after the middle of the third year. In that cycle, straight-time average hourly earnings reached a final peak level nearly 18 per cent above the initial peak, while in Cycle III—already more than a year longer than Cycle I—wage rates still average only about 14 per cent greater than the initial peak level. Thus, although the secular increase in average hourly earnings has continued virtually uninterrupted since 1953, giving current average rates well above those of 12 years ago, the increase in the period 1960 to 1965 has been much milder than that of 1953 to 1957.

### COMPARISON OF WAGES AND PRODUCTIVITY

Although the series used here may not be those best suited for the purpose, a comparison of the rates of change in the indexes of output per production worker man-hour and of straight-time average hourly earnings of production workers in manufacturing may yield some useful information. When the monthly data are plotted on a semilogarithmic chart (Chart 8), the existence of some cyclical movement in the output per man-hour series and its almost complete absence in the earnings series is evident. The comparison further shows that from, say, early in 1960 to date, the rate of increase of labor productivity has been well above that of wage rates. The numerous ups and downs in output per man-hour in Cycle

**Chart 8**

**INDEXES OF OUTPUT PER PRODUCTION WORKER MAN-HOUR AND OF AVERAGE HOURLY EARNINGS OF PRODUCTION WORKERS: ALL MANUFACTURING**




SOURCE: Board of Governors of the Federal Reserve System and U. S. Department of Labor, Bureau of Labor Statistics.

II make the comparison difficult for that period, while in Cycle I the rate of increase in earnings appears to have outstripped that of productivity for the roughly 18 months from the autumn of 1955 to the spring of 1957.

Over the nearly 12 years included in these three cycles, the index of output per production worker man-hour increased by about 59 per cent, while the index of average hourly earnings of production workers increased by nearly 48 per cent. On the basis of crude freehand trend estimates, it appears that for the entire period the rate of increase in output per man-hour was in the range of 4 to 4½ per cent per year, while that of average hourly earnings was in the range of 4 to 4¼ per cent per year from July 1953 to the first half of 1959 and in the range of 2½ to 3 per cent per year since the first half of 1959. A gap between productivity and wage rate increases of roughly the magnitude indicated since 1959 or 1960 would be expected to have a felicitous influence on labor costs and total production costs, even though the behavior of overhead labor costs and wage supplements might well weaken the total effect on prices.

### MARGINS ADDED TO COSTS

In addition to the direct costs of labor and materials, industrial prices include another element—the margin added to costs. This margin may be considered as a flexible markup over direct costs, made up of overhead costs (including depreciation charges) somehow spread over output, and profits sufficient to yield a target rate of return on investment at the standard level of output. Although standard output and longrun profit targets are involved in this formulation, these components of the margin are sometimes subject to the shorter-run influence of such things as the prices of producers' equipment, demand conditions in the individual product market and in the aggregate, a particular firm's reactions to the behavior of its oligopolistic rivals, and other company goals, such as its market-share policy.

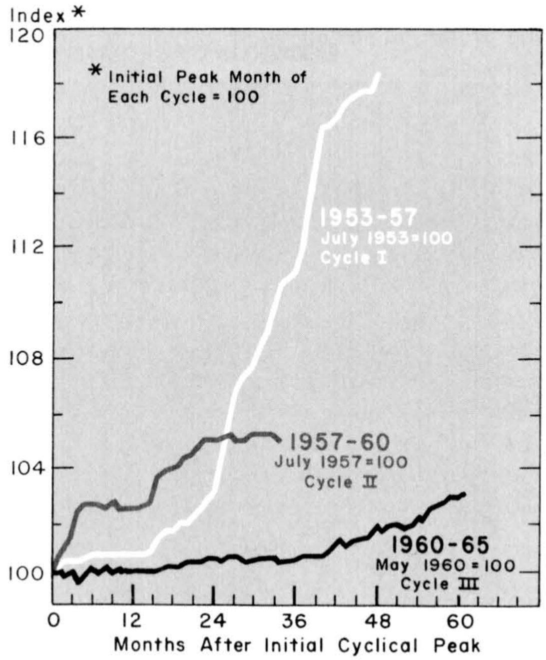
#### Wholesale Prices of Producers' Equipment

The importance of rapidly rising prices of capital goods has been accorded a significant role in nearly all theories or explanations of the inflationary process. The sharply contrasting behavior of the wholesale prices of producers' equipment in the three cycles may be seen in Chart 9. These are the prices of capital goods, including primarily motor vehicles, machinery—such as metal working, electrical, and general purpose machinery—and equipment.

The outstanding features of Chart 9 are the rapid pace of the 18 per cent rise in the price of producers' equipment over the course of Cycle I and the relatively quite slow increase

**Chart 9**

**WHOLESALE PRICE INDEX: PRODUCERS' EQUIPMENT**




SOURCE: Board of Governors of the Federal Reserve System.

in capital equipment prices in Cycle III. Comparison with Chart 1 quickly shows the similarity of movement of producers' equipment prices and of all industrial commodities prices in Cycle I and again in Cycle III. Although some of the similarity is certainly accounted for by the inclusion of producers' equipment prices in the total industrial commodities price series, it appears very likely that the behavior of capital goods prices is a definite determining influence on movements in the general price level—whatever one thinks is the appropriate explanation of the inflationary process. It is also true that prices of producers' equipment are a part of the industrial products index, and that capital goods prices are influenced by the prices of industrial materials.

### Demand Effects

*Ratio of Unfilled Orders to Shipments.* One difficulty in seeking to identify the influences of changes in demand on changes in industrial prices is the necessity for having an operational definition of demand. Since it is excess demand, in the aggregate or in particular industries, that is of importance in inflationary price increases, a working indicator or measure of that concept is especially important. Although no precise measure has been developed, one possible indicator is the ratio of unfilled orders to shipments in manufacturing.

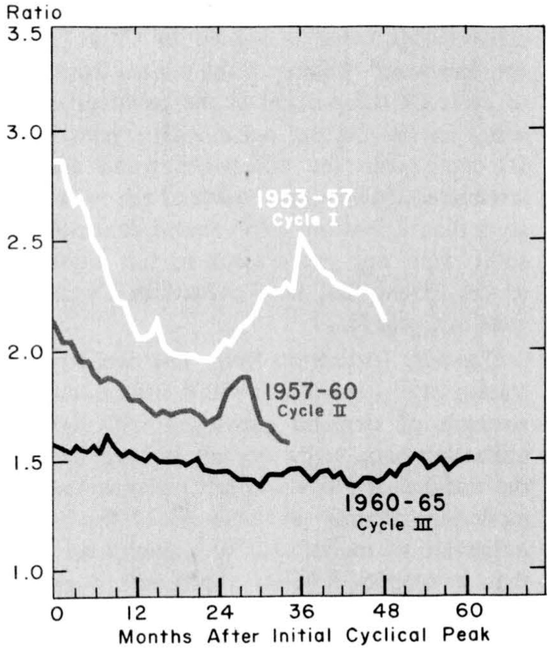
Cyclical movements in unfilled orders usually conform to those in general business activity, becoming very high in the late stages of business expansions as buyers continue to place large amounts of new orders. Since capacity utilization rates are generally high at the same time, output growth does not keep pace with the growth in orders and the ratio of unfilled orders to shipments increases (i.e., average delivery periods lengthen). Consequently, as backlogs change, not only absolutely but also in relation to shipments, cyclical movements of the unfilled orders-shipments ratio also appear.

The ratio of unfilled orders to shipments may therefore be used as an indicator of excess demand, in the sense of demand pressure on available industrial capacity, with sharp and sizable increases in the ratio showing the presence of excess demand. Price increases are an alternative to backlog accumulation, or producers may mix these two possible means of adjusting to excess demand. Price change and backlog change have been found to be positively correlated in major manufacturing industries.[4]

The ratios of unfilled orders to shipments for all of manufacturing in Cycles I, II, and III are presented graphically in Chart 10.

**Chart 10**

**RATIO OF UNFILLED ORDERS TO SHIPMENTS: ALL MANUFACTURING**




SOURCE: U. S. Department of Commerce, Bureau of the Census.

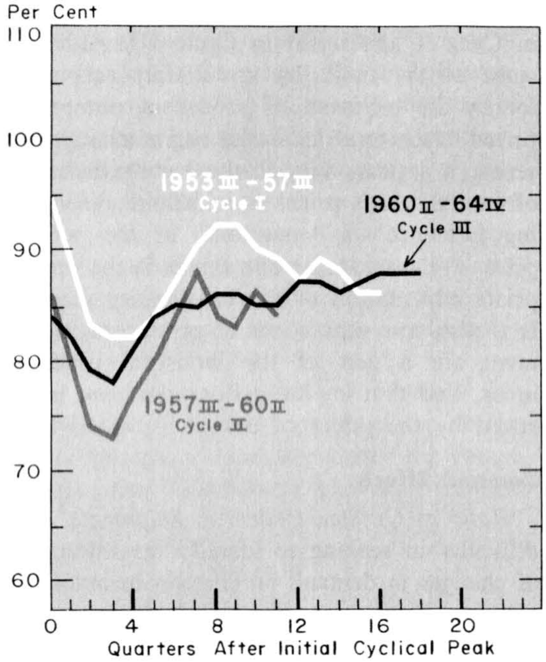
[4] Victor Zarnowitz, "Unfilled Orders, Price Changes, and Business Fluctuations," *Review of Economics and Statistics*, November 1962, p. 392.

Several comments may be made concerning these series. First, the especially sharp decline in the ratio during the contraction period of Cycle I is undoubtedly related to the preceding rapid buildup in orders as a result of the military procurement and private hoarding brought on by the Korean War. Second, the cyclical fluctuation in the ratio is apparent in each of the three cycles, although the degree of such movement does lessen between Cycles I and II, and again between Cycles II and III. The size of the ratio declines past the general cyclical trough, begins to rise after the expansion is well under way, and (in Cycles I and II) started to fall several months before the second cyclical peak was reached. Third, in addition to the attenuation in its cyclical movement, the ratio of unfilled orders to shipments has been following a downward trend throughout the period that spans the three cycles. This trend is shown in Chart 10 by the downward shifting of the curves from cycle to cycle. A comparison of the behavior of this series in the current cycle with Cycles I and II, even given the downward trend and the attenuated cyclical movement of the ratio, suggests that at midyear 1965 excess demand pressures were not yet present in this expansion to the extent that they existed in Cycle I or even in Cycle II.

*Capacity Utilization Rate.* The capacity utilization rate is another possible indicator of the strength of demand pressures, although the utilization rate series do not behave just like the unfilled orders-shipments ratio series. The moderate increase in Cycle III of the rate of utilization of manufacturing capacity was such that it remained below the Cycle I rate at similar points in the cycle until the beginning of 1964 (Chart 11). The Cycle III initial peak rate was below the initial peak levels of the other two cycles, and the decline during the contraction period was slower and less deep. Upon turning upward, the utilization

**Chart 11**

**PER CENT RATE OF CAPACITY UTILIZATION: ALL MANUFACTURING**




SOURCE: Peter Gajewski, "Manufacturing Capacity Measures and Current Economic Analysis," American Statistical Association, 1964 Proceedings.

rate in the current cycle rose for roughly half a year at a pace about equivalent to those of Cycles I and II. Then it leveled off and began the relatively gentle climb that has continued to at least the end of 1964. On the basis of these two measures, the pressures that excess demand can bring to bear upon industrial prices do not seem to have appeared yet in the current expansion.

The relatively restrained performance of the capacity utilization rate in the present cycle, compared with the wider and sharper movements during the two earlier cycles, implies the existence so far during this cycle of a more balanced increase in output and capacity. Following a comparatively brief and mild recession, output has expanded relatively slowly and relatively smoothly, permitting the avoidance of many of the imbalances that more violent changes often bring.

## CONCLUSION

Various empirical data, selected and presented from the standpoint of a particular framework for viewing the industrial pricing process, have been used to describe and compare the performance of the manufacturing sector during the last three business cycles. From this confrontation of the framework with the selected data, it appears that mixed models of the inflationary process—which include cost, markup, and demand elements—provide a worthwhile approach to an explanation and understanding of price level changes. In the course of this discussion, some support has perhaps been provided for the following contentions:

1. Cost and demand factors are both important for industrial price changes.
2. Both labor costs and costs of materials play important parts in price changes.
3. Demand conditions affect industrial prices via their impact on sensitive materials prices and on the margins added to direct costs by industrial producers.
4. The relationship between labor productivity and wage rates has a significant influence on industrial prices through the medium of unit labor costs.
5. Prices of producers' equipment are of real consequence in an explanation of over-all industrial price changes.

All of these elements enter into an understanding of why price movements in the current cycle have been significantly different from those experienced in the cycle of 1953-57.

# A New Regional Indicator: Electric Power Consumption

REGIONAL analysis is frequently hampered by data limitations. Yardsticks comparable to gross national product and national income are not readily available for subareas of the Nation, and often for want of a statistic, an answer is lost; for want of an answer, the pertinent question is lost. While systems of regional income and product accounts are the subject of a growing body of literature, attention also has been directed toward devising regional counterparts to the Federal Reserve Board's Index of Industrial Production.

The industrial production index reflects changes in the physical output of the Nation's mines, manufacturing establishments, and utilities. In some industries, monthly output changes are measured indirectly by using man-hour inputs adjusted for productivity change. To supplement the man-hour data, the Federal Reserve System has been collecting monthly figures on the consumption of electricity by industry. These electricity statistics for some industries may prove to be more accurate indicators of output than the presently used man-hour series, although neither input series is clearly superior to the other in all cases, and they are probably best used in conjunction with each other.

Monthly statistics on electric power consumption by the Tenth Federal Reserve District's mining and manufacturing establishments have been reported regularly by District utilities since 1959. This wealth of detail is helpful in analyzing District business conditions.

In this article, various dimensions of growth in the Tenth District for the 1959-64 period are compared with those for the national economy. First, the period is appraised in terms of two readily available measures of economic activity for subareas of the Nation—income and employment. Next, attention is focused on the performance of the manufacturing and mining sectors, in order to provide the background for interpreting the electric power series. Finally, input data—man-hours and electric power consumption—are combined to provide guidelines for the approximation of District industrial production.

## INCOME AND EMPLOYMENT

Table 1 presents annual relative changes in personal income, nonfarm wage and salary employment, and nonfarm wage and salary disbursements for the District and the United States. Because of the difficulty in obtaining approximate coverage of the District from statewide series, totals for six states (Colorado, Kansas, Nebraska, New Mexico, Oklahoma, and Wyoming) and for seven states (the six plus Missouri) are presented. Since the District does not include all of Missouri, New Mexico, and Oklahoma, both totals reflect some non-District activity, but the problem is particularly acute in the case of Missouri. While the District part of Missouri covers a relatively small section of the state, it nonetheless includes one of the District's more important manufacturing centers—the Missouri portion of the Kansas City metropolitan area, as well as St. Joseph and Joplin. Where seven-state statistics are used, they give a great deal of weight to Missouri developments, only a portion of which

**Table 1**
**INCOME AND EMPLOYMENT GROWTH**
**1959-64**

| | 1959-60 | 1960-61 | 1961-62 | 1962-63 | 1963-64 | Average Yearly Change 1959-64 |
|---|---|---|---|---|---|---|
| | (In per cent) | | | | | |
| **Personal Income:** | | | | | | |
| Six District States | 5.8 | 4.6 | 5.3 | 3.2 | 3.9 | 4.6 |
| Seven District States | 4.8 | 4.3 | 5.3 | 3.8 | 4.3 | 4.5 |
| United States | 4.6 | 4.0 | 6.0 | 4.9 | 5.7 | 5.0 |
| **Nonfarm Wage and Salary Employment:** | | | | | | |
| Six District States | 2.2 | 1.4 | 2.1 | 1.5 | 1.8 | 1.8 |
| Seven District States | 1.7 | 0.4 | 2.0 | 1.7 | 2.0 | 1.6 |
| United States | 1.7 | −0.4 | 2.8 | 2.0 | 2.7 | 1.8 |
| **Nonfarm Wage and Salary Disbursements:** | | | | | | |
| Six District States | 5.3 | 4.7 | 6.1 | 4.1 | n.a. | 5.0* |
| Seven District States | 4.6 | 3.7 | 6.0 | 4.8 | n.a. | 4.8* |
| United States | 5.2 | 2.7 | 6.7 | 5.2 | n.a. | 5.0* |

n.a. Not available.
*Average for 1959-63.

NOTE: The seven District states include Colorado, Kansas, Missouri, Nebraska, New Mexico, Oklahoma, and Wyoming. The six-District-state total excludes Missouri, a portion of which is not within the Tenth District. Portions of New Mexico and Oklahoma also lie outside the Tenth District, but the inclusion of these areas in the District total is felt to be of minor importance.

SOURCE: Income and wage and salary disbursements data are from U. S. Department of Commerce, Office of Business Economics; employment figures are from U. S. Department of Labor, Bureau of Labor Statistics, and individual state employment security agencies.

occurs in the District.

Personal income growth in the District between 1959 and 1964 has averaged somewhat less than the 5 per cent per year registered by the Nation. For the first two periods shown (1959-60 and 1960-61), the relative increase in District personal income exceeded the national rates. The reverse was true of the yearly changes recorded between 1961 and 1964.

Departures from the national pattern of personal income growth are often attributable to the differential impact of changes in farm income. Since agricultural income for the Nation has remained relatively unchanged during the 1960-64 period, it is not surprising that in the Tenth District, where agriculture is relatively more important, recent income gains fall somewhat short of the national increases. In addition, farm income has grown even more slowly in the District than for the Nation as a whole, thereby accentuating the difference in District personal income growth.

In order to focus on the nonagricultural aspects of the District economy, changes in nonfarm wage and salary disbursements—a component of personal income—and nonfarm wage and salary employment are also presented in Table 1. From these data, it is clear that nonagricultural developments in the District more closely approximate the national experience in terms of the average yearly changes for the 1959-64 period. Employment figures for the six District states and the United States show equal average yearly rates of change of 1.8 per cent. In terms of nonfarm wage and salary disbursements, the average gains also are equal at 5 per cent per year for the 1959-63 period. When Missouri is included, both nonfarm average yearly changes are slightly lower.

However, when viewed annually, the differences between District and U. S. growth rates in the nonagricultural sector fall into the two distinct phases referred to earlier in discussing personal income growth. District figures for all three variables in the first two periods compare favorably[1] in nearly all cases with the national changes, while the more recent period shows the District lagging. The dampening influence of agriculture on personal income was mentioned earlier and a closer look at the nonagricultural sector reveals a similar adverse shift—quite pronounced in the case of mining, while less consistent in the manufacturing sector—in the District position relative to the Nation.

## MANUFACTURING AND MINING

Table 2 presents yearly changes in selected manufacturing and mining variables for the

[1] A favorable comparison for the District is defined as a greater relative increase, a smaller relative decline, or an increase in contrast to a national decline.

**Table 2**
**GROWTH IN MANUFACTURING AND MINING**
**1959-64**

| | 1959-60 | 1960-61 | 1961-62 | 1962-63 | 1963-64 | Average Yearly Change 1959-64 |
|---|---|---|---|---|---|---|
| | (In per cent) | | | | | |
| **Manufacturing Employment:** | | | | | | |
| Six District States | 1.6 | 0.6 | 2.4 | −0.9 | 2.2 | 1.2 |
| Seven District States | 1.0 | −1.9 | 2.8 | 0.4 | 2.0 | 0.9 |
| United States | 0.7 | −2.8 | 3.2 | 0.9 | 1.8 | 0.8 |
| **Mining Employment:** | | | | | | |
| Six District States | −2.3 | −2.6 | −4.7 | −3.6 | −1.5 | −2.9 |
| Seven District States | −2.4 | −3.0 | −5.0 | −3.2 | −1.0 | −2.9 |
| United States | −2.7 | −5.6 | −3.3 | −2.3 | 0 | −2.8 |
| **Value Added in Manufacturing:** | | | | | | |
| Six District States | 5.3 | 3.3 | 8.5 | 5.9 | n.a. | 5.8* |
| Seven District States | 5.0 | 0.5 | 9.1 | 4.4 | n.a. | 4.8* |
| United States | 1.7 | 0.1 | 9.2 | 6.2 | n.a. | 4.3* |
| **Value of Mineral Production:** | | | | | | |
| Six District States | 4.8 | 2.8 | 0.8 | 3.0 | n.a. | 2.8* |
| Seven District States | 4.4 | 2.2 | 0.8 | 3.0 | n.a. | 2.6* |
| United States | 3.7 | 1.1 | 3.3 | 4.2 | n.a. | 3.1* |

n.a. Not available.
*Average for 1959-63.

NOTE: Value added in manufacturing is a measure of the market value of final manufactured products less the cost of materials from outside the manufacturing sector, while value of mineral production is a measure of the current dollar value of mine shipments, sales, or marketable production (including consumption by producers).

SOURCE: Employment data, see Table 1; value added in manufacturing data from U. S. Department of Commerce, Bureau of the Census; value of mineral production data from U. S. Department of the Interior, Bureau of Mines.

District and the Nation. The employment data indicate relative changes in labor inputs while the value added in manufacturing and value of mineral production figures indicate changes in the value of output. When the District manufacturing and mining data are compared with their national counterparts, the District rates for 1959-60 and 1960-61 again compare favorably with those for the United States, and the District 1961-62 and 1962-63 rates are less than those for the Nation. The 1963-64 employment figures suggest a possible improvement for District manufacturing and a continued decline for District mining.

Differences between District and national average yearly rates are more pronounced in manufacturing than in mining, particularly when the six-state total is used. The average yearly six-state employment and value added in manufacturing gains of 1.2 and 5.8 per cent, respectively, contrast with national rates of 0.8 per cent in employment and 4.3 per cent in manufacturing value added. For the seven-state total, the average yearly manufacturing rates of 0.9 per cent and 4.8 per cent more closely approximate their national counterparts. In mining employment, the District and the national average yearly declines are similar, but the value of mineral production in the District has tended to lag behind that of the Nation in recent years. Thus, the average gain in District value added in manufacturing compares more favorably with the Nation than do gains in District mineral production. Although the data have certain conceptual shortcomings as measures of output,[2] their sum (value added in manufacturing plus value of mineral production) may be used to approximate comparative changes in District and U. S. total industrial output. By utilizing this combined measure of industrial output, the stronger performance of the manufacturing sector helps to offset the weaker showing in mining with the result that District average yearly gains of 4.5 per cent for the six states and 4.2 per cent for the seven states compare more favorably with an average of 4.2 per cent for the Nation.

## ELECTRIC POWER CONSUMPTION

The similarity between the District and national average yearly gains in industrial output is reinforced by the electric power series data. Table 3 presents annual changes in the use of electric power by manufacturing and

[2] Both measures reflect changes in the value of production and not pure quantity changes. In addition, the value of mineral production series fails to exclude the value of intermediate products from shipments and thus does not even measure changes in the value of final product.

mining establishments in the District and the Nation. A more refined geographic coverage of District activity is possible with the electric power series, and the six-state versus seven-state distinction is no longer necessary. The number of kilowatt hours (KWH) consumed by the District's industrial sector rose, on average, by 5.6 per cent per year between 1959 and 1964. In the Nation as a whole, growth in a comparable electric power series averaged 5.9 per cent per year over the period.

The recent shift in the District growth position from favorable to unfavorable relative to the Nation (noted in Tables 1 and 2) is also apparent in Table 3. In 1959-60 and 1960-61, the District rates exceeded those for the United States while the 1961-62, 1962-63, and 1963-64 national percentage changes are greater.

Charts 1 and 2 show the monthly indexes of electric power consumption for the Nation (upper line of Chart 1) and the District (Chart 2). Although the base periods for the two indexes are different (1959=100 for the District and 1957-59=100 for the Nation), comparison of the District and U. S. electric power series suggests a great deal of over-all similarity with the most obvious differences occurring in 1960 and 1964. During 1960, the index of electric power consumption in the District trended downward during the early months, rose to a peak in September, and fell to somewhat lower levels during the last 3 months, while the movement of the U. S. index conforms more closely with the mid-1960 cyclical downturn in general economic activity. In 1964, both indexes are rising but the U. S. series increases more rapidly.

The less pronounced cyclical influence on the District monthly series is reflected in the annual changes of Table 3. While electric pow-

**Chart 1**

**INDUSTRIAL PRODUCTION AND ELECTRIC POWER CONSUMPTION—UNITED STATES**

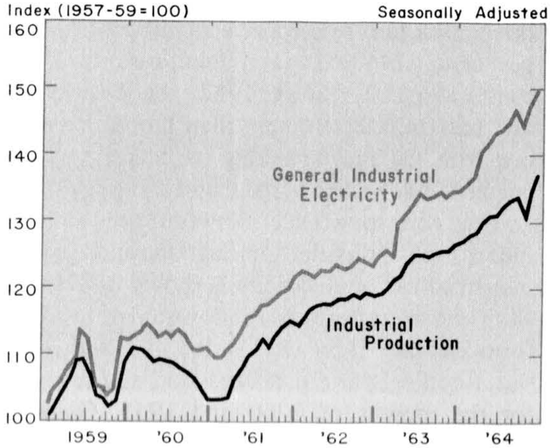



**Chart 2**

**INDUSTRIAL ELECTRIC POWER CONSUMPTION—DISTRICT**

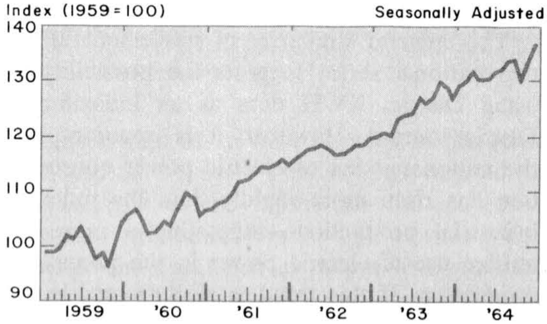



**Table 3**

**GROWTH IN ELECTRIC POWER CONSUMPTION BY MINING AND MANUFACTURING ESTABLISHMENTS**

**1959-64**

| | 1959-60 | 1960-61 | 1961-62 | 1962-63 | 1963-64 | Average Yearly Gain 1959-64 |
|---|---|---|---|---|---|---|
| | (In per cent) | | | | | |
| District | 5.5 | 5.8 | 5.1 | 6.1 | 5.7 | 5.6 |
| United States | 5.0 | 2.0 | 7.0 | 6.8 | 8.8 | 5.9 |

NOTE: District figures include only those portions of Missouri, New Mexico, and Oklahoma that lie within the boundaries of the Tenth Federal Reserve District. U. S. and District figures are not strictly comparable in that the former include some non-industrial uses of electricity, i.e., by establishments other than mining and manufacturing. Moreover, the use of electricity by the Atomic Energy Commission is omitted from the U.S. figures, but included in District series.

SOURCE: U. S. figures derived from the Federal Reserve Board's Index of General Industrial Electricity; District figures compiled by the Federal Reserve Bank of Kansas City in cooperation with District utilities and industries generating their own power.

er consumption in the District rose at a fairly constant rate of more than 5 per cent per year for the 1959-62 period, the annual gains for the Nation fell from 5 per cent (1959-60) to 2 per cent (1960-61) and then rose to 7 per cent (1961-62). Since 1962, the District index has risen less rapidly than the national index with the gap becoming particularly apparent in 1964. (See Charts 1 and 2).

The correspondence between the national indexes of industrial production and general industrial use of electricity is shown in Chart 1. Both series reflect sharp downturns resulting from the late 1959 steel strike and both trace out a cyclical pattern of recession and recovery for the months of 1960 and 1961. Gains in both series were more moderate in 1962 and the indexes move upward at an accelerated pace during 1963 and 1964. The October 1964 decline in both series stems from a strike in the automobile industry.

This general similarity of movement in the two national series suggests the possibility of using District KWH data as an indicator of District output. However, it is apparent that the national index of electric power consumption has risen more rapidly than the index of industrial production—suggesting a more intensive use of electric power in the process of production. If this trend is also present in the District, the District KWH series may be employed as an upper limit estimator of changes in District industrial output. On the other hand, to the extent that electric power is being substituted for manpower as a result of automation, a series measuring man-hours consumed in production would provide a lower limit estimate of output changes.

## ALTERNATIVE ESTIMATES OF DISTRICT OUTPUT

Table 4 presents annual indexes of man-hours and KWH consumption by the District's industrial sector which may be viewed as the lower and upper bounds for a District output index. An alternative way of estimating changes in District output would incorporate the national ratio of output to electric power consumption and the District KWH series. The national ratio is assumed to prevail in the District and, to the extent that the assumption is valid, the product of the national ratio and the District KWH index will yield an accurate estimate of changes in District output.

Unfortunately, a strict correspondence between the output to electric power consumption ratios in the Nation and the District is questionable. An obvious difficulty in justifying this assumption relates to the difference in industrial structure between the District and the Nation. The District's nondurable manufacturing and mining sectors are probably more important and the durable manufacturing sector less important than the corresponding sectors are for the Nation as a whole, and differences in industrial composition are likely to influence the way in which the output per KWH ratio changes over time. However, District ratios of value added in manufacturing plus value of mineral production—a crude measure of industrial output—to electric power consump-

**Table 4**

**ANNUAL INDEXES OF INDUSTRIAL ELECTRIC POWER CONSUMPTION AND MAN-HOURS**

1959 = 100

| | 1960 | 1961 | 1962 | 1963 | 1964 |
|---|---|---|---|---|---|
| District: KWH Consumption | 105.5 | 111.7 | 117.4 | 124.5 | 131.6 |
| Man-hours | 99.7 | 99.8 | 102.2 | 101.5 | 103.7 |
| United States: | | | | | |
| General Industrial Electricity | 105.0 | 107.2 | 114.7 | 122.5 | 133.2 |
| Man-hours | 99.1 | 96.5 | 100.8 | 101.9 | 104.1 |

NOTE: The man-hours series reflects the number of man-hours paid rather than the number actually worked in manufacturing and mining establishments. The District man-hours series includes an approximation of the District portion of Missouri, but makes no correction for non-District parts of New Mexico and Oklahoma.

SOURCE: Electric power indexes, see Table 3; man-hours indexes were derived from the U. S. Department of Labor, Bureau of Labor Statistics, and individual state employment security agency estimates of establishment employment and average weekly hours of production workers.

tion are not radically different from comparable national ratios.[3] Thus, the use of the national output/electric power consumption ratios as approximations of the District ratios may be justifiable.

Annual changes in the District output measure, based on the national output/electric power consumption ratios and the District KWH indexes, are shown in the top row of Table 5. The District's growth pattern relative to the Nation, viewed in terms of the electric power consumption, is similar to that indicated in Tables 1 and 2 and these traits are reflected in the estimated output changes shown in Table 5. In short, the District's average yearly gain of 4.2 per cent is not very different from the national 4.5 per cent average yearly increase, even though the individual yearly rates of output growth show an adverse shift in the District's position.

Still another method of employing the electric power data to estimate changes in District output is suggested by traditional production theory in which the production process is viewed as a transformation of productive resources or inputs—such as labor and capital—into output, and the relationship between inputs and output is specified by a production function. For present purposes, electric power consumption serves as an approximation of the productive service flowing from the use of capital, and labor inputs are measured in terms of man-hours.

An aggregate production function commonly used in the analysis of economic growth explains relative changes in output in terms of a weighted sum of relative changes in the labor and capital inputs.[4] The weights applied to the changes in the inputs are the respective marginal products of labor and capital which indicate the expansion in output obtainable by the addition of a unit of labor or capital while holding the input of the other factor constant. While the particular production function from which this relationship is derived is only one of many possible expressions of the production

**Table 5**
**INDUSTRIAL OUTPUT GROWTH**
**1959-64**

| | 1959-60 | 1960-61 | 1961-62 | 1962-63 | 1963-64 | Average Yearly Change 1959-64 |
|---|---|---|---|---|---|---|
| | | | (In per cent) | | | |
| District: Output measure based on the ratio method | 3.2 | 4.3 | 5.9 | 4.3 | 3.2 | 4.2 |
| Output measure based on the production function method | 3.7 | 4.0 | 4.3 | 4.0 | 4.6 | 4.1 |
| United States: Output of manufacturing and mining establishments | 2.7 | 0.6 | 7.8 | 5.0 | 6.2 | 4.5 |

NOTE: The District output measure based on the ratio method assumes that the national output/electric power consumption ratio prevails in the District. The District output measure based on the production function method assumes that the national marginal products of man-hours and electric power prevail in the District. The U. S. output measure used throughout the calculations was based on the Federal Reserve Board's Index of Industrial Production, but the output of utilities was eliminated to make the output measure more comparable with the electric power and man-hours series.

SOURCE: U. S. figures were derived from the Federal Reserve Board's Index of Industrial Production. District figures were derived from indexes explained but not shown in the text.

[3] The ratios of value added in manufacturing plus value of mineral production to electric power consumption are as follows:

| | 1959 | 1960 | 1961 | 1962 | 1963 |
|---|---|---|---|---|---|
| District | 1.000 | .995 | .959 | .967 | .951 |
| United States | 1.000 | .970 | .952 | .967 | .959 |

The mean of the output indexes for the six- and seven-state District totals was used in the District ratios, and all ratios were derived from indexes based on 1959=100.

[4] The relationship $dO/O = (b)\ dL/L + (1-b)\ dK/K$, where $dO/O$, $dL/L$, and $dK/K$ are the relative changes in output, labor, and capital, respectively, and (b) and (1-b) are the respective marginal products of labor and capital, is derived from the Cobb-Douglas production function $O = AL^{b}K^{1-b}$, where O is an index of output, L is an index of labor input, and K is an index of capital input. A is a parameter that permits the production function to shift over time as technology changes, but, for present purposes, it is assumed to be constant. In addition, the marginal products are assumed to be positive and to sum to one. The latter assumption implies constant returns to scale in production.

process, it has been widely used in economic research and it possesses the mixed virtue of greater simplicity.

Since changes in District labor and capital inputs can be derived from the man-hours and KWH indexes of Table 4, only the relevant marginal products are needed to generate a measure for changing District output. During the 1959-64 period, output of the Nation's manufacturing and mining establishments rose by 24.2 per cent, while electric power consumption increased by 33.2 per cent and man-hours by 4.1 per cent. Under the appropriate assumptions, this implies a marginal product of labor equal to .31 and a marginal product of capital equal to .69.[5] If these marginal products apply for the District as well—an assumption which may be questioned—they may be employed in conjunction with the District man-hours and KWH data to derive a District output measure. Estimates based on this assumption also are shown in Table 5.

Growth in the District output measure based on the production function technique is not markedly different from that indicated by the ratio method. The average yearly gain (4.1 per cent) remains slightly less than the national average and the individual yearly rates for the District show the same shift from greater than to less than the corresponding annual rates for the Nation. This second method of District output estimation produces a smoother pattern of District output growth than does the ratio method, but both indicate that relative changes in District output exhibit more stability than do the national rates.

[5]See footnote 4 for the original form of the equation. Assuming no change in technology, $24.2\% = (b)\ (4.1\%) + (1\text{-}b)\ (33.2\%)$, $b = .31$, $1\text{-}b = .69$.

### SUMMARY AND CONCLUSIONS

Alternative methods for comparing the District's 1959-64 growth record with that of the Nation have been discussed in this article. The electric power data enrich the set of variables with which District economic activity can be analyzed. Three of the four methods of District output estimation presented utilized the electric power data. The first technique employed the District KWH data as an upper limit estimate of District output. The output measure based on the man-hours series alone was suggested as a lower limit output estimator. Next, the electric power series was used in conjunction with the national output/electric power ratio to correct for the trend toward more intensive use of electric power in the production process. While this technique gives implicit recognition to the changing relative importance of labor's productive services, the production function method of District output estimation explicitly relates output to both KWH and man-hours data.

The comparative analysis of variables suggested some degree of insulation in District industrial activity from sharp fluctuations over the 1959-64 period. While the national economy experienced a marked downturn in activity from May 1960-February 1961, changes in District conditions were more favorable. During the rapid national expansion which followed the recession, District gains were more moderate than those for the Nation, although over the entire 1959-64 period, District and U. S. growth rates were similar. A more detailed analysis of the District KWH series may shed added light on the particular patterns of industrial development underlying this stability.