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FEDERAL RESERVE BANK OF CLEVELAND

A NOTE ON INTERPRETING MONETARY VARIABLES

As the nation's central bank, the Federal Reserve System has responsibility for managing the monetary system in a way that helps achieve the broad goals of economic policy. These goals are well known and widely accepted: economic growth (maximum production and maximum employment), stable prices, and reasonable balance in the nation's international transactions.

While the general nature of the role of the Federal Reserve in monetary management is not difficult to explain, it is difficult to explain the specifics of how that role should be performed, for example, how monetary policy should be designed, how the variables to be influenced should be selected, and how the results should be measured. Thus, it is not surprising that economic literature is replete with academic and nonacademic, technical and nontechnical, quantitative and non-quantitative (qualitative) discussions on the specifics of monetary policy—ranging from issues involving definitions and measurement to issues concerned with the policymaking process, the implementation of policy, the variables to be affected, and the ultimate goals

of monetary policy. One dominant characteristic pervades all these discussions—there is complete agreement on very few things. What this implies is that the state of economic knowledge, while steadily advancing, has not come sufficiently far to provide answers to some basic questions.

SOME MONETARY VARIABLES

It is in this spirit that this article briefly discusses some of the general problems involved in interpreting monetary statistics, that is, the behavior of the variables that the Federal Reserve is generally considered to be able to influence, directly or indirectly. Monetary statistics are difficult to interpret because there is no precise and complete specification of either (1) which monetary variable(s) is (are) most important in terms of the ultimate effect on policy goals such as economic growth, stable prices, and balance of payments equilibrium, or (2) the actual process (linkages) by which change(s) in a monetary variable is (are) transmitted to ultimate goals. In addition to these seemingly overwhelming considerations, there are some practical problems

that compound the task of interpreting short-run changes in monetary variables.

From the standpoint of Federal Reserve influence, a host of monetary variables have been suggested as being the most important, either to be used when evaluating monetary policy or to be relied on when implementing policy. For example, since one of the major instruments of monetary policy is open market operations, that is, the purchase or sale of Government securities which adds to or subtracts from bank reserves, some economists have suggested that the amount of reserves supplied (or withdrawn) through open market purchases (sales) of securities should be the major measure or target of monetary policy. This is so perhaps because the Federal Reserve is able to offset by open market transactions, the other factors that affect bank reserves, and whether the Federal Reserve supplies or does not supply reserves, it is suggested, can be construed to represent the intent of monetary policy. (Reserves supplied through open market operations—assuming constant reserve requirements—are identified as non-borrowed reserves.) At the same time, banks may obtain borrowed reserves, under certain circumstances, by discounting or securing advances from the Reserve banks, that is, by borrowing. Some analysts feel that the level of borrowings, since it presumably reflects the extent of pressure on banks to make reserve adjustments, should be taken as the major measure or target of monetary policy. Still others feel that the net reserve position of banks (excess reserves less member bank borrowings) is a better statistic to consider when evaluating or implementing monetary policy. On the other hand, some economists

feel that total reserves (nonborrowed plus borrowed reserves) are a better measure (or target) to be used when evaluating or implementing monetary policy.¹

There is similar lack of agreement beyond the reserve measures. For example, there is the fundamental question of how responses to changes in monetary policy—to the reserve variables—are to be measured. In the case of banks, for example, should policy be measured in terms of total deposit growth, or on the other side of the balance sheet—by bank credit growth? Is a particular type of deposit, such as demand deposits (or more broadly, demand deposits and currency—money supply) the relevant magnitude, or is a particular type of bank credit such as business loans the key variable? Are credit conditions—the availability and cost of credit—the important variable as opposed to the quantity of bank credit (or total credit)? In this connection, interest rates, which are an element of credit conditions, are considered by a number of analysts to be a significant variable, in terms of both evaluating and implementing monetary policy. It goes without saying that beyond the foregoing “intermediate” stage of the monetary process, there is as much lack of agreement, if not more, in evaluating the influence of the monetary variables on broader objectives and goals, to say nothing of selecting the variable(s) to watch.

Ironically, even if there were clear-cut and definitive evidence of the appropriate monetary variable(s) to control and watch, there would still be a fundamental and practical

¹ The measures mentioned are intended only to suggest the variety of measures available and the lack of agreement as to which is (are) the most significant measure(s).

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problem involved in the presentation, use, and interpretation of basic statistical information—especially for assessments of short-run changes in monetary variables with respect to desired policy changes. In this article, for purposes of illustration, attention is primarily devoted to some of the more basic monetary or reserve variables.

MEASURING MONETARY VARIABLES

There are many ways to measure monetary or reserve variables, and each method or approach usually yields different results. For example, data that are used may be on a daily, weekly, monthly, quarterly, or annual basis. When the appropriate time unit is decided upon, it must be decided whether the data should be analyzed on the basis of levels, absolute changes, or rates of change. And, then, it is necessary to determine the appropriate time period over which to consider levels or changes. In using rates of change, which are based on terminal values, it should be remembered that both the time span and the unit of the terminal period (for example, week, month, or quarter) will influence the resultant computed rate of change. Changing either the time span or the terminal units (for example, to a subsequent period such as from April to May, or to a quarterly as opposed to a monthly average) can produce substantial differences in rates of change based on those terminal values.

As an illustration, the following rates of increase can be associated with the conventionally-defined money supply for the first two quarters of 1966:²

	First Quarter 1966	Second Quarter 1966
Based on quarterly averages of monthly averages of daily figures:		
(1) Annual rate of change from preceding quarter	+6.0%	+5.5%
(2) Annual rate of change from same quarter in preceding year	+5.3%	+6.0%
Based on monthly averages of daily figures:		
(3) Change from three months earlier, at annual rate: December 1965 to March 1966 and	+5.0%	
March 1966 to June 1966		+4.3%

Perhaps the most perplexing aspect of the above figures is not the different rates of change generated by the different methods, but the fact that two computations (1 and 3) indicate a deceleration in the rate of growth during the second quarter while the third (2) indicates an acceleration. Since the same variable (money supply) is being measured, the differences obviously reflect the fact that the computations are based on different time spans and different average lengths of the terminal periods. At this point, a question can legitimately be asked, which set of statistics is the most meaningful in terms of interpreting the behavior of the money supply in relation to an evaluation of monetary policy?

In answering this question, the figures need to be put into a more proper perspective. For example, the money supply (quarterly averages based on monthly averages of daily figures) increased substantially in both the third and fourth quarters of 1965; therefore, the money supply for the first two quarters of 1966, even with no further increases during

² These and subsequent figures are seasonally adjusted.

those two quarters, would still show year-over-year increases from the first two quarters of

Changes in the Money Supply
from the Preceding Quarter
(annual rates of growth)

1965				1966	
1st. Q.	2nd. Q.	3rd. Q.	4th. Q.	1st. Q.	2nd. Q.
+2.0	+3.0	+5.0	+6.9	+6.0	+5.5

1965 (3.8 percent and 3.0 percent, respectively). Since the money supply actually increased substantially in the first two quarters of 1966, year-over-year gains from 1965 also were substantial.

Actual Year-Over-Year Rates of Gain
in the Money Supply

1965				1966	
1st. Q.	2nd. Q.	3rd. Q.	4th. Q.	1st. Q.	2nd. Q.
+4.0	+3.9	+3.7	+4.3	+5.3	+6.0

The change from three months earlier (between the last months of the quarters) reflects the peculiarities of the terminal months involved. For example, the substantial increase in the money supply that occurred in December 1965 contributed substantially to

Monthly Changes in the Money Supply
at Annual Rates

1965						1966							
July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
+5.2	+4.4	+8.1	+8.0	+2.9	+11.6	+5.7	-1.4	+7.8	+11.3	-4.9	+ 6.3	-10.5	0.0

a high rate of growth for the fourth quarter as a whole. Any rate of increase based on December would thus be expected to exhibit moderate increases. However, since the money supply actually increased considerably in

both January and March 1966, the rate of increase from December to March became quite substantial even though it was less than the increase in the preceding period. As another example, growth of the money supply

Changes in the Money Supply
Between Last Months of the Quarters
(at annual rates)

1965				1966	
1st. Q.	2nd. Q.	3rd. Q.	4th. Q.	1st. Q.	2nd. Q.
+1.5	+3.5	+5.9	+7.6	+5.0	+4.3
(12/64- 3/65)	(3/65- 6/65)	(6/65- 9/65)	(9/65- 12/65)	(12/65- 3/66)	(3/66- 6/66)

in April 1966 was almost as great as the December 1965 increase; that growth in fact accounted for almost all of the net increase in the second quarter since money supply changes in May and June were virtually offsetting. The March to June growth, however, was still below the December to March growth.

PROBLEMS OF MONTHLY DATA

Generally, the shorter the time span of basic data, the more volatile rates of change are likely to be (due of course to the behavior of the underlying series). Thus, while monthly rates of change in various monetary variables (expressed as annual rates) are helpful in indicating the pace and direction of short-run changes, the nature of the variables under consideration is such that monthly rates of change will exhibit considerable volatility, to the extent that their underlying significance is indeterminable.

This is clearly revealed in Table I, where a number of monetary variables are presented for purposes of illustration. Putting the question most simply, how should monetary policy be evaluated during the period shown in the

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TABLE I
Changes in Selected Monetary Variables

	Percent Change From Preceding Month at Annual Rates								
	1965			1966					
	December	January	February	March	April	May	June	July	August
Total Reserves . . .	+14.5%	+ 6.1%	+4.3%	+ 2.4%	+13.5%	+0.1%	-0.7%	+ 8.9%	-13.7%
Nonborrowed Reserves	+10.5	+ 9.0	+3.1	- 5.2	+11.1	-0.3	-1.8	+ 4.4	- 8.8
Money Supply . . .	+11.6	+ 5.7	-1.4	+ 7.8	+11.3	-4.9	+6.3	-10.5	0.0
Bank Credit	+11.9	+12.2	+0.4	+11.3	+ 9.6 p	+6.3 p	+4.3 p*	+11.0 p	+ 6.2 p

p Preliminary.

* Beginning June 9, about \$1.1 billion of balances accumulated for payment of personal loans were deducted as a result of a change in Federal Reserve regulations.

NOTE: Data are monthly averages of daily figures, except for bank credit data which are for the last Wednesday of the month. All the series are seasonally adjusted.

Sources: Board of Governors of the Federal Reserve System and Federal Reserve Bank of Cleveland

table? It is apparent from the table that the growth of total reserves decelerated from December through March, and then fluctuated widely in subsequent months, including some negative values. Nonborrowed reserves increased at a slackening pace early in 1966, declined in March, and then also behaved erratically.

As long as successive changes are in the same direction, they are relatively easy to interpret; if they are not in the same direction, that is, if monthly rates of change alternate between positive and negative changes, they become extremely difficult to evaluate. A decline (negative value) in one month followed by an increase (positive value) in the next month raises a question as to the net rate of change over the two months, since at least a portion of the increase is offset by the decline in the previous month.

Such a situation is apparent in the behavior of the money supply in the time period covered in Table I; month-to-month changes in the money supply were substantial, with large increases being followed by large decreases,

and conversely. While some of the monthly fluctuations were due to technical factors, for example, changes in seasonal patterns associated with shifts in U. S. Treasury deposits, there is still a large element of unexplained variation in monthly values. Bank credit also exhibited large fluctuations in the period shown in the table although all changes were positive. (Monthly swings in bank credit were also influenced by shifts in U. S. Treasury deposits, particularly as the latter affected seasonal adjustment of the bank credit data.)

Despite the fact that monthly changes may suggest, over some time span, whether a variable is rising, falling, or remaining about the same, it is often impossible to adjudge the underlying movements of the particular series, especially since monthly changes often offset one another. Accordingly, short-term measures should be supplemented by longer run measures, for example, averaging or looking for periods of sustained change.

USE OF LONGER TIME PERIODS

Unfortunately, it is easy to run into similar problems when selecting longer run mea-

tures. For example, on a *priori* grounds, there would seem to be nothing particularly significant or sacrosanct about calendar quarters, fiscal years, or other contrived time periods in interpreting movements in time series covering monetary variables—or any other economic time series for that matter. Perhaps a three-month moving average would be appropriate so that there would be a “quarterly” average for each month of the year. Perhaps not.

On the other hand, and merely as an illustration, another measure that could be used is year-over-year changes for each month of the year (the change in a variable—absolute or percentage change—from a given month in the preceding year to the same month in the current year). Such a measure appears to provide continuous year-to-year perspective for each month, that is, a longer term perspective to supplement shorter term measures. Moreover, it is not tied to calendar or fiscal year periods, which have little economic significance.

Year-to-year changes, in percentage terms, for the selected monetary variables used in

Table I are presented in Table II. Year-to-year changes exhibit more stability than monthly changes since short-run fluctuations are smoothed out over the longer time period. The greater stability of the year-to-year changes makes it easier to discern longer term patterns. It is noticeable that for total and nonborrowed reserves, and to some extent bank credit, the growth rates tend to become lower as the year progresses. The rates of change still have to be interpreted with care since they are based on two arbitrarily selected values, and do not reflect the intervening patterns. Nevertheless, a sequence of year-to-year changes may be helpful as a supplement to short-run measures in assessing changes in monetary variables.

Use of year-to-year percentage changes could overcome many seasonal adjustment problems. Since changes would be between the same month (or quarter) in respective years, the basic data could be used in unadjusted form and would not have to be seasonally adjusted by procedures that are frequently open to question. Problems would still arise, however, where seasonal patterns

TABLE II
Changes in Selected Monetary Variables

	Percent Change From Same Month in Preceding Year								
	1965	1966							
	December	January	February	March	April	May	June	July	August
Total Reserves . . .	+ 5.3%	+ 5.3%	+4.7%	+4.4%	+4.8%	+4.8%	+3.9%	+4.3%	+3.2%
Nonborrowed Reserves	+ 4.3	+ 4.9	+5.4	+3.8	+4.1	+3.9	+3.4	+3.4	+2.5
Money Supply . . .	+ 4.7	+ 5.2	+5.3	+5.6	+6.1	+5.9	+5.8	+4.4	+4.0 p
Bank Credit	+10.2	+10.3	+9.3	+8.9	+9.3 p	+8.9 p	+8.4 p*	+8.8 p	+8.3 p

p Preliminary.

* Beginning June 9, about \$1.1 billion of balances accumulated for payment of personal loans were deducted as a result of a change in Federal Reserve regulations.

NOTE: Data are monthly averages of daily figures, except for bank credit data which are for the last Wednesday of the month. All the series are seasonally adjusted.

Sources: Board of Governors of the Federal Reserve System and Federal Reserve Bank of Cleveland

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are changing rather rapidly; such a case, for example, would be the changing seasonal pattern of U. S. Government deposits as a result of accelerated tax payments.

The problems involved in measuring and interpreting short-run changes really reflect more fundamental difficulties. As suggested earlier, the fundamental problem involves the question of what type of change really constitutes an economically meaningful change. In the present context, how long must a given change in various reserve aggregates (for example, total or nonborrowed reserves) persist before a bank (the banking system) responds by expanding deposits and credit, or how large a change must actually occur; more than likely, the larger the change, given other factors, the shorter the reaction time on the part of the banks. In other words, there is probably a variable reaction time on the part of the banks depending on the duration and magnitude of the change as well as expectations concerning future changes (is the change likely to be permanent, and what will be the effects on the level of interest rates, the demand for bank funds, and the volume of liq-

uid assets?). The reaction time could also be expected to vary according to the type and size of bank in that, for example, larger money market banks would be expected to respond more rapidly than smaller banks that are outside the central money market. Unfortunately, not enough is known about the nature and speed of the response pattern of banks to determine any quantifiably precise pattern.

In the absence of knowledge about short-run response patterns, it appears that several different measures are necessary to interpret changes in monetary variables. Reliance on any one measure may give rise to incomplete or false interpretations. Longer term measures should be used to supplement short-term measures so that basic patterns may be discerned, and so that the intervening contours giving rise to longer term changes can be determined.

Finally, since persistent changes over a longer period of time, say six months to a year, take on a permanent quality that overrides shorter term variations, longer term measures of changes in monetary variables may be particularly useful in making any judgment about monetary policy.



REGIONAL TRENDS IN STEEL PRODUCTION

Four of the nation's 11 steel producing centers are located in the Fourth Federal Reserve District. These four centers produce a substantial portion of the nation's steel, accounting for more than a third (50 million tons) of the nation's record 131 million ton steel output in 1965. Nevertheless, steel output of Fourth District centers accounts for a smaller share of the U. S. total than earlier, even though steel production in the District has increased appreciably since 1961, a development that has served to interrupt the steady attrition in the District's share of total output. The current share of total steel output accounted for by mills in the District represents a significant loss of position as compared with, say, 1947 when the Fourth District produced almost half of the nation's steel. In short, during the postwar period the Fourth District, in relative terms, has declined as a steel producing region.

The relative loss of position is reflected in the gradual but persistent widening of the gap between total steel production in the nation and the combined output of centers in the Fourth District. The widening gap between the respective series—as shown in the

chart—has been due to the fact that the combined output of mills in the District posted an infinitesimally small average annual rate of increase (0.1 percent) as compared with that for the U. S. as a whole (1.5 percent) during the 1947-65 period.¹ Indicative of the declining importance of the District in total steel output is the fact that the combined output of District centers in 1965—even after three years of rapidly expanding production—was hardly more than it had been in 1955, the previous all-time high (see Table I). In contrast, steel output in the U. S. in 1965 (and 1964) had gone much beyond the previous high (1955). As can be seen from Table I, the nature of the smaller contribution of District output—as well as its poor growth record—is pointed up by the large number of years since 1948 (eight) that annual steel

¹ The average annual rates of change used in this article are derived by using the compound interest formula based on logarithms of the data ($\log Y = \log A + [\log B] X$). The use of average annual rates of change allows the first and final years of the overall time period to influence the statistical results to the same extent as any interim year. Thus, the first and final years do not, by virtue of their position, determine either the rate of change or the direction of trend.

STEEL INGOT PRODUCTION

U.S. and Major Geographic Centers

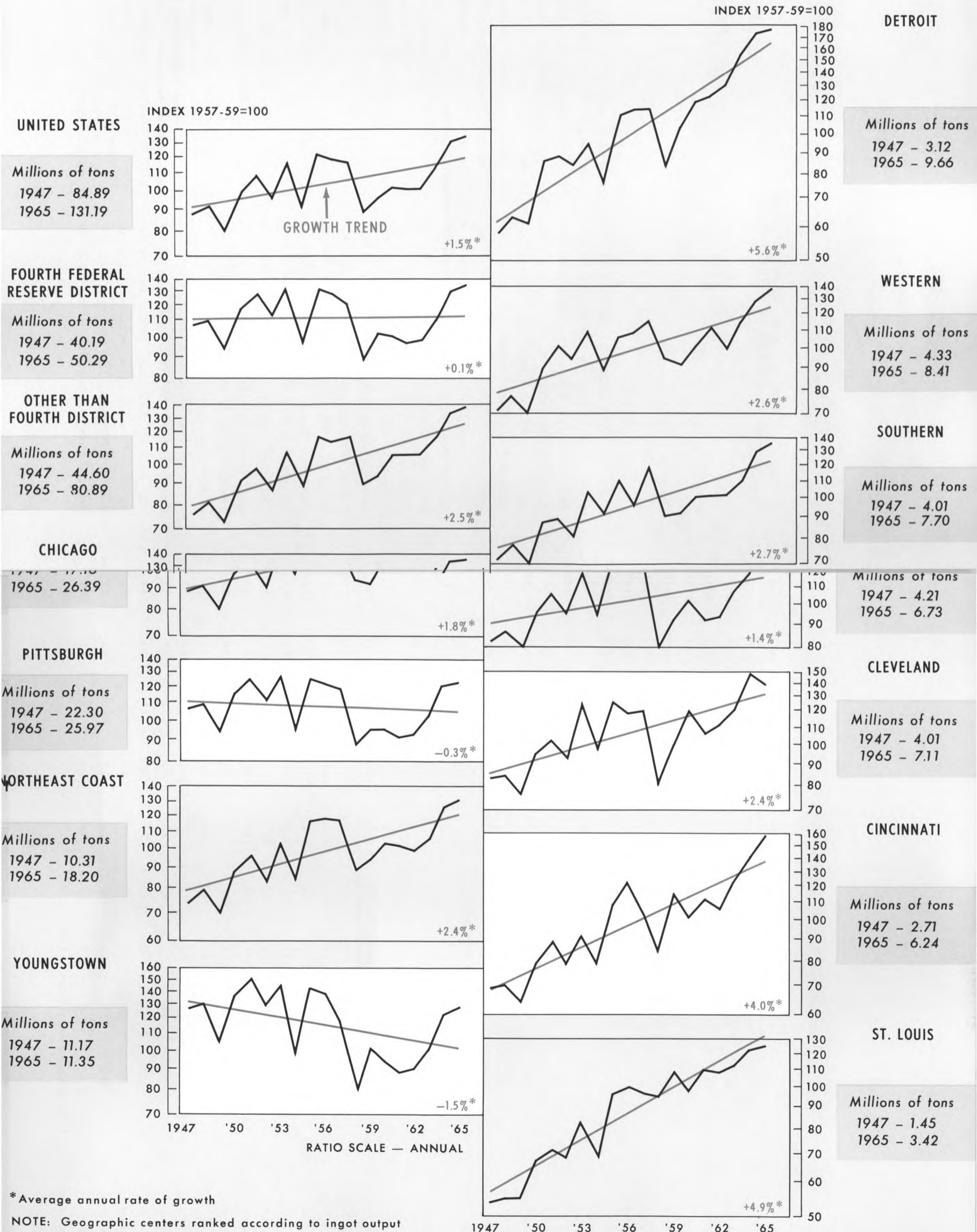


TABLE I
Steel Ingot Production, 1947-65
U. S. and Major Steel Producing Centers
(in millions of tons)

	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	Average Annual Rates of Growth
United States	84.89	88.64	77.98	96.84	105.20	93.17	111.61	88.31	117.04	152.22	112.72	85.26	93.45	99.28	98.01	98.33	109.26	127.08	131.19	+1.5%
Fourth District	40.19	41.27	35.36	43.95	48.02	42.35	49.14	36.47	49.35	48.53	45.09	32.56	38.34	37.85	36.43	37.07	41.24	48.89	50.29	+0.1
Other Than Fourth District	44.60	47.09	42.46	52.94	57.18	50.71	62.37	51.95	67.64	66.41	67.53	52.76	55.13	61.18	61.63	61.37	67.97	77.49	80.89	+2.5
Chicago	17.16	17.75	15.60	19.12	20.48	17.55	22.04	18.92	23.60	22.63	22.24	18.34	17.94	20.68	20.68	21.07	23.02	25.94	26.39	+1.8
Pittsburgh	22.30	22.94	19.78	24.20	26.30	23.36	26.72	19.99	26.30	25.67	24.83	18.31	19.99	19.99	19.15	19.57	21.67	25.25	25.97	-0.3
Northeast Coast	10.31	11.01	9.75	12.12	13.38	11.56	14.35	11.70	16.17	16.44	16.30	12.40	13.10	14.35	14.07	13.65	14.77	17.69	18.20	+2.4
Youngstown	11.17	11.52	9.40	12.05	13.29	11.43	12.85	8.69	12.67	12.32	10.46	7.09	9.04	8.33	7.80	7.98	8.93	10.90	11.35	-1.5
Detroit	3.12	3.45	3.34	4.65	4.81	4.60	5.14	4.10	6.02	6.24	6.24	4.54	5.63	6.51	6.67	7.11	8.42	9.41	9.66	+5.6
Western	4.33	4.69	4.27	5.43	6.16	5.73	6.64	5.36	6.46	6.64	7.01	5.73	5.55	6.16	6.77	6.10	7.01	7.80	8.41	+2.6
Southern	4.01	4.35	3.96	4.92	5.03	4.58	5.88	5.20	6.22	5.43	6.67	5.09	5.20	5.65	5.71	5.71	6.22	7.23	7.70	+2.7
Buffalo	4.21	4.37	4.06	4.87	5.38	4.82	6.04	4.77	6.55	6.29	6.45	4.06	4.72	5.18	4.72	4.77	5.43	6.04	7.11	+1.4
Cleveland	4.01	4.06	3.67	4.59	4.92	4.49	5.99	4.68	6.08	5.75	5.79	3.86	4.83	5.55	5.12	5.36	5.84	7.19	6.73	+2.4
Cincinnati	2.71	2.75	2.52	3.11	3.50	3.07	3.58	3.11	4.29	4.80	4.01	3.30	4.48	3.97	4.36	4.17	4.80	5.54	6.24	+4.0
St. Louis	1.45	1.48	1.48	1.84	1.95	1.86	2.27	1.89	2.63	2.74	2.63	2.60	2.99	2.66	3.01	2.96	3.10	3.37	3.42	+4.9

Sources: American Iron and Steel Institute and Federal Reserve Bank of Cleveland

TABLE II
Shares of Total Steel Ingot Output
Produced by Major Steel Centers, 1947-65

	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	
United States	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fourth District	47.4	46.7	45.4	45.4	45.6	45.5	44.1	41.2	42.2	42.2	40.0	38.2	41.0	38.2	37.2	37.7	37.8	38.7	38.3	
Other Than Fourth District	52.6	52.3	54.6	54.6	54.4	54.5	55.9	58.8	57.8	57.8	60.0	61.8	59.0	61.8	62.8	62.3	62.2	61.3	61.7	
Chicago	20.2	20.1	20.1	19.7	19.5	18.9	19.7	21.4	20.2	19.7	19.8	21.5	19.2	20.9	21.1	21.4	21.1	20.5	20.1	
Pittsburgh	26.3	26.0	25.4	25.0	25.0	25.1	24.0	22.6	22.5	22.3	22.0	21.5	21.3	20.2	19.5	19.9	19.9	20.0	19.8	
Northeast Coast	12.1	12.5	12.5	12.5	12.7	12.4	12.9	13.3	13.8	14.3	14.5	14.5	14.0	14.5	14.3	13.9	13.5	14.0	13.9	
Youngstown	13.2	13.0	12.1	12.5	12.6	12.3	11.5	9.8	10.8	10.7	9.3	8.3	9.7	8.4	8.0	8.1	8.2	8.6	8.6	
Detroit	3.7	3.9	4.3	4.8	4.6	4.9	4.6	4.6	5.1	5.4	5.5	5.3	6.0	6.6	6.8	7.2	7.7	7.4	7.4	
Western	5.1	5.3	5.5	5.6	5.9	6.2	6.0	6.1	5.5	5.8	6.2	6.7	5.9	6.2	6.9	6.2	6.4	6.2	6.4	
Southern	4.7	4.9	5.1	5.1	4.8	4.9	5.3	5.9	5.3	4.7	5.9	6.0	5.6	5.7	5.8	5.8	5.7	5.7	5.9	
Buffalo	5.0	4.9	5.2	5.0	5.1	5.2	5.4	5.4	5.6	5.5	5.7	4.8	5.1	5.2	4.8	4.8	5.0	4.8	5.4	
Cleveland	4.7	4.6	4.7	4.7	4.7	4.8	5.4	5.3	5.2	5.0	5.1	4.5	5.2	5.6	5.2	5.5	5.3	5.7	5.1	
Cincinnati	3.2	3.1	3.2	3.2	3.3	3.3	3.2	3.5	3.7	4.2	3.6	3.9	4.8	4.0	4.5	4.2	4.4	4.4	4.8	
St. Louis	1.7	1.7	1.9	1.9	1.8	2.0	2.0	2.1	2.2	2.4	2.4	3.1	3.2	2.7	3.1	3.0	2.8	2.7	2.6	

Sources: American Iron and Steel Institute and Federal Reserve Bank of Cleveland

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output in the District failed to match 1947-48 levels, particularly in the late 1950's and early 1960's. The situation in the nation as a whole was conspicuously better as can be seen by comparing the first two lines in Table I with the respective figures in each case for 1947 and 1948.

Not only did the growth path of steel output in Fourth District centers differ from that of the nation during 1947-65, particularly since 1955, but the combined output of District centers was also characterized by much wider fluctuations during periods of change in economic activity. That is to say, the swings in steel output from peak periods to trough periods, and from troughs to peaks, were relatively larger for the Fourth District than for the U. S. as a whole. In short, then, combined steel output for Fourth District centers generally grew less and fluctuated more than elsewhere in the nation. These patterns are clearly visible when production figures for the District—both total and individual centers—are compared with figures for steel centers located outside the District.

STEEL OUTPUT: VOLUME, GROWTH, AND CYCLICAL SWINGS

Volume of Steel Output. Steel output for the nation as a whole was a record 131.2 million tons in 1965. Correspondingly, steel production in the Fourth District, as well as outside the District, was also at record levels (see Table I). Mills within the District produced 50 million tons of steel in 1965, or 25 percent more than they had in 1947; mills outside the District produced a total of 81 million tons in 1965, or 81 percent more than in 1947.

As shown in Table I as well as in the chart, of the four steel centers in the Fourth District, only in the Cincinnati area did production set a new record in 1965. Outside the Fourth District, production in all seven steel areas reached new highs in 1965—in fact, in most cases considerably higher than previous records. While record production had been achieved in Cleveland in 1964, output in 1965 receded slightly. In the cases of Pittsburgh and Youngstown, despite sizable increases in recent years, steel output did not return to the record levels achieved in 1953 and 1951, respectively.

Average Annual Rate of Growth. While the combined output of steel centers in the Fourth District was moving upward at an almost imperceptible rate of 0.1 percent per year between 1947 and 1965, output of the combined steel centers outside the District was advancing at an annual rate of 2.5 percent (see Table I). Of the four centers located within the Fourth District, in only the Cincinnati area did production register a growth rate (4 percent) that exceeded the growth rate of the combined centers outside the District (2.5 percent), although Cleveland was not far behind (2.4 percent). In marked contrast to trends elsewhere, Pittsburgh and Youngstown had average annual rates of decline during the 1947-65 period (—0.3 percent for Pittsburgh and —1.5 percent for Youngstown), reflecting the influence of the many years when steel production in those centers badly lagged output elsewhere. All centers outside the Fourth District scored long-term gains (positive growth rates) during 1947-65.

In terms of average rate of growth, Cincinnati ranked high among the 11 steel centers.

In fact, only two centers—Detroit with a 5.6 percent average annual rate of increase and St. Louis with a 4.9 percent rate of increase—surpassed Cincinnati. The 2.4 percent growth rate of steel production in the Cleveland area, while less impressive than that of Cincinnati, was still larger than the growth rates of the Chicago (1.8 percent) and Buffalo (1.4 percent) areas, among steel centers outside the District. As the only two steel producing regions in the nation to experience a decline in trend during 1947-65, Pittsburgh and Youngstown are of course at the bottom of the list—tenth and eleventh, respectively—in a ranking of growth rates for the 11 steel centers of the nation.

Changes in Share of Production. The growth pattern and cyclical swings experienced by each steel producing center during 1947-65 were reflected in the changing proportion of total steel output accounted for by each center. As shown in Table II, in 1947 the four steel centers in the Fourth District accounted for 47.4 percent of total steel production. In contrast, in 1965 the District's share of total production had declined to 38.3 percent. This is not surprising in view of the comparative growth rates for the Fourth District and the other-than-Fourth District areas. Nevertheless, because of the relative spurt in steel output in recent years at District centers, the proportion achieved in 1965 remained a shade above the lowest point in share of total output accounted for by the District—37.2 percent in 1961.

Two of the steel producing areas within the Fourth District increased their proportionate shares of total steel production during 1947-65. Thus, steel output in the Cincinnati area,

which had amounted to 3.2 percent of total output in 1947, increased to 4.8 percent in 1965; and Cleveland's share, which had been 4.7 percent in 1947, improved to 5.1 percent in 1965. On the other side of the ledger, two District centers accounted for smaller shares of total output in 1965 than in 1947. Steel output in the Pittsburgh area amounted to 19.8 percent of total U. S. production in 1965 compared with 26.3 percent in 1947, and Youngstown accounted for 8.6 percent in 1965 compared with 13.2 percent in 1947. In the case of Pittsburgh, the reduction in share of total output was fairly evenly spread over the 1947-65 period, although about 60 percent of the reduction in share occurred in the first half of the overall period. Also, Pittsburgh has not lost any ground since 1961, and in fact has even recouped somewhat. The pattern was fairly similar in the Youngstown area during 1947-65, as shown in Table II, although Youngstown lost relatively more ground than Pittsburgh in terms of share of national total.

The losses in share of total production experienced by Pittsburgh and Youngstown over the years have been turned into gains in proportions of total output accounted for by most of the other steel producing centers. Detroit has been the largest gainer, moving from 3.7 percent of total output in 1947 to 7.4 percent in 1965. On the other hand, Chicago, now the leading steel producing area, accounted for almost the same proportion of the nation's steel output in 1965 as it did in 1947.

Cyclical Swings. The cyclical swings in steel output invariably have been wider in the Fourth District than in the other-than-Fourth

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TABLE III
Cyclical Swings in Steel Output
Percent Change From Peak to Trough

Business Cycle Periods (Recessions)	United States	Fourth District	Other Than Fourth District	Cincinnati	Cleveland	Youngstown	Pittsburgh
1948-49	-12%	-14%	-10%	-9%	-10%	-19%	-14%
1953-54	-21	-26	-17	-13	-21	-33	-23
1955-58	-27	-33	-22	-23	-37	-44	-30
1960-61	-1	-4	+1	+10	-8	-6	-4

Business Cycle Periods (Expansions)	Percent Change From Trough to Peak						
	United States	Fourth District	Other Than Fourth District	Cincinnati	Cleveland	Youngstown	Pittsburgh
1949-53	+43%	+39%	+47%	+42%	+63%	+37%	+35%
1954-55	+33	+35	+30	+38	+30	+46	+32
1958-60	+16	+16	+16	+20	+44	+18	+9
1961-65	+34	+38	+31	+43	+31	+45	+35

NOTE: Percentage changes are based on annual data, with the terminal dates of each period representing the years in which peaks or troughs in steel output occurred.

Sources: American Iron and Steel Institute and Federal Reserve Bank of Cleveland

District areas, and as a result, in the U. S. as a whole.² Thus, as shown in the upper part of Table III, in the four recession periods since 1947, the peak to trough drop in steel production was relatively greater on each occasion in the District than it was outside the District (see columns 2 and 3). It is also apparent from Table III that during the first three recession periods, the difference between percentage declines in steel production in the Fourth District and all other steel centers widened with each recession. Thus, during 1948-49, the decline in Fourth District production was 4 percentage points larger; during 1953-54, the decline was 9 percentage points larger; and during 1955-58,

11 percentage points larger. During 1960-61, the decline in the District amounted to 4 percent, while the steel output of other-than-Fourth District areas actually rose by 1 percent. As can be seen from the data for individual centers, the Youngstown area was the "biggest swinger" in the first three recessions, and Cincinnati the most moderate. The Cleveland area showed the sharpest decline in 1960-61, while Cincinnati moved completely contrary to the District pattern, actually posting a 10-percent increase.

Looking at the trough to peak changes, only during the 1949-53 expansion did steel production in the Fourth District fail to rise by at least as much as, or more than, outside the District. However, even with the greater percentage increases in production in two of the periods and an equal percentage increase in one period, steel output in the District lost ground during 1947-65, indicating that these

² Because of the problems involved in adjusting monthly steel production for seasonal variation, annual data are used in this analysis. Percentage changes are based on swings in annual data, using as terminal dates the years in which peaks and troughs in steel output occurred.

advances were not strong enough to compensate sufficiently for the preceding downturns.

PATTERNS IN FOURTH DISTRICT CENTERS

Pittsburgh. For many years the Pittsburgh area represented the leading steel producing region in the U. S. Since 1960, however, Pittsburgh has ranked second to Chicago in volume of output, as can be seen from Table I. The shift of positions of the two areas was the inevitable result of their individual growth patterns since 1947. In the late 1940's and early 1950's, annual steel production in Pittsburgh exceeded that in Chicago by 5 to 6 million tons. However, with production, on an average, growing in Chicago and declining in Pittsburgh, the 5-million ton difference was eventually wiped out. In 1965, steel output in the Chicago area exceeded output in the Pittsburgh area by almost half a million tons. In 1965, Pittsburgh accounted for only 19.8 percent of steel output in the nation as compared with 26.3 percent in 1947.

The long-term downtrend of the Pittsburgh steel district probably reflects the gradual change over the years in the technology of making steel and marketing the finished product. Regardless of the reason for the secular decline, as shown in the chart, record steel production was achieved in Pittsburgh in 1953, and output failed to reach that level again in any of the succeeding steel peaks in 1955, 1964, and 1965.

Fluctuations in steel output in the Pittsburgh district generally have been less than for the U. S. and the Fourth District as a whole during both recessions and expansions. Swings

in Pittsburgh steel production have not been as wide as in Youngstown but generally more volatile than in the other two steel producing centers in the Fourth District. Disregarding business cycle periods, as shown in the chart, during 1959-63 steel output in Pittsburgh showed relatively little year-to-year change compared with other steel centers. In fact, between 1959 and 1960 steel production in Pittsburgh remained unchanged, while it rose sharply in seven steel districts and dropped almost as sharply in the other three districts.

Youngstown. The Youngstown district ranked fourth in production of steel in 1965, having dropped out of the number three spot in the U. S. as long ago as 1949. Unlike other districts, Youngstown reached its postwar peak in production as early as 1951, and each surge since that time (except for 1965) has fallen short of that peak by an increasingly larger amount (see the chart). In 1947, output of the Youngstown area amounted to 11.2 million tons. In 1951, which was Youngstown's record year, production amounted to 13.3 million tons. In 1953, 1955, 1964, 1965, all of which were years when new national records in steel production were being set, production in the Youngstown area amounted to 12.9 million tons, 12.7 million tons, 10.9 million tons, and 11.4 million tons, respectively. (Thus, only in 1965 did production increase over the previous peak; but it still failed to return to the 1951 record level.)

Production dropped by a greater percentage in Youngstown than in any of the other Fourth District centers in three out of the four cyclical downturns shown in Table III. In two of the four advances in output, production in Youngstown increased by a greater percent-

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age than in any of the other Fourth District centers. For example, during 1961-65, production was up 45 percent in Youngstown compared with 43 percent in Cincinnati, 35 percent in Pittsburgh, and 31 percent in Cleveland. Nevertheless, over the long term it is apparent from the —1.5 percent average annual decline that the periods of expansion have been insufficient to compensate for the periods of decline.

Cleveland. As one of the smallest steel districts in the U. S., Cleveland ranked ninth in 1965 in volume of steel produced. The Cleveland district produced 6.5 million tons of steel in 1965 (slightly more than 5 percent of the nation's total output), an increase of 68 percent from the 4 million tons produced in 1947. The average annual growth rate of 2.4 percent for Cleveland during 1947-65 was higher than that for the Fourth District as a whole (0.1 percent) as well as for the nation (1.5 percent), but lagged such fast growing steel centers as Detroit, St. Louis, and Cincinnati. As can be seen from the data in Table I, as well as from the chart, the bulk of the growth in steel production in the Cleveland area took place during the first half of the 1950's.

Steel production in Cleveland over the years has tended to be very volatile. Unlike in Youngstown, however, the sharp plunges in Cleveland production have been more than offset by increases in periods of economic expansion, so that the area's output has registered some secular growth. In 1965, the experience of Cleveland was different in that steel output decreased while it was increasing in the other ten districts.

Cincinnati. Among the 11 steel districts in

the United States, the Cincinnati district ranked tenth in volume of steel produced in 1965. Two key features—the growth rate and cyclical behavior—have distinguished Cincinnati from the other steel centers in the Fourth District—Cleveland, Youngstown, and Pittsburgh. That is to say, steel production in Cincinnati has grown more and fluctuated less than in the other District centers.

Steel production in Cincinnati grew at an average annual rate of 4 percent during 1947-65. In the rest of the nation, only Detroit and St. Louis surpassed Cincinnati in growth of steel production. In 1947, steel output in the Cincinnati area amounted to 2.7 million tons; in 1965 it amounted to 6.2 million tons, an increase of 130 percent from the 1947 volume. Cincinnati's better-than-average growth rate resulted in a steadily higher proportion of total steel output between 1954 and 1965. If recent trends were to continue, Cincinnati might well nudge Cleveland out of ninth position in the ranking of steel producing centers.

A comparison of percentage decreases in steel output from peak to trough in four post-war downturns indicates that Cincinnati's strong growth pattern resisted the downward pressure of cyclical declines. In each of the first three downswings, Cincinnati's percentage decline was less than that of any of the other steel centers in the District, and during 1960-61 Cincinnati posted an increase in contrast to declines in the other three centers. In fact, when a similar comparison is made between Cincinnati and the combined steel centers outside the District, the figures show that, as a general matter, Cincinnati fared quite well.

CONCLUDING COMMENTS

The steel industry in the Fourth District has declined in relative importance during the postwar period, although the percentage increase in District production since 1961 has matched that of the nation. The combined output of the four steel centers located within the District chalked up only an average annual rate of growth of 0.1 percent during 1947-65, with better-than-average growth rates of steel output in Cincinnati and Cleveland being virtually canceled by declines in rates of change in both Pittsburgh and Youngstown. With the exception of Cincinnati, production in steel centers located within the District has evidenced wider cyclical swings than has

production in centers outside the District, particularly in the four cyclical downturns between 1947 and 1965. There are probably a number of reasons why steel output in the Fourth District fluctuates more widely over the business cycle than does output in the nation, as well as why District output has declined in relative importance. Long-term trends and cyclical behavior of the various steel regions are determined by mill location, steel product mix, shifts in demand, and import-export relationships, among other things. But it is no simple matter to quantify these factors. If research presently going on is successful in isolating some of these reasons, they will be reported on in a subsequent article.



APPENDIX

11 Major Steel Producing Districts in the United States

CHICAGO DISTRICT

Chicago, Illinois
Chicago Heights, Illinois
Lemont, Illinois
Morton Grove, Illinois
Sterling, Illinois
East Chicago, Indiana
Gary, Indiana
Kokomo, Indiana
Fort Wayne, Indiana
New Castle, Indiana
Duluth, Minnesota

PITTSBURGH DISTRICT

Johnstown, Pennsylvania
Washington, Pennsylvania
Donora, Pennsylvania
Braeburn, Pennsylvania
Latrobe, Pennsylvania
Monessen, Pennsylvania
Aliquippa, Pennsylvania
Ambridge, Pennsylvania
Beaver Falls, Pennsylvania
Midland, Pennsylvania
Monaca, Pennsylvania
Butler, Pennsylvania
Duquesne, Pennsylvania
Braddock, Pennsylvania
McKeesport, Pennsylvania
Munhall, Pennsylvania
Clairton, Pennsylvania
Brackenridge, Pennsylvania
Pittsburgh, Pennsylvania
Bridgeville, Pennsylvania
Carnegie, Pennsylvania
West Homestead, Pennsylvania
Oakmont, Pennsylvania
Weirton, West Virginia
Steubenville, Ohio
Toronto, Ohio

NORTHEAST COAST DISTRICT

Bridgeport, Connecticut
Phillipsdale, Rhode Island
Watervliet, New York
Harrison, New Jersey

Roebing, New Jersey
Philadelphia, Pennsylvania
Coatesville, Pennsylvania
Phoenixville, Pennsylvania
Ivy Rock, Pennsylvania
Fairless Hills, Pennsylvania
Reading, Pennsylvania
Bethlehem, Pennsylvania
Harrisburg, Pennsylvania
Steelton, Pennsylvania
Milton, Pennsylvania
Burnham, Pennsylvania
Sparrows Point, Maryland
Baltimore, Maryland
Claymont, Delaware

YOUNGSTOWN DISTRICT

New Castle, Pennsylvania
Farrell, Pennsylvania
Campbell, Ohio
Youngstown, Ohio
Lowellville, Ohio
Warren, Ohio
Canton, Ohio
Massillon, Ohio
Mansfield, Ohio

DETROIT DISTRICT

Dearborn, Michigan
Ecorse, Michigan
Ferndale, Michigan
Trenton, Michigan
Warren, Michigan

WESTERN DISTRICT

Pueblo, Colorado
Geneva, Utah
Helena, Arizona
Seattle, Washington
Portland, Oregon
South San Francisco, California
Emeryville, California
Niles, California
Pittsburg, California
Los Angeles, California
Torrance, California
Fontana, California

SOUTHERN DISTRICT

Newport News, Virginia
Roanoke, Virginia
Atlanta, Georgia
Tampa, Florida
Knoxville, Tennessee
Ensley, Alabama
Fairfield, Alabama
Birmingham, Alabama
Gadsden, Alabama
Anniston, Alabama
Jackson, Mississippi
Sand Springs, Oklahoma
Fort Worth, Texas
Lone Star, Texas
Longview, Texas
Houston, Texas
Pampa, Texas

BUFFALO DISTRICT

Cortland, New York
Syracuse, New York
Lockport, New York
Buffalo, New York
Lackawanna, New York
Tonawanda, New York
Dunkirk, New York
Irvine, Pennsylvania
Erie, Pennsylvania

CLEVELAND DISTRICT

Cleveland, Ohio
Lorain, Ohio

CINCINNATI DISTRICT

Huntington, West Virginia
Cincinnati, Ohio
Middletown, Ohio
Portsmouth, Ohio
Ashland, Kentucky
Newport, Kentucky
Owensboro, Kentucky

ST. LOUIS DISTRICT

Peoria, Illinois
Alton, Illinois
Granite City, Illinois
Kansas City, Missouri