Volume Title: Business Cycle Indicators, Volume 1

Volume Author/Editor: Geoffrey H. Moore, ed.

Volume Publisher: Princeton University Press

Volume ISBN: 0-870-14093-0

Volume URL: http://www.nber.org/books/moor61-1

Publication Date: 1961

Chapter Title: Statistics for Short-Term Economic Forecasting

Chapter Author: Julius Shiskin

Chapter URL: http://www.nber.org/chapters/c0738

Chapter pages in book: (p. 598 - 644)

CHAPTER 18

Statistics for Short-Term Economic Forecasting

Julius Shiskin

DURING recent years there has been a growing public interest in short-term business fluctuations. Thus the 1957–58 recession was probably the most carefully observed recession in U.S. history, and the current expansion is being followed with similar interest. Each important statistic issued is studied not only by professional economists and statisticians, but also by reporters and high government officials, including the President himself. In a press conference held on April 27, 1958, President Eisenhower stated, ". . . certainly the Federal Government should be terrifically interested in watching every statistic, every index [that suggests] what the economy is going to do."

This paper describes a statistical program that takes a step in the direction of satisfying this interest. It is concerned mainly with principles, but also describes a reporting and analysis system that has been established to follow current business cycle movements, and discusses some of the problems of improving and extending it.

The problem at hand is short-term economic forecasting, and the statistics gathered must be geared to this specific problem. The principal questions that must be answered in short-term economic forecasting necessarily change as the business cycle moves from one stage to another. At the beginning of a recession, it is important to know what its duration and ultimate severity is likely to be if it is permitted to continue without major countercyclical measures. Also of interest is the rapidity of the decline and how it compares with rates of decline in previous recessions. As the recession develops, interest centers on finding signs of an upturn. During expansions, the important questions are the ultimate extent of the rise in business activity, the amount of inflation that accompanies it, and the signs of a downturn that appear as the expansion unfolds.

In order to answer such questions, a statistical program must have:

1. Time series representing all the important economic processes.

NOTE: This paper, completed in October 1959, describes some of the results of an experiment carried out by the Bureau of the Census at the request of the Council of Economic Advisers. An earlier draft was published in the *Proceedings of the Business and Economic Statistics Section, American Statistical Association,* December 1958.

The writer is under heavy obligation to Raymond J. Saulnier, Chairman of the Council of Economic Advisers, and Geoffrey H. Moore for helpful advice at every stage in the studies described in this paper. Constructive criticisms of the manuscript were made by Thomas R. Atkinson of the Federal Reserve Bank of Atlanta, Gerhard Bry, and Murray D. Dessel of the Bureau of the Census.

2. Data available both at frequent intervals (monthly and, for some strategic series, weekly) and promptly (within a few days after the end of the period covered).
3. Data that are seasonally adjusted.
4. For irregular series, data that are smoothed by short-term moving averages, so that the month-to-month movements reflect primarily the cycle trend and are not dominated by seasonal or irregular factors.
5. Data that are accurate; the measurement error in the data must not be so large as to impair the validity of the month-to-month changes in the seasonally adjusted series.
6. A framework specifically designed for current business cycle analysis; new tools for organizing and summarizing the data can be used for this purpose.

Need for Comprehensive Data

A comprehensive system of statistical reporting that is very helpful in studying economic changes in the economy has been built up over a long period of time by government and private statistical agencies. *Economic Indicators*, for instance, which is prepared once a month by the Council of Economic Advisers for the Joint Committee on the Economic Report, contains approximately 125 different current statistical series. These series cover virtually all aspects of economic activity. In addition, a great deal of the more detailed information on these processes (for example, the industry and geographical components of employment) is published currently in the *Survey of Current Business*, the *Federal Reserve Bulletin*, and other magazines and daily newspapers.

Nevertheless, there are still a few weaknesses and gaps in the data. Two illustrations will suffice to show how such limitations affect our studies of the current expansion and why constant review and revision of the current statistical program is necessary.

Early in 1958, the series on the number of new business incorporations, published by Dun and Bradstreet, began to rise vigorously. By the end of 1958 it was apparent that this series was rising more vigorously than any other important indicator, and also more vigorously than during any other period of recent history. Ordinarily this series provides a significant indication of the current state of vitality of American business—the confidence with which businessmen face the future. It has a good record as a "leading" series; that is, it has usually turned up around cyclical revivals and down around cyclical contractions in advance of the indicators of general business conditions, such as gross national product, industrial production, and nonagricultural employment. It led at thirty-one out of the forty-eight turning points (65 per cent) for which it is available. It has, however, two important limitations. First, it is quite irregular in its movements. The application of the electronic

computer program described in Chapter 17 to new business incorporations shows that from 1947 to 1956 the average month-to-month change (without regard to sign) in the irregular component was 4.0 per cent compared to 1.3 per cent in the cyclical component. Second, and perhaps more important, it is limited to business incorporations. It does not, therefore, cover new businesses formed by private individual entrepreneurs and partners, and it includes not only new businesses but also shifts from one form of business organization to another (see Chapter 13).

Investigation revealed that the vigorous upward movement in 1958 reflected a recent change in the tax law which made it favorable for individual proprietors and partnerships to incorporate. Thus, it was impossible to judge to what extent the rise represented a true rise in new business formation and to what extent it represented only a shift from one form of business organization to another.

The existing series on all business births (which includes nonincorporated as well as incorporated new businesses) has many weaknesses. Until recently it was semiannual, and only in the last year has it become available on a quarterly basis. Furthermore, it is not based on a current data reporting system, but rather on estimates derived from indirect sources. It is clear that a monthly series on new business formations and discontinuations, based on a direct reporting system, is required to measure this important phase of economic activity. The feasibility of collecting such data in field surveys is now being investigated by the Bureau of the Census in collaboration with the Office of Business Economics.

The second example concerns freight carloadings, which had been one of the most important and reliable indicators of current business conditions. It had been a good measure of the total flow of merchandise from sector to sector of the economy. In recent years, however, it has been losing significance because of the shift of freight business from railroads to trucks and, to a lesser extent, to aircraft. As a result, during the period since World War II, this series has had a downward secular trend. This phenomenon probably accounts for its having shown a pronounced postwar tendency to turn down before business cycle peaks. Here, new series are needed on truck loadings, and perhaps air freight volume, to combine with freight carloadings into a new series on total freight carried.

For such reasons as these, a frequent review and continued improvement of our current statistical program is required, despite its present comprehensiveness.

Timing Requirements

The 1948–49 recession lasted eleven months, the 1953–54 recession thirteen months, and the 1957–58 recession nine months. It is obvious

that for analyzing movements of such short duration and particularly for determining appropriate economic policy, statistical data must be available frequently and promptly.

Whereas annual figures are appropriate for studies of long-term growth, they cannot be used to study fluctuations that may reverse themselves within a year. Quarterly data are better, but are still of limited value. During the 1957–58 recession, for example, only three quarterly observations became available for study. Monthly data are more helpful, particularly where they are supplemented by some weekly series (to make it possible to anticipate the corresponding monthly totals and to make some judgments of trends within the month). Weekly figures are particularly useful in the neighborhood of business cycle turning points.

Weekly, seasonally adjusted figures can be useful even when week-to-week movements are not in themselves significant. Where weekly figures are available, four comparisons can be made each month: the first week of the given month with the first week of the preceding month; the second week of the given month with the second week of the preceding month; and so on. Weekly figures can thus provide more current information than monthly figures, as well as making more frequent current comparisons possible. A four-week moving average of weekly figures provides more information than a set of monthly totals and, obviously, more than a monthly series that covers one week of each month (as most of the series on employment do).

Furthermore, for studying business cycles the figures must be available not only frequently, but also promptly. Monthly figures available two or three months after the end of the month covered cannot be used effectively in judging the situation today.

During recent years there has been a significant speeding up in the release of government and other statistical series. The record for some of the key business indicators is particularly good. Preliminary figures for many of these series are now available between the tenth and the fifteenth of the month following that covered by the data. Such series include the Federal Reserve index of industrial production, the various employment and unemployment series, retail sales, new orders for durable manufactures, personal income, bank debits outside New York City, spot market commodity prices, and of course stock prices.

Need for Seasonal Adjustments

Seasonal movements dominate the month-to-month fluctuations of many economic series and distort the month-to-month cyclical movements of others. In order to overcome this handicap, the series must be seasonally adjusted.

An electronic computer time series program has made possible high-quality seasonal adjustments on a large scale.[1] During the past few years, roughly 10,000 different economic series have been adjusted by this computer program. Virtually all economic series of recognized value in studying national economic conditions have now been seasonally adjusted. The electronic adjustments are satisfactory for most series, but not for all. For example, series that change their level abruptly at times (such as unemployment and agricultural stocks) are not well adjusted by the standard computer program. The electronic computer method used for adjusting the beginning and end years also yields unsatisfactory results for some series. A technique has not yet been found for handling revisions of seasonally adjusted series when data for an additional year or two are added. For these reasons, careful professional review of each series run through the computer is necessary. Nevertheless, this program represents a major stride forward in providing data in seasonally adjusted form. At relatively small cost, it is now possible to get high-quality seasonal adjustments even for economic analyses involving large numbers of series.

In addition to the monthly program, an electronic computer technique for computing weekly seasonal factors and for seasonally adjusting weekly series has been developed. Many important weekly series—at least fifty—are available currently.[2] Their use has been restricted, however, because most of them are not seasonally adjusted. Four important weekly series have recently been adjusted by the computer program: initial claims for unemployment insurance, steel production, freight cars loaded, and department store sales (Chart 18.1).

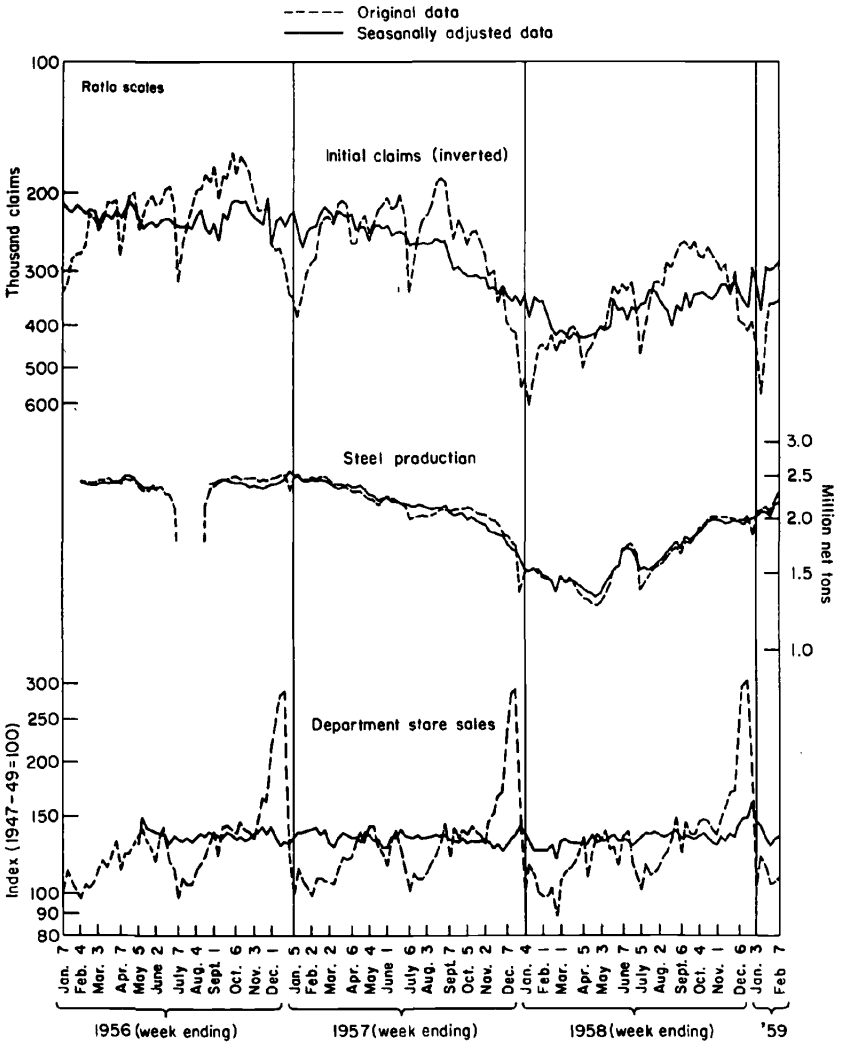
With appropriate manipulations of the original series of observations, the Census Bureau's electronic computer seasonal program can be used to eliminate almost any kind of regular short-term fluctuations from time series. To seasonally adjust weekly series by the electronic computer program prepared for monthly series, each weekly series is divided into four separate series, one comprising the first weeks of each month, another the second weeks of each month, and so on. Each of these four series is then run through the monthly census seasonal program and the results are rearranged chronologically into a continuous weekly seasonally adjusted series. Data for the four missing weeks of each year are obtained

[1] See Chapter 17; also "Decomposition of Economic Time Series," *Science*, December 19, 1958, pp. 1539–1546; and "Seasonal Adjustments by Electronic Computer Methods," *Journal of the American Statistical Association*, December 1957, pp. 415–449 (reprinted as Technical Paper 12 by the National Bureau of Economic Research, New York, 1958).

The program described in this paper was originally prepared for Sperry-Rand's Univac I. It has now been programmed for the IBM 650, 704, 705, and 709.

[2] For a list see Leonard H. Lempert, "Weekly Business Statistics," *Proceedings of the Business and Economic Statistics Section, American Statistical Association*, 1955, pp. 217–218.

CHART 18.1
Three Seasonally Adjusted Weekly Series, 1956–59



SOURCE of original data: Initial Claims: U.S. Department of Labor, Bureau of Employment Security; Steel Production: Iron Age and the National Industrial Conference Board; Department Store Sales: Federal Reserve Board. Department Store Sales were manually adjusted for Easter and Christmas prior to seasonal adjustment by machine. The steel strike in 1956 is indicated by the break in the original data.

by averaging seasonal factors for the preceding and following weeks. A similar technique can also be used for adjusting ten-day or semimonthly series.

Adjustments for the varying dates of Easter and of the introduction of new automobile models are being made by still another manipulation of the original observations. Here all the weeks containing Easter, for example, are aligned regardless of date. The figures for the six weeks before Easter and for the five after for each year are then juxtaposed. Hence, they fill out the twelve-term periods required as units for the electronic computer program. Each of these twelve-week periods is treated as a year: six or more years are punched on cards and fed through the program as a continuous time series. Adjustments are then made by applying the resulting "seasonal factors" in such a way that the same factor is applied to each of the weeks containing Easter, the seasonal factor for the previous week is applied to each of the weeks preceding Easter, and so on. Similar "segment" adjustments can be used to allow for differences in the date of Labor Day, the date of the introduction of new automobile models, and so on.

The experiments with such approaches are promising. There can be no doubt, however, that most of the developmental work on these problems still lies ahead.

Allowing for Irregular Movements

Even after the seasonal factor is removed from a series, the underlying trend is not always clear. Short-term irregularities becloud the business cycle pattern in many series, particularly during the last few months for which figures are available. The systematic reduction of, or allowance for, such irregularities can improve our understanding of the significance of recent observations in a time series, especially for short-term forecasting.

A method of measuring irregular movements and taking them into account in analyzing current changes in economic data has been described elsewhere (see Chapter 17). This approach involves, first, eliminating the seasonal factor from a series and then breaking down the seasonally adjusted series into estimates of the cycle-trend and irregular components. The cycle-trend component measures the underlying more meaningful business trends, which are considered to be smooth. The irregular component measures the residual erratic fluctuations occasioned by a wide variety of factors: exceptional events, such as unusual weather, strikes, unexpected political developments, or the failure of a large business concern, and statistical errors, such as sampling errors, response errors, and errors caused by defective seasonal adjustments.

Studies show that the average amplitude of the irregular factor remains about the same regardless of the span between the months.

compared; that is, the average percentage change of the irregular factor will be about the same when computed for consecutive months (January–February, February–March, etc.), two-month spans (January–March, February–April, etc.), three-month spans (January–April, February–May, etc.), and so on. In contrast, the cycle-trend factor cumulates uninterruptedly in one direction as the span increases, for periods usually lasting six months or more (see Table 18.1). For some series the average amplitudes of the irregular factor are smaller than those of the cycle-trend even when measured over consecutive months. For most other economic series, there is some time span at which the average amplitude of the cycle-trend factor will overtake that of the irregular factor. The span necessary to obtain a ratio of the average monthly amplitude of the irregular to the cyclical factor that is below unity may be taken as an index of the months required for the cyclical factor to become dominant over the irregular factor, on the average. This index is identified by the symbol *MCD* (Months for Cyclical Dominance).

Table 18.2 shows a frequency distribution of *MCD* for 149 important U.S. series for the interwar years, 1919–39, and the period after World War II. This table provides a broad view of the relations between the irregular and the cyclical factors in U.S. economic series. It shows that, on a month-to-month basis, the average change in the irregular factor is larger than that in the cyclical factor in about 75 per cent of the series; over three-month intervals it is larger in about 25 per cent of the series; over six-month intervals it is larger in less than 10 per cent of the series. These results emphasize the importance of knowing the relative magnitudes of irregular and cyclical factors in interpreting current movements in economic series. They indicate that the month-to-month movements of most seasonally adjusted series are not "cyclically significant"; for most series, meaningful economic trends are revealed only by comparisons over three-month or longer spans. For many series, of course, month-to-month changes are more significant, and this group (with *MCD* equal to one) includes such important series as the Federal Reserve index of industrial production, employment in nonagricultural establishments, personal income, the wholesale price index, and manufacturers' inventories. *MCD* for unemployment is two; for retail sales, new business incorporations, and new orders for durable manufactures—three; for temporary layoffs—five; and for liabilities of business failures—six. For a more complete listing, see Chapter 3, Table 3.8, and Chapter 17, Table 17.3.

Comparisons of the differences between figures a specified number of months apart are also shown by simple moving averages. For example, an unweighted three-month moving average is calculated by summing the figures for the first three months, then adding the fourth month and

TABLE 18.1

Average Amplitudes of Irregular and Cyclical Components for Different Monthly Spans, Five Economic Series, 1947–56

Span (no. of months)	Business Failures			Residential Construction Contracts[a]			Average Hours Worked			Unemployment			Retail Sales		
	$\bar{I}$	$\bar{C}$	$\bar{I}/\bar{C}$	$\bar{I}$	$\bar{C}$	$\bar{I}/\bar{C}$	$\bar{I}$	$\bar{C}$	$\bar{I}/\bar{C}$	$\bar{I}$	$\bar{C}$	$\bar{I}/\bar{C}$	$\bar{I}$	$\bar{C}$	$\bar{I}/\bar{C}$
1	15.71	3.21	4.89	10.62	4.69	2.26	.30	.19	1.58	3.95	2.98	1.32	1.72	.56	3.07
2	15.01	6.28	2.39	12.85	10.09	1.27	.34	.39	0.87	4.69	6.00	0.78	1.79	1.12	1.60
3	14.65	9.01	1.62	12.60	15.04	0.84	.31	.57	0.54	4.64	8.98	0.52	1.66	1.64	1.01
4	14.13	11.24	1.26	11.64	20.08	0.58	.30	.74	0.41	4.79	11.94	0.40	1.85	2.15	0.86
5	13.64	13.10	1.04	11.23	25.02	0.45	.32	.89	0.36	3.91	14.74	0.26	1.43	2.63	0.54
6	12.91	14.60	0.88	10.24	29.93	0.34	.28	1.04	0.27	3.76	17.50	0.21	1.47	3.07	0.48
9	12.20	20.21	0.60	10.96	44.57	0.24	.27	1.48	0.18	4.19	25.74	0.16	1.54	4.30	0.36
12	15.06	25.32	0.59	13.22	59.42	0.22	.35	1.85	0.19	4.94	33.33	0.15	1.88	6.44	0.29

[a] Residential construction contracts cover the period July 1940 to June 1956.

$\bar{I}$ = Average percentage change (without regard to sign) in irregular factor.

$\bar{C}$ = Average percentage change (without regard to sign) in cycle-trend factor.

dropping the first, adding the fifth month and dropping the second, and so on (in each case the sum is, of course, divided by three). Thus, in effect, a moving average series shows changes over varying spans. The consecutive values of a three-month moving average shows changes over three-month spans (counting from midmonth to midmonth), e.g. January–April, February–May, etc.; a four-month moving average

TABLE 18.2

Months Required for Cyclical Factor to Dominate Irregular Factor in 149 Important Economic Series, 1919–39 and 1947–56

Months Required for Cyclical Factor Dominance	*Percentage Distribution of 149 Series According to Measure, MCD*	
	1919–39	1947–56
1	23	27
2	29	21
3	25	23
4	14	11
5	5	10
6 or more	4	8
Total	100	100

For an explanation of *MCD*, see text and Chapter 17.

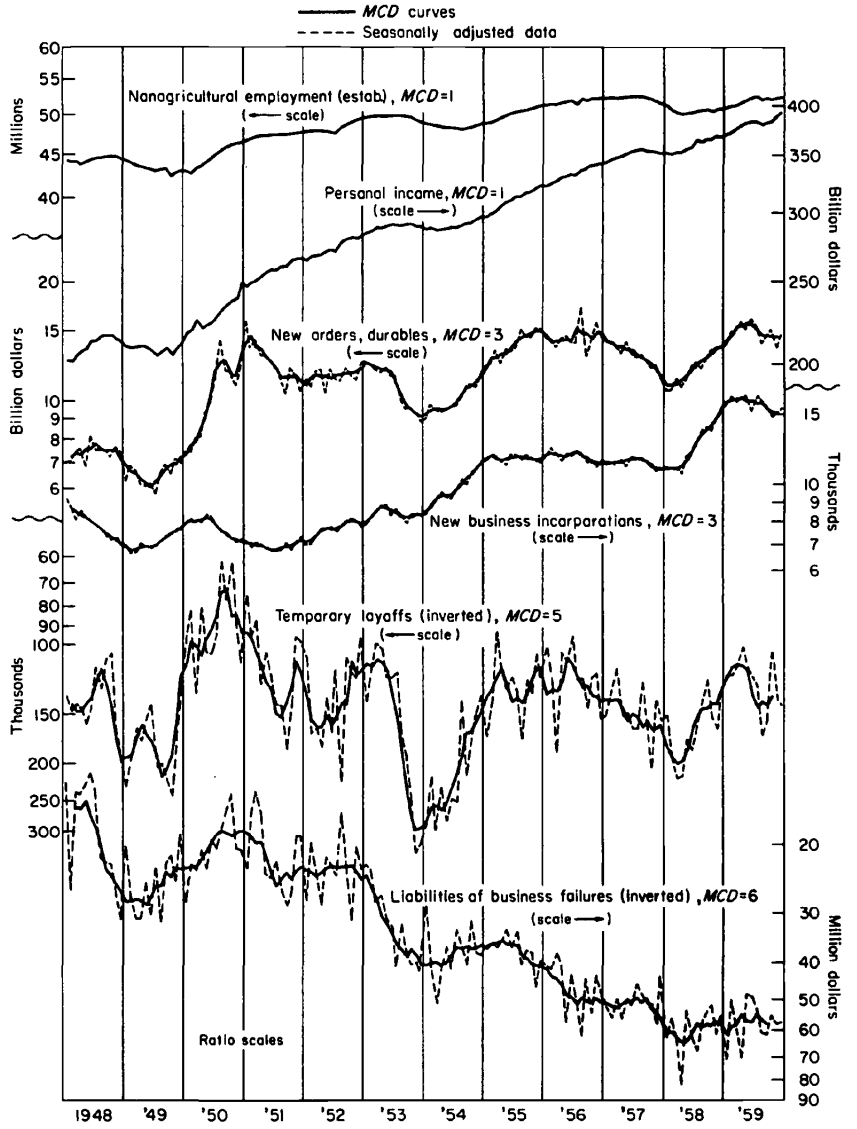
shows changes over four-month spans; a five-month moving average shows changes over five-month spans; and so on. Hence, if the period of a moving average is selected equal to *MCD*, the month-to-month movements in the moving average will just be dominated, on the average, by the cycle-trend movements in the data.

Empirical studies show that *MCD* moving averages all have about the same degree of smoothness. Consequently, *MCD* moving averages of highly irregular series, such as temporary layoffs and liabilities of business failures, will show their cyclical movements about as clearly as the seasonally adjusted data for such smooth series as nonagricultural employment and personal income.

Moving averages, however, suffer from the handicap of not reaching to the current month. Since they are centered on the middle month of the interval covered by the average, there are no values for the last month(s). Thus, the advantage gained in smoothness is offset to some extent by the disadvantage lost in currency. This is the price paid for the improvement in the series achieved by smoothing it. Longer-term moving averages would, of course, result in smoother series, but they would be less current. The *MCD* span seems to offer a reasonable compromise in terms of smoothness and currency. The seasonally adjusted figures and their *MCD* moving averages are shown in Chart 18.2 for six widely used business indicators.

CHART 18.2

Six Business Indicators and Their *MCD* Moving Averages, 1948–59



The chart shows the seasonally adjusted series for six widely used business indicators. *MCD* curves are also shown for these series. For two—nonagricultural employment and personal income—*MCD* equals one; their *MCD* curves are, therefore, the same as the seasonally adjusted series. For the others, *MCD* is greater than one; their *MCD* curves are, therefore, short-term moving averages with periods equal to *MCD*.

Still another method of reducing extremes has recently been developed in the Census Bureau's electronic computer time-series program. It is an electronic technique that identifies and eliminates large irregularities from each series, thereby yielding a new series of original observations that is free of extreme irregularities. The resulting values, designated as modified original observations, will yield a smoother set of seasonally adjusted figures when divided by the seasonal factors. Further smoothing can be accomplished by iteration—that is, the modified original observations can be treated as the original observations and run through the same computer program. This will give not only new, further modified original observations, but also purer seasonal factors and still smoother seasonally adjusted series.

Accuracy Requirements

Everyone agrees that statistics should be accurate. The question is: how accurate?

It is pointless to say that "the figures should be absolutely accurate" or "as accurate as possible" because this does not take into account the particular uses to which the statistics are put, nor does it recognize the connection between the need for statistics and the cost of collecting and compiling them.

An approach to determining the accuracy required for statistics used in studies of business cycle fluctuations is suggested by the measure *MCD* described above. In studies of the business cycle, the direction and magnitude of change in economic series is of fundamental importance. It is also important to distinguish persistent, cumulative changes from irregular fluctuations. In series with a low value of *MCD* this distinction can be made more promptly, or (with a given degree of promptness) more accurately, than in series with high *MCD*. From this point of view, then, one of the goals of statistics collectors should be to compile series for which *MCD* is low (e.g. unity).

A distinction should be made between the part of the irregular fluctuations that is due to measurement error and the part that is due to real fluctuations. Where the measurement error is known, it is possible to balance the costs and gains of reducing it. For this reason, measurement errors (response, processing, sampling, and similar errors) should be compiled for all series, and their relationship to *MCD* analyzed.

For some series, *MCD* can be reduced to unity by reducing the errors of measurement. If this can be done at reasonable cost, it is an obvious course to follow. For other series, the measurement error is already relatively small and it may not be possible to reduce the irregular movements to the point where the month-to-month movements in the seasonally adjusted series are "cyclically significant." In such cases short-term

moving averages of the seasonally adjusted series, with the period of moving average equal to *MCD*, may be provided to aid in the interpretation of movements in the series.

Of course, when a new survey is started to provide time-series data, it is not possible to calculate *MCD*. Related series may provide useful clues for tentatively estimating it. The effects of a procedural change in a survey may also be difficult to judge, as it may have a significant impact on the irregular component (i.e. enlarging the survey's sample may substantially reduce the sampling error which contributes to the irregular component). Experiments carried out by adding error series (i.e. fictitious measurement errors) of increasing magnitude to the existing series, and calculating the *MCD* for each such contrived series may be helpful in these cases.

Historical studies are based upon "final" figures, whereas current studies are, to a considerable extent, based upon "preliminary" figures, usually subject to revision before they become final. Final, accurate statistics are necessary for two purposes in business cycle analysis. First, they provide the base for measuring the change between the current and some preceding level; i.e. as a rule, the more accurate the base, the more accurate the measure of change (unless the current estimates are subject to a persistent bias). Second, they are needed for historical research, where the basic principles governing the patterns of economic change must be uncovered.

There is also an urgent need for prompt statistics. But promptness almost always reduces accuracy. "Speed-up" statistical programs always entail pressure upon respondents to report early. For this reason the preliminary figures reported by some respondents are estimates rather than book figures; in fact, respondents are usually requested to submit estimates if final figures are not yet available. Furthermore, it is almost always necessary for the data collecting agency, if time is to be gained, to "close out" the survey with some reports missing. Estimates have to be made for the missing reports. Preliminary figures cannot be expected to be as accurate as those which are made up later when all the reports are in. Thus, there is a conflict between the two important goals of accuracy and promptness.

In interpreting current business fluctuations, it is important to know how accurately preliminary figures do, in fact, reflect the final figures. Inaccurate preliminary figures could seriously limit the usefulness of business indicator series for current analysis.

Two studies of the accuracy of preliminary figures are shown here. The first shows the effects of revisions in the Census Bureau series on new orders for durable manufactures. Under the present system, three figures become available for each month: (1) an advance report, fifteen days

TABLE 18.3

Comparison of Month-to-Month Percentage Changes from Advance, Preliminary, and Final Reports, New Orders for Durable Manufactures, March 1958–August 1959

	Percentage Change			*Difference*	
	Advance Report (1)	Preliminary Report (2)	Final Report (3)	(1)−(3)	(2)−(3)
1958					
March to April	−0.8	−7.4	−5.7	+4.9	−1.7
April to May	+3.8	+4.2	+5.4	−1.6	−1.2
May to June	+1.9	+3.2	+7.3	−5.4	−4.1
June to July	+2.5	+1.1	+2.2	+0.3	−1.1
July to August	−2.1	−1.8	−2.7	+0.6	+0.9
August to September	+6.7	+3.4	+5.6	+1.1	−2.2
September to October	+4.7	+5.1	+5.2	−0.5	−0.1
October to November	−2.6	+0.9	+0.3	−2.9	+0.6
November to December	−1.0	−0.2	−0.7	−0.3	+0.5
1959					
December to January	−2.5	+1.1	+1.6	−4.1	−0.5
January to February	+9.7	+7.3	+7.3	+2.4	0.0
February to March	−0.8	+1.5	+2.6	−3.4	−1.1
March to April	+2.9	+1.8	+3.2	−0.3	−1.4
April to May	−3.8	−4.4	−3.5	−0.3	−0.9
May to June	+3.2	+4.0	+5.9	−2.7	−1.9
June to July	−1.1	−3.4			
July to August	−13.5	−9.6			
Average (without regard to sign)			3.9	1.9	1.1

NOTE: The advance report is based on about 45 per cent of total new orders for durable manufacturers, the preliminary report on about 55 per cent, and the final report on about 65 per cent.

after the month covered; (2) a preliminary estimate, thirty days after; and (3) a final estimate, sixty days after, with each successive figure based on a larger sample. These figures are usually different and occasionally the differences are pronounced, as can be seen in Table 18.3. However, the average difference (without regard to sign) between the month-to-month percentage changes in the advance and final reports between March 1958 and August 1959 was only 1.9 per cent. This difference is well below the average month-to-month change of 3.9 for the same period (for which the advance report was available) and of 5.4 for the entire post-World War II period. It would, therefore, appear that the advance figures provide a useful preview of the final report. Table 18.3 also shows that the preliminary figure usually provides a more reliable estimate of the final figure than does the advance report.

The advance report does, however, appear to have a downward bias

TABLE 18.4

Comparison of Diffusion Indexes Computed from Advance, Preliminary, and Final Reports, New Orders for Durable Manufactures, Total, December 1958–August 1959

	Diffusion Index			*Difference*	
	Advance Report (1)	Preliminary Report (2)	Final Report (3)	(1)−(3)	(2)−(3)
1958					
December to March	17	45	50	−33	−5
January to April	52	67	52	0	+15
February to May	57	62	62	−5	0
March to June	67	71	76	−9	−5
April to July	83	67	71	+12	−4
May to August	57	71	67	−10	+4
June to September	74	76	81	−7	−5
July to October	76	67	83	−7	−16
August to November	43	43	76	−33	−33
September to December	19	52	55	−36	−3
1959					
October to January	38	52	52	−14	0
November to February	76	71	71	+5	0
December to March	86	86	88	−2	−2
January to April	81	81	86	−5	−5
February to May	62	67	62	0	+5
March to June	43	43	43	0	0
April to July	50	43			
May to August	24				
Average (without regard to sign)				11.1	6.4

NOTE: The diffusion indexes in this table are computed over three-month spans, and show the percentage of 21 durable goods industries reporting an increase in new orders.

(as does the preliminary report). The new orders statistics in the advance report were lower than in the final report ten times out of fifteen with, and twelve times out of fifteen without, the most erratic component—transportation equipment. The diffusion index also has been consistently too low, as is shown in Table 18.4. A study of different techniques for improving the early estimates is under way at the Bureau of the Census. In addition to improving the coverage of the advance report, a possibility under consideration is to utilize past relations between the advance and the final figures to adjust the early figures when they become available.

A more inclusive test is provided by our comprehensive diffusion indexes, which measure the percentage of business activities expanding. The diffusion indexes based on current data available for the first time, the same series three months later and then again six months later, are given in Table 18.5. In considering the effects of revisions upon these

TABLE 18.5

Comparison of Original and Revised Diffusion Indexes

	AVERAGE, LEADERS					AVERAGE, COINCIDENT					AVERAGE, ALL SERIES				
	Diffusion Indexes Based on Data Released			*Difference*		*Diffusion Indexes Based on Data Released*			*Difference*		*Diffusion Indexes Based on Data Released*			*Difference*	
	Earliest (1)	Three Months Later (2)	Six Months Later (3)	(1)–(3)	(2)–(3)	Earliest (1)	Three Months Later (2)	Six Months Later (3)	(1)–(3)	(2)–(3)	Earliest (1)	Three Months Later (2)	Six Months Later (3)	(1)–(3)	(2)–(3)
1958															
Jan.	38	36	36	+2	0	32	26	26	+6	0	34	32	32	+2	0
Feb.	46	41	40	+6	+1	19	23	22	−3	+1	33	33	32	+1	+1
Mar.	42	48	48	−6	0	16	10	10	+6	0	30	31	31	−1	0
Apr.	45	42	42	+3	0	16	19	19	−3	0	32	32	32	0	0
May	66	69	69	−3	0	40	42	42	−2	0	54	57	57	−3	0
June	69	72	72	−3	0	63	63	63	0	0	66	68	68	−2	0
July	79	76	76	+3	0	69	71	71	−2	0	74	74	74	0	0
Aug.	67	72	73	−6	−1	78	78	78	0	0	72	75	75	−3	0
Sep.	71	73	73	−2	0	71	75	75	−4	0	71	74	74	−3	0
Oct.	67	72	72	−5	0	66	66	66	0	0	66	69	69	−3	0
Nov.	65	75	75	−10	0	64	62	62	+2	0	65	69	69	−4	0
Dec.	60	69	69	−9	0	63	71	71	−8	0	62	70	70	−8	0
1959															
Jan.	69	73	73	−4	0	62	66	66	−4	0	66	70	70	−4	0
Feb.	68	66	66	+2	0	63	70	72	−9	−2	66	68	68	−2	0
Mar.	73	76		−3*		76	77		−1*		74	76		−2*	
Apr.	73	73		0*		72	79		−7*		73	76		−3*	
May	78	79		−1*		84	87		−3*		80	82		−2*	
June	59					77					67				
July	52					75					62				
Aug.	35					51					41				

* (1)–(2).

NOTE: These diffusion indexes are based upon 279 component series in eight major groups, arranged by NBER timing classification. The average for the leaders is an unweighted average of diffusion indexes for five groups: (1) average weekly hours in manufacturing (21 series); (2) new orders for durable manufactures (21 series); (3) stock prices (86 series); (4) spot market commodity prices (22 series); and (5) initial claims for unemployment insurance, inverted (47 series). The average for the roughly coincident series is an unweighted average of diffusion indexes for three groups: (1) nonagricultural employment (32 series); (2) industrial production (26 series); and (3) retail sales (24 series).

broad indexes, it should be borne in mind that two of the five major components of the leaders are not subject to revision: (1) stock prices and (2) initial claims. This table indicates that the early reported figures are subject to considerable revision during the first three months, but are largely stabilized after three months. More important, the table suggests a bias in the underlying figures during the 1958–59 expansion. The figures originally reported tended to be too low and were typically revised upward, in both the leading and the coincident groups. The bias in these figures may help to explain some of the early dissatisfaction with the apparent rate of recovery.

A criterion for judging the reliability of preliminary estimates might be that revisions of such figures should be smaller than the average month-to-month change in the final seasonally adjusted figures. Where the revisions are larger, the preliminary figures can be misleading and should, therefore, be improved or discontinued. Where the revisions are relatively small, publication of the revised figures might be undertaken, say, only once a year. Where this goal of reducing the amount of revision later necessary can be achieved by postponing the publication of the preliminary estimates by only a day or two, it may be worth-while to do so.

Revisions occur not only because of more complete coverage and more accurately reported final figures as time goes on, but also because of revisions in the seasonal adjustment factors. The electronic computer program requires some refinement in this respect because, at present, it can produce changes in past seasonal factors even when only a few months of additional data are added. A "control" on such revisions is planned for the next major revision of the present program. Our thought is to develop an optional routine which (1) compares the new seasonally adjusted series with the old series in the computer, and (2) prints revised figures only when the differences are significant. The tentative criterion for defining a "significant" revision is that suggested above: one which is larger than the average month-to-month change (without regard to sign) in the seasonally adjusted series.

The difficulties of using preliminary figures preface other difficulties involved in handling current figures. Thus, seasonal adjustment factors are always based upon historical data. The implicit assumption of their applicability to current data creates an additional margin of error. Also, the smoothing of series, which can accomplish much for historical time series, is considerably less useful on a current basis. That is, there are many satisfactory smoothing formulas for eliminating the irregular factor from historical series so that the underlying trends are clearly exposed; they are not, however, applicable to current figures, because the data for the future months needed for the computations are not available. Such

limitations of the data are probably most significant at the very time when the greatest accuracy is required—around business cycle turning points. At such critical stages of the cycle, the magnitude of the cyclical change is often smaller than at other stages. Obviously caution must be the byword in interpreting current business fluctuations.

New Tools for Business Cycle Studies

Although "business fluctuations" have been a subject of study in many universities and private research organizations for several generations, our understanding of the causes of business cycles and methods of dealing with them is far from satisfactory. Twenty-five recessions have been recorded in the United States since 1854. While there is a considerable amount of similarity among them, variation in severity, scope, and duration is also a distinct feature, and the reasons for these variations are still largely obscure.

Over the past few decades the National Bureau of Economic Research has been engaged in a comprehensive study of business cycles. One of the broad results of this work is an accumulation of evidence on the interplay of economic forces which generate advances in total activity for periods ranging from eight or ten months to several years, followed by declines for what are usually shorter periods. In general, it appears that as the forces for economic expansion become dominant, factors which work in the opposite direction are brought into play and gradually spread and gain strength. Eventually, these contractive forces overtake the others and there is a reversal of the upward trend. But even while this reversal is getting under way, expansive forces once again begin to spread and gain strength, so that the new downward trend of economic events is eventually reversed.

In the course of its attempt to identify and measure these forces, the National Bureau has built up a large record of monthly and quarterly time series to provide a statistical basis for the analysis. It has also developed several analytical tools helpful in forecasting prospective business conditions: a record of the typical sequence of economic fluctuations and, more specifically, a list of series that usually lead; the diffusion index, which provides a clue in making early judgments on shifts in the general trend of business activity; and a technique that promises to be helpful in making early judgments about the ultimate severity of a current recession or the ultimate advance of a current expansion (see Chapters 3 and 5). Like the data to which they must be applied, these analytical tools have important limitations. Nevertheless, they represent a significant addition to our other, extensive but also weak, techniques for making short-term forecasts of business conditions.

The National Bureau studies have been based upon large numbers of

monthly series. They required, as a first step, the adjustment of each series for seasonal variations. Seasonal adjustment computations have, in the past, been laborious and costly. Similarly, calculations of various business cycle measures have been expensive and slow. The mass handling of large numbers of series by National Bureau methods was, until recent years, extremely difficult to carry out on a time schedule that would make them helpful in current analyses of business conditions.

During the past few years electronic computer programs have been developed which have made possible the application of these methods of business cycle analysis to current economic problems on a large scale. One of these programs, a time-series analysis and adjustment program, has been referred to above. It makes it possible to seasonally adjust large numbers of series promptly and accurately and also to prepare smooth curves of the results. Another program, a time-series dispersion program, provides a method of analyzing groups of series in relation to one another. It computes the rates of change of each series in the group for any specified set of time intervals, assembles these rates into a series of frequency distributions, and computes the average (mean) rate of change and the standard deviation. The dispersion program also shows the median and each of the decile rates of change for each time interval, the average for rising series alone and the average for falling series alone, and the percentage of series rising (the diffusion index). It compiles for each month a distribution showing the number of series that have been rising (or falling) for one, two, three, four, five, and six or more consecutive months, and the mean of this distribution (average duration of run). It lists the direction of change (+, 0, −) for each series over successive time intervals. The rates of change are shown on a per month as well as aggregative basis. An adaptation of this dispersion program permits computations from a fixed month, say a business cycle peak, to each of the following forty-eight months. Any peak or trough date, or series of dates, can be selected for this variation of the standard program. Other criteria for selecting a chronology, such as the dates of severe strikes, can also be used.

A large number of the measures computed by these programs are now being used to follow current business fluctuations. Many others have to wait until resources are available to check their usefulness. The programs include no computations that could not be made by clerks. But they make it possible to make large numbers of computations quickly and cheaply. Consequently, they have made it feasible for the first time to organize large numbers of series into a system for current business cycle analysis.[3]

[3] A full description of the time series analysis and adjustment program appears in Chapter 17. A description of the time-series dispersion program appears as an appendix to this paper. The National Bureau has also prepared an electronic computer program for computing the measures of cyclical amplitudes and patterns described by Burns and Mitchell in *Measuring Business Cycles*.

Electronic computers have also had an important role in improving the timing of statistical reports which provide the various data series used. For example, the tabulation of the unemployment figures is now completed about one week after the period covered by the data, compared to two weeks previously. In addition, the estimates are better because an improved estimation formula could be used on the computer, and considerably more detailed data are tabulated. During 1960 and 1961 all the Census Bureau's current surveys will be transferred to electronic processing, including manufacturers' sales, orders and inventories, retail sales, construction starts and put-in-place, and exports and imports. In all these cases, the use of electronic computers will shorten release time by several days. While the absolute amount of time is small, it should be borne in mind that the saving constitutes a large proportion of the total processing time. Further, the resulting tabulations are more accurate and more detailed.

The impact of electronic computers on the statistical program required for short-term economic forecasting can be summarized as follows:

1. They speed up the release of current statistics for use in business conditions analysis.

2. They make it possible to carry out complex computations that previously could not have been attempted manually. As a result, the available statistics are more accurate and more detailed.

3. They stimulate the review of traditional procedures and lead to new and improved techniques, by forcing the economic statistician to make more explicit his assumptions at every step in a procedure.

4. They free the economic statistician from the costs and other burdens of routine clerical work, leaving additional resources available for substantive analysis.

5. The speed with which the results of experiments are obtained improves the efficiency and productiveness of research workers. A large volume of data can be made ready for further analysis on short notice. For example, large-scale seasonal computations that become necessary because of revisions in original data, or because previous seasonals have become out of date, can be completed quickly.

6. Electronic computers can also be programmed to make some choices that eliminate the need for human judgment. The data can be routinely tested for different characteristics and, depending upon the results of such tests, alternative computations can be made, all without human intervention.

Despite these contributions that electronic computers can make to computations for economic analysis, careful review of the results is always essential, because of the possibility not only of machine errors (which are rare), but also of human errors in getting the proper data to the machine,

in writing the computation program, or in failing to anticipate certain contingencies with which the program cannot adequately cope. In short, electronic computers can provide more detailed and better quality data for making professional judgments, but they cannot be relied upon to do the professional's work.

A Reporting System for Observing Current Business Cycle Movements

At the request of the Council of Economic Advisers, the Bureau of the Census has been carrying out experimental work during the past few years with a view to developing a method of appraising current business fluctuations in a monthly economic report that takes advantage of both modern analytical tools and data processing equipment. The particular system developed thus far is summarized below.[4]

It seems necessary to use a large number of series in these studies, partly to keep track of the many different processes, industries, and geographic areas comprising the American economy, and partly because of the limitations of individual series (i.e. inaccuracies of measurement and irregularity of behavior). More than 300 series are presently used in the monthly current economic report.

First, about forty economic series have been selected to indicate broadly the short-term changes in the economy, following the recommendations of Geoffrey H. Moore of the National Bureau of Economic Research. These series have been classified into "leading," "roughly coincident," or "lagging" groups. Fluctuations in these three groups of series present a continuous, never-ending flow. Movements of the leading series provide clues to subsequent fluctuations in the broad measures of economic activities. The fluctuations of the roughly coincident series measure the current performance of the economy. The role of the lagging series is, partly, to confirm the movements of the coincident series and, in some cases, to reflect conditions that may bring about turning points in the leading series.

In addition to these general series, about 300 more are now being used to follow developments in various sections of the economy in more detail and to compute diffusion indexes. These include:

1. Average hours worked per week in the twenty-one major manufacturing industries. This group contributes leading series and knowledge about the behavior of different industries (see Chapter 15).

2. New orders for durable manufactures, which has in the past been

[4] In preparing the monthly reports, valuable assistance is provided by Michael J. Conlon, Allan H. Young, Betty F. Tunstall, and Marcia Peterson of the Bureau of the Census.

It may be of interest to note that the preparation of each monthly report is accomplished in a few days, and the results become available on the 16th, 17th, or 18th of the month following that covered by the data, depending on how the week end falls.

a reliable indicator of prospective business conditions. Furthermore, most of the individual industry series in the new orders group have also consistently led the corresponding sales figures (see Chapter 14). Twenty-one series are included in this group.

3. Stock market prices, which have in the past also served as a sensitive indicator of business conditions. The eighty-six Standard and Poor stock market industry series, covering a total of about 500 individual companies reported on the New York Stock Exchange, were selected. Many of these individual series, as well as their total, are consistent leaders.[5]

4. Spot market commodity prices (twenty-two series), which have in the past been a sensitive indicator of prospective business conditions. Moreover, prices are of special interest because of the widespread concern with inflation.

5. Initial claims for unemployment insurance, which are of interest for two reasons. First, the aggregate series has frequently led business cycle turns (cf. Appendix B). Second, initial claims data are available on a geographic basis and are, therefore, helpful in studying the impact of business fluctuations upon the different geographic regions. Forty-seven labor market area series are now being used.

6. Employment in nonagricultural establishments, for thirty-two industry groups, covering employment in all industries outside of farming. This group of series is one of the most comprehensive available monthly, and it provides one of the best measures of short-term changes in total business activity. The group includes twenty-one manufacturing and eleven nonmanufacturing industries.

7. Industrial production (twenty-six industries). It is obviously necessary to have, in addition to the input measures of employment and average weekly hours, comprehensive measures of output. The Federal Reserve Board's indexes of mining and manufacturing production are most appropriate for this purpose.

8. Retail sales, by kind of business (twenty-four series). Total retail sales has been classified as a lagging series on the basis of its behavior before World War II. During the postwar period, however, it has been roughly coincident at the peaks and has led at the troughs of the business cycle. Also, the amplitude of its fluctuations has been very mild during this period.

9. A group of nineteen consumer price series, because of the importance of observing closely any inflationary tendencies during business expansions. Since these series in general have conformed poorly to business cycles, they are not included in the various indexes described below.

10. Finally, several quarterly diffusion indexes of businessmen's

[5] See Edmund A. Mennis, "Security Prices and Business Cycles," *Analysts Journal*, February 1955, pp. 79–86.

anticipations, compared with actual performance: (a) net sales of all manufacturers, (b) new orders for durable manufactures, (c) freight carloadings of nineteen manufactured commodity groups, and (d) new plant and equipment expenditures.

Utilizing the statistical data listed above, the following statistical measures of current economic trends are provided on a current basis:

1. Severity of recessions and vigor of expansions. Monthly comparisons have been made between the declines from the peak to successive stages of the 1957–58 recession and the declines over corresponding spans of the 1953–54, 1948–49, 1937–38, and 1929–33 recessions. First, the declines were measured from reference peaks, that is, from peaks in general business conditions. These comparisons span the full interval from the peak in general business preceding the 1957–58 recession (July 1957) to the most recent month for which data are available, and corresponding periods of earlier recessions. Similar comparisons have been made between the expansion starting from the business cycle trough in April 1958 and the seven previous expansions starting in 1921, 1924, 1927, 1933, 1938, 1949, and 1954. Tables 18.6 and 18.7 illustrate these comparisons, the former being based on the data used during the 1957–58 recession and the latter on the fuller list of series used during the 1958–59 expansion.[6]

"Specific cycle" comparisons were also made during the early months of the recession and expansion. Specific cycles and specific peaks are cycles and peaks of the aggregates, or averages, for each of the nine groups of economic indicators listed above. Since the specific peak months were not the same for each of the nine aggregate series, the historical periods covered by these comparisons (peak month to current month) were not the same for all groups of indicators. Here rates of change for the 1957–58 recession (from the most recent specific peak to the most recent month) were compared with rates of change over periods of the same duration in earlier recessions.[7]

2. Diffusion indexes. A separate current diffusion index has been computed for each of the first nine groups of series listed above (that is, one for average hours worked, another for new orders, a third for stock prices, and so on). These individual diffusion indexes have also been combined into averages, with the diffusion index for each group given a weight of one. The common quality that has been used to group the series is their similarity in cyclical timing; thus, one general index has been prepared for the group of five leaders (the first five groups listed above) and another for the three "roughly coincident groups" (the next three

[6] For further discussion of this type of analysis, see Chapters 3 and 5.

[7] Some comparisons of the use of specific and reference benchmarks are made in Pao Lun Cheng and Leonard H. Lempert, "Rates of Change and Cyclical Magnitude," *Proceedings of the Business and Economic Statistics Section, American Statistical Association,* December 1958.

groups). These eight groups are also combined into a single average diffusion index (Chart 18.3). A three-month span is used uniformly in all series to determine directions of change (for some groups, separate diffusion indexes based on one-month spans are also compiled).

Although similar in general configuration, these diffusion indexes are smoother than the corresponding diffusion indexes for the eight NBER leading indicators, eight coincident series, and the twenty-one indicators combined, when the latter are also based on three-month spans (Table 18.8).[8] Presumably the greater smoothness is due to the use of a much larger number of series. Nevertheless, the diffusion indexes still include a large irregular factor, as large as, or larger than, those in the aggregate series for business failure liabilities and commercial and industrial construction contracts (cf. Chapter 17, Table 17.2). On the other hand, the cyclical factor is also large. The ratios of the average monthly amplitude of the irregular factor to that of the cyclical factor are about two, which is smaller than that for most of the National Bureau leading series. This suggests that comparisons made in these diffusion indexes over two- or three-month periods can usually be relied upon to provide an indication of cyclical movements.

3. Direction-of-change tables. The emphasis throughout the monthly report on current economic conditions is upon measures of *change: change* from the peaks of cycles, *change* from the standing three months earlier, *change* from the standing at the previous month. The magnitude of these changes is of obvious importance. In studying the cumulative movements of the business cycle, however, the direction of change must be given a great deal of attention. Persistent changes in the same direction may be significant, even though small. Furthermore, to be most helpful, a statistical system must have a general economic framework, that is, changes shown by the statistical indicators must be interpretable in economic terms. This is particularly important in the case of diffusion indexes, which show only the percentage of series rising and do not show which components are rising and which are falling. To provide such information, tables have been prepared showing the direction of change monthly in each of the component series. They show not only which series are rising currently, but also how long they have been rising; in addition, they indicate whether series are rising or falling consistently or moving erratically. These tables, therefore, provide a convenient summary view of changing economic conditions. Similar tables containing the rates of change would provide more information, but they are also more difficult to absorb.

[8] The diffusion indexes for the 21 indicators that appear in Chapter 3 are smoother than those based on uniform three-month spans, but use longer spans (four to six months) for eleven of the series.

TABLE 18.6

Comparison of Five Recent Recession Periods: Standardized Percentage Changes and Rankings from Reference Peak Levels and Reference Peak Dates

A. STANDARDIZED PERCENTAGE CHANGES IN SEVENTEEN ECONOMIC SERIES FROM THE MOST RECENT REFERENCE PEAK TO APRIL 1958 AND CORRESPONDING PERIODS OF EARLIER RECESSIONS

Series	*Months after Reference Peak*	*Recession Beginning at Reference Peak of*				
		Aug. 1929	May 1937	Nov. 1948	July 1953	July 1957
Leading						
1.0 Average workweek, mfg.	9	−11.6	−19.7	−2.8	−4.2	−4.2
4.0 New orders, durables	9	−7.1	−8.0	−3.0	−4.4	−3.9
10.0 Common stock price index	9	−8.1	−13.6	0.0	+4.6	−4.8
12.2 Wholesale price index, basic comm.	9	−9.5	−24.4	−15.9	+3.3	−3.5
3.2 No. of initial claims for unemploy. (inv.)	9	n.a.	n.a.	−13.7	−10.5	−11.5
7.1 No. of new incorporations	9	−3.5	−6.1	−0.2	+1.4	−8.1
5.0 Housing starts	9	−8.9	−4.4	+5.3	+1.6	−0.7
6.0 Comm. & indus. build. contracts	9	−8.7	−12.3	−8.8	−7.0	−5.2
8.0 Bus. failures, liabil. (inv.)	9	−6.3	−7.7	−2.8	−0.2	−9.3
2.0 Gross accession rate, mfg.	9	n.a.	−3.8	−3.2	−7.6	−2.5
3.0 Layoff rate, mfg. (inv.)	9	n.a.	−11.6	−6.0	−9.0	−7.0
Roughly Coincident						
13.0 Employ. in nonagric. estab.	9	−13.1	−14.0	−6.9	−5.6	−8.7
15.0 Total indus. prod. index	9	−10.8	−21.9	−4.8	−6.5	−8.4
20.2 Sales by retail stores (excl. food)	9	−4.8	−14.6	−0.3	−1.3	−5.1
19.0 Personal income	9	−10.1	−10.4	−3.5	−1.1	−1.1
18.0 Bank debits outside NYC	9	−15.8	−12.0	−5.7	−1.4	−4.3
Other						
Consumer price index	9	−4.9	−3.4	−4.9	+0.9	+6.6

B. RANKINGS AND AVERAGE STANDARDIZED PERCENTAGE CHANGES IN LEADING, ROUGHLY COINCIDENT, AND ALL SIXTEEN SERIES FROM REFERENCE PEAKS TO NINTH MONTH FOLLOWING REFERENCE PEAKS

	Rankings (rank of 1 = least severe)					*Standardized Percentage Changes*				
	1929	1937	1948	1953	1957	1929	1937	1948	1953	1957
Average of eleven leading	4	5	2	1	3	−8.0	−11.1	−4.6	−2.9	−5.5
Average of five roughly coincident	4	5	2	1	3	−10.9	−14.6	−4.2	−3.2	−5.5
Average of sixteen series	4	5	2	1	3	−9.1	−12.3	−4.5	−3.0	−5.5

NOTE: The series numbers correspond to those in Volume II.

EXPLANATORY NOTE: This table is one of a series that were constructed to compare the declines from the peak to successive stages of the 1957–58 recession and the declines over corresponding periods of the 1953–54, 1948–49, 1937–38, and 1929–33 recessions. For the series of tables from which this illustration was selected, the declines were measured from the reference peaks, that is from the peaks in general business conditions. These comparisons spanned the full interval from the peak in general business preceding the 1957–58 recession (July 1957) to the most recent month for which data were available, and corresponding periods of earlier recessions. The interval between July 1957 and April 1958, covered by the table shown above, is nine months. Changes over this nine-month period are compared with changes over nine-month periods following the general business peaks preceding the four previous recessions. The periods covered in the earlier recessions are August 1929 to May 1930, May 1937 to February 1938, November 1948 to August 1949, and July 1953 to April 1954.

The percentages shown in the table are not conventional percentage changes, but result from standardization of modified percentage changes (see note 10). Because they are standardized, these percentage changes can be averaged even though they are based on different types of economic activity. Average standardized percentage changes for the leading, roughly coincident, and all series are shown in the lower section of the table along with severity rankings of the five most recent recessions. Rankings are based on the average standardized percentage changes with a rank of 1 indicating the least severe and a rank of 5 indicating the most severe of the five recessions nine months after reference peaks.

TABLE 18.7

Comparison of Eight Recent Expansion Periods from Reference Peak Levels and Reference Trough Dates

PERCENTAGE CHANGES (PLUS 100) IN TWENTY-FIVE ECONOMIC TIME SERIES FROM THE MOST RECENT REFERENCE PEAK TO THE MOST RECENT MONTH AND CORRESPONDING PERIODS OF EARLIER CYCLES

Series	*Months after Reference Troughs*	*Expansion Periods Beginning in* 1921	1924	1927	1933	1938	1949	1954	1958
Leading									
1.0 Average workweek, mfg.	19	n.a.	97.0	99.8	68.4	95.8	102.8	99.8	99.5
2.0 Gross accession rate, mfg.	18	97.6	49.5	108.5	43.2	90.5	119.0	87.5	87.1
3.0 Layoff rate, mfg. (inv.)	18	n.a.	53.8	100.0	34.3	89.5	130.0	64.7	50.0
4.0 New orders, durables	19	214.5	121.6	97.3	37.2	106.2	171.6	118.6	105.6
5.0 Housing starts	19	182.4	129.1	80.5	20.4	151.0	122.1	105.6	119.2
6.0 Comm. & indus. build. contracts	18	36.6	103.6	124.7	16.6	81.0	131.4	104.5	119.3
7.1 No. of new incorporations	18	81.6	105.8	117.4	61.6	88.7	96.3	142.2	125.9
8.0 Bus. failures, liabil. (inv.)	19	15.1	131.6	109.4	209.3	90.9	110.7	107.9	79.0
9.0 Corporate profits (Q)	12	n.a.	n.a.	n.a.	n.a.	n.a.	136.1	121.9	120.0
10.0 Common stock price index	19	105.1	146.1	200.8	29.7	75.7	143.4	195.5	118.0
12.0 Indus. raw materials spot market price index	19	n.a.	n.a.	n.a.	n.a.	n.a.	135.8	115.5	102.0
Roughly Coincident									
13.0 Employ. in nonagric. estab.	19	88.3	97.1	104.9	80.3	99.0	105.7	102.8	99.3
14.0 Unemployment rate (inv.)	19	n.a.	n.a.	n.a.	0.2	72.3	129.4	61.4	74.7
15.0 Total indus. prod. index	19	104.5	102.0	115.1	62.3	101.5	117.3	103.6	102.1
16.0 GNP, current dollars (Q)	15	n.a.	113.5	112.2	62.2	98.6	119.5	110.9	106.9
17.0 GNP, 1954 dollars (Q)	15	n.a.	n.a.	n.a.	n.a.	n.a.	112.3	107.5	103.3
18.0 Bank debits outside NYC	19	90.9	115.3	116.4	45.1	99.5	126.2	120.9	115.0

19.0 Personal income	18	n.a.	111.8	112.8	60.6	100.5	118.2	111.6	107.8
20.0 Sales by retail stores	19	100.0	105.9	105.4	71.0	101.6	117.6	108.8	106.2
21.0 Wholesale price index (excl. food)	19	69.9	94.3	92.9	84.8	96.8	111.6	105.1	101.8
Lagging									
22.0 Plant & equip. expend.	18	n.a.	n.a.	n.a.	n.a.	n.a.	114.4	116.8	89.9
23.0 Wage & salary cost/unit of output	19	76.7	94.4	90.8	88.3	98.1	103.4	103.8	101.1
24.0 Mfrs. inventories	18	n.a.	n.a.	n.a.	73.8	96.8	120.5	104.4	95.1
25.0 Consumer instal. debt	18	n.a.	n.a.	n.a.	57.4	114.0	169.0	134.0	115.6
26.0 Bank interest rates on bus. loans (Q)	15	87.2	91.4	112.5	69.0	95.8	114.4	105.4	109.1

NOTE: The series numbers correspond to those in Volume II.

EXPLANATORY NOTE: This table facilitates evaluation of the current business cycle expansion by showing the amount of expansion (or contraction) that has taken place in each series since the most recent reference peak relative to the amounts of expansion (or contraction) over corresponding intervals of the seven preceding expansions.

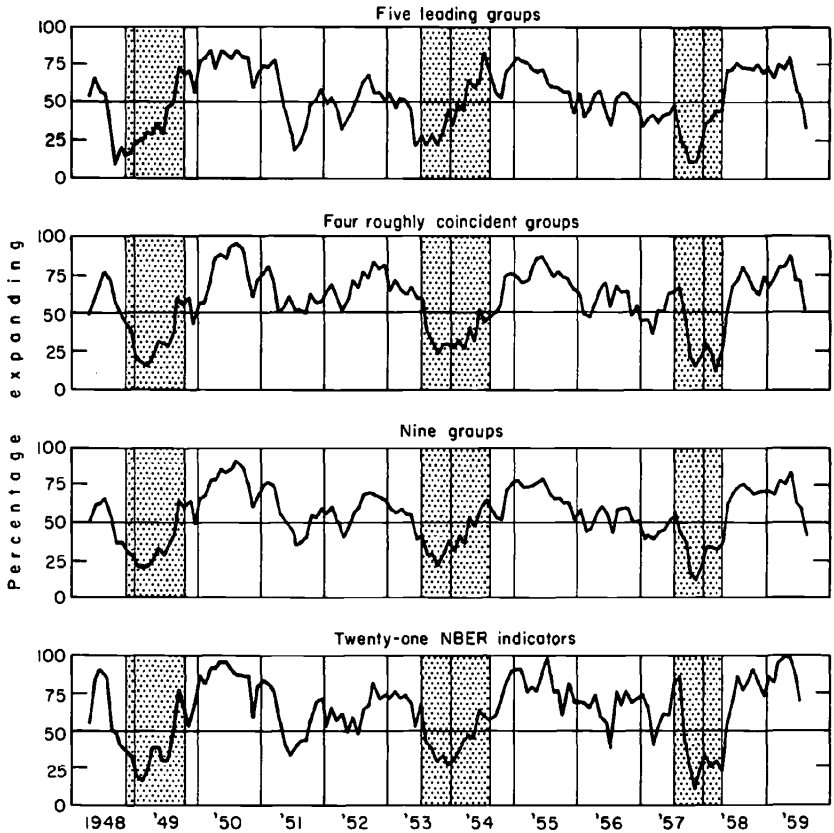
Percentage changes are computed from eight reference peaks to months a fixed period after each reference trough. For example, the percentage change in personal income from the reference peak in July 1957 to November 1959, the most recent month for which data are available, is +7.8. Since November 1959 is 19 months after the reference trough in April 1958, the percentage changes in earlier cycles are computed for periods 19 months after the reference trough. The values at the previous reference peaks are used as comparison bases. Thus, the percentage change of +18.2 in personal income indicated for the 1949 cycle was computed from the reference peak in November 1948 to the 19th month after the reference trough in October 1949, i.e. to May 1951.

In December 1959 data for several series were not available for November 1959; for these series a shorter interval from the April 1958 reference trough was used—an 18-month interval, or in the case of quarterly series a 12- or 15-month interval. In the illustrative table the percentage changes have been added to 100, so that the figures actually show the levels at the "current" month relative to those at the previous reference peak months.

A similar table is prepared each month showing the percentage changes from the troughs. The percentage formula used is the conventional formula $100\ (B - A)/A$, where A is the value for the first period and B is the value for the second period.

CHART 18.3

Average Diffusion Indexes, Leaders, Roughly Coincident Groups, All Groups, and Twenty-one NBER Economic Indicators, 1948–59



For list of component groups, see text.

Components are seasonally adjusted except stock prices, which have no seasonal.

Shaded areas represent business contractions; unshaded areas, expansions.

Diffusion indexes are based on 281 component series in nine groups. The nine groups include the first eight listed in the text, with group 6—nonagricultural employment—divided into two groups: 21 manufacturing industries and 13 nonagricultural industries (including durable and nondurable manufactures).

Diffusion indexes are based on directions of change over three-month spans and are plotted in the terminal month. Latest data plotted: August 1959.

TABLE 18.8

Measures of Smoothness: Diffusion Indexes

	Average Amplitudes[a]					
	Original Observations $\bar{O}$ (1)	Irregular Component $\bar{I}$ (2)	Cyclical Component $\bar{C}$ (3)	$\bar{I}/\bar{C}$ (4)	*MCD*[b] (5)	Average Duration of Run[c] (6)
All Series						
1. Comprehensive (279 series)	14.2	11.5	6.1	1.9	3	2.0
2. 21 business indicators	22.0	17.0	7.1	2.4	3	1.8
Leaders						
3. Comprehensive (197 series)	21.2	17.1	8.0	2.1	3	2.0
4. 8 leading indicators	43.7	38.4	11.8	3.2	6	1.7
Roughly Coincident Series						
5. Comprehensive (82 series)	17.8	14.1	6.1	2.3	3	1.7
6. 8 roughly coincident indicators	30.0	40.8	22.1	1.8	6	1.8

[a] Average month-to-month change without regard to sign.

[b] Percentage ratios of the average monthly amplitudes of the irregular and cyclical factors are computed for consecutive months (January–February, February–March, etc.), two-month spans (January–March, February–April, etc.), three-month spans (January–April, February–May), and so on. "Months Required for Cyclical Dominance" is the first interval of months for which the average amplitude of the cyclical factor is more than that of the irregular factor and remains so.

[c] The average duration of run is equal to the average number of consecutive monthly changes in the same direction in the seasonally adjusted series.

NOTE: Computed from seasonally adjusted diffusion indexes based on directions of change over three-month spans. Although the diffusion indexes are based on seasonally adjusted data and hence presumably require no seasonal adjustment, the electronic computer program used to derive $\bar{I}$ and $\bar{C}$ includes the elimination of seasonal ($\bar{S}$). The computed $\bar{I}$, therefore, is no doubt somewhat smaller than it would be if this step were omitted. The $\bar{S}$ figures so computed were, for the indexes on lines 1 to 6, respectively: 5.2, 9.1, 8.4, 20.9, 7.5, 34.1. These are closely correlated with the values of $\bar{I}$ in col. 2. For a more detailed description of these measures, see Chapter 17.

TABLE 18.9

Direction of Change in Component Series over Three-Month Spans, and Percentage of Series Rising, 1957–59, Nonagricultural Employment

	1957												1958												1959					
	O to J	N to F	D to M	J to A	F to M	M to J	A to J	M to A	J to S	J to O	A to N	S to D	O to J	N to F	D to M	J to A	F to M	M to J	A to J	M to A	J to S	J to O	A to N	S to D	O to J	N to F	D to M	J to A	F to M	M to J
Percentage rising[a]	34	39	23	42	47	56	52	56	47	23	17	16	14	14	3	8	25	47	59	66	78	61	58	59	64	58	77	80	86	77
All series (aggregate)	+	+	0	0	+	+	+	+	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+	+
Ordnance and accessories	0	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	0	−	−	0	0	+	+	+	+	0	0	+	0
Lumber and wood prod.	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	−	−	+	+	+
Furniture and fixtures	−	−	−	+	+	+	+	+	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	+	+	+	+	+	+
Stone, clay, and glass	−	−	−	−	0	+	−	−	−	+	−	−	−	−	−	−	−	+	+	+	+	−	−	−	+	−	+	+	+	+
Prim. metal industries	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+
Fabricated metal indus.	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	+	+	+	−	+	−	+	−	+	+	+	+
Mach. excl. electrical	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	0	+	+	+	+	+	+
Electrical machinery	−	−	−	−	−	+	+	+	+	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+
Transportation equip.	+	+	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	+	−	+	+	+	+	+	+	+	+
Instruments and rel. prod.	−	−	−	−	−	−	−	+	0	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+
Misc. mfg. indus.	−	−	−	0	+	+	+	+	+	0	−	−	−	−	−	−	0	+	+	+	+	+	−	−	−	−	+	+	+	+
Food and kindred prod.	−	−	−	−	−	−	−	−	−	−	−	+	+	+	−	−	−	+	−	−	−	−	−	+	+	+	+	+	−	−
Tobacco manufactures	0	−	−	−	−	−	−	0	0	−	−	−	+	+	−	−	−	−	−	−	0	−	0	−	−	+	+	+	0	−
Textile mill products	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	+	+	+	+	+	−	−	−	−	+	+	+	+
Apparel products	−	−	−	+	+	+	−	−	−	−	0	−	−	−	−	−	+	+	+	−	0	−	+	+	+	−	+	+	+	+
Paper and allied prod.	+	+	−	+	+	−	−	−	−	0	−	0	−	−	−	−	−	−	−	+	+	+	+	+	−	0	+	+	+	+
Printing and pub.	−	−	0	+	−	−	−	0	+	+	0	−	−	−	−	−	−	−	−	+	+	+	−	−	−	+	+	+	+	+
Chem. and allied prod.	+	+	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	0	+	−	+	0	+	+	+	+	+
Prod. of petrol. & coal	−	−	−	−	−	−	−	−	0	+	0	−	−	−	−	−	−	−	−	−	0	−	+	+	+	−	+	+	+	−
Rubber products	+	+	−	−	−	−	+	+	+	+	0	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	−	−	−
Leather & leather prod.	−	−	−	+	+	+	−	−	+	−	+	−	−	−	−	−	−	+	+	+	+	−	+	+	+	−	−	−	+	+
Mining	−	−	−	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+
Contract const.	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	+	+	+	+	0	+	−	−	−	−	+	+	+	+
Transportation	0	−	−	−	−	−	0	+	+	−	−	−	−	−	−	−	−	−	+	+	+	+	+	−	+	+	+	−	+	+
Communication	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Other public utilities	−	+	−	+	+	+	+	+	+	0	−	0	−	−	−	−	+	+	+	+	+	−	−	−	−	−	−	+	+	0
Wholesale trade	+	+	+	+	+	+	+	+	0	−	−	−	−	−	−	−	−	−	−	−	+	+	0	−	+	+	+	+	+	+
Retail trade	0	+	−	−	−	+	+	+	+	−	−	−	0	−	−	−	−	0	+	+	+	+	−	0	+	+	+	+	+	+
Finance, ins., real est.	−	0	+	+	+	+	+	+	+	+	+	0	−	−	−	−	+	+	+	+	+	−	0	−	−	+	+	+	+	+
Service	+	+	+	+	0	+	+	+	+	−	0	0	+	0	−	−	−	+	+	+	+	−	+	+	+	+	+	−	+	+
Fed. government	−	+	+	−	−	−	+	+	−	−	−	−	−	+	−	0	0	+	+	+	+	+	−	+	−	−	−	−	−	+
State and local govt.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	0

[a] Number of series rising (+) plus half the number unchanged (0) divided by the total number of series.

The way in which these tables can be helpful in tracing the spread of the 1957 recession, and subsequent recovery, is well illustrated by the nonagricultural employment direction-of-change table (Table 18.9). This table shows that declines first occurred in durable and nondurable manufactures. They spread gradually to other industries until, after about a year, they had encompassed all industries except government.[9]

4. New measures. Further improvements in measures of business cycle movements now in use and development of new measures are to be expected. For example, experiments now being conducted indicate that, after a few modifications, percentage rates of change in aggregate series closely resemble diffusion indexes (which are based on the same components).[10] Such averages are easier to prepare than diffusion indexes, since they do not first require analysis of the seasonally adjusted component series. They can, therefore, be more easily extended to additional areas of the economy and to earlier periods. They can also be more readily computed for weekly and ten-day series to provide prompter and more frequent current data. Comparison of average rates of change and our average diffusion indexes are given in Chart 18.4 and amplitude-adjusted indexes based upon modified rates of change are shown in Chart 18.5.[11] These indexes can also be used to make summary comparisons of the patterns and timing of different business cycles, as is illustrated in

[9] For other dramatic illustrations of the usefulness of direction-of-change tables in studying timing sequences during the course of a business cycle, see Chapter 2, Table 2.1, and Chapter 3, Table 3.3.

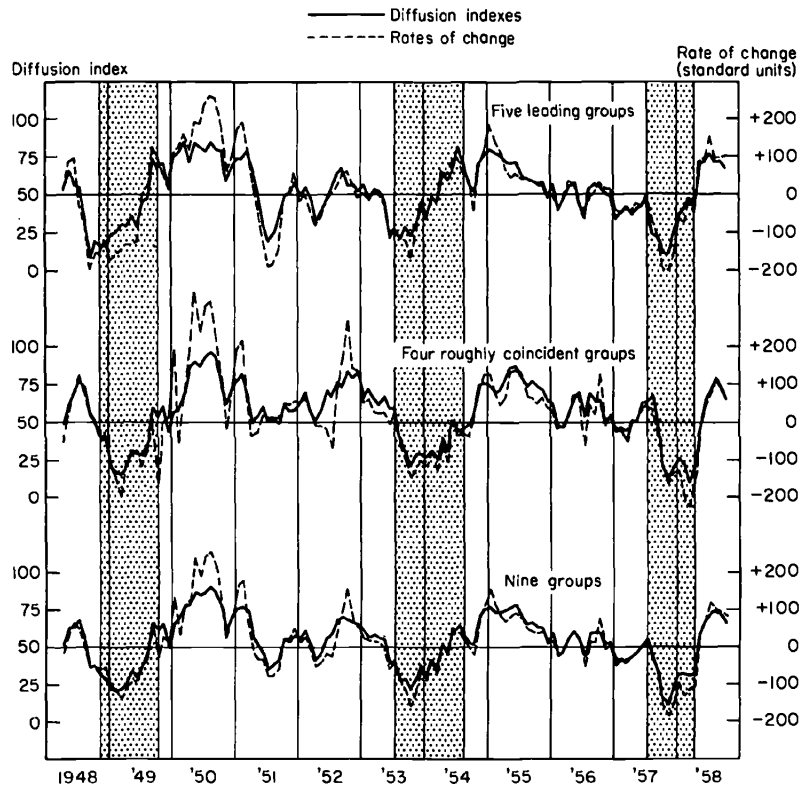
[10] These modifications consist of computing the rates by the formula $200(B - A)/(B + A)$ instead of $100(B - A)/A$, where A is the value for the first period and B the value for the second period. The rate of change can vary from -100 to infinity when the conventional formula is used, but only from -200 to $+200$ when the modified formula is used. The second modification consists of expressing the rates in units which standardize the amplitudes of their fluctuations. This is accomplished by dividing the individual month-to-month rates for a series by the average month-to-month rate (without regard to sign) for the series. These modified, standardized rates of change are converted to indexes, as shown in Chart 18.4. The value for the first month for which the data are available is set at 100, and the values for subsequent months are obtained by application of the formula $A(200 + r)/(200 - r)$, where A is the value for the month preceding the desired month and r is the modified, standardized rate for the desired month. Electronic computer programs for these computations are described in section V of the appendix to Chapter 17 and in the appendix to this chapter.

The average rates of change shown in Chart 18.4 are unweighted; that is, each rate of change series is given a weight of one. Weighted rate of change series, where the rates are computed directly from the aggregates, are also very similar to diffusion indexes. For discussions of the relations between rate of change series and diffusion indexes, see Chapters 8 and 9. Also, Arthur L. Broida, "Diffusion Indexes," *American Statistician*, June 1955, pp. 7–16; Sidney S. Alexander, "Rate of Change Approaches to Forecasting—Diffusion Indexes and First Differences," *The Economic Journal*, June 1958, pp. 288–301; Bert G. Hickman, "Diffusion, Acceleration, and Business Cycles," *American Economic Review*, September 1959, pp. 535–565; and the references in these articles. The modified rate of change formula was suggested by Burns and Mitchell in *Measuring Business Cycles*, p. 143.

[11] For other methods of deriving amplitude-adjusted indexes, see Chapters 4 and 19.

CHART 18.4

Average Diffusion Indexes and Average Modified Rates of Change, Leading, Roughly Coincident, and All Groups, 1948–58



Shaded areas represent business contractions; unshaded areas, expansions.

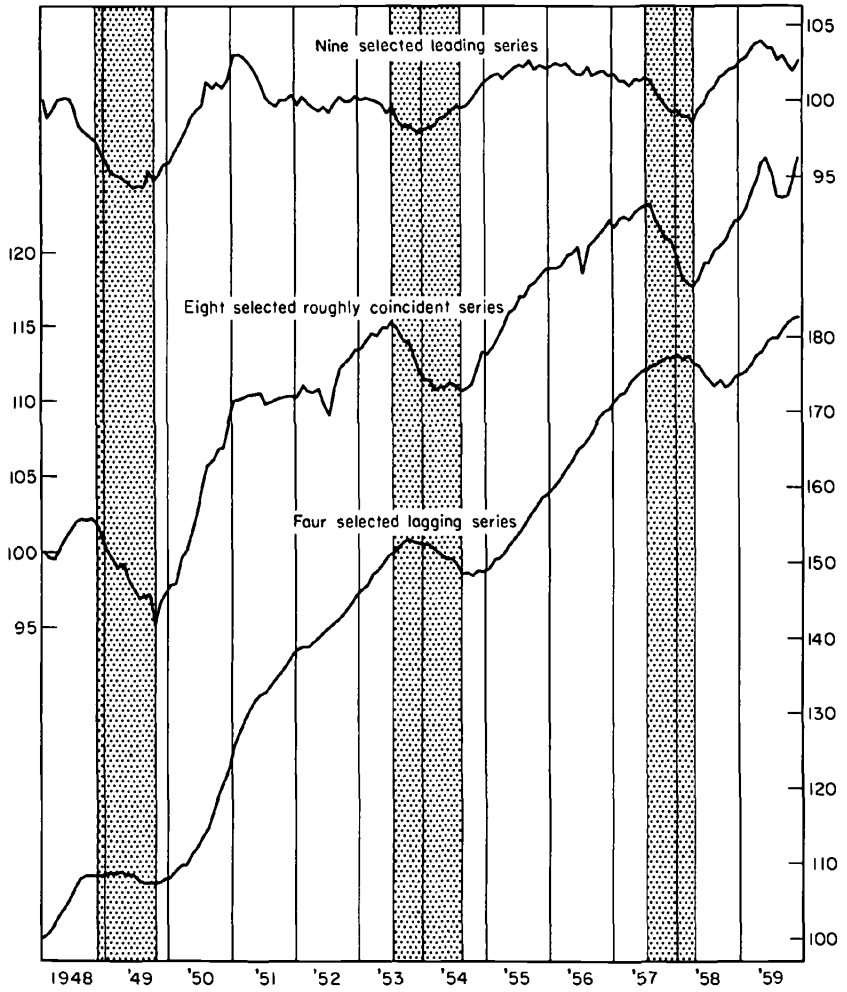
Diffusion indexes are based on 281 component series in nine groups. The nine groups include the first eight listed in the text, with group 6—nonagricultural employment—. divided into two groups: 21 manufacturing industries and 13 nonagricultural industries (including durable and nondurable manufactures).

Rates of change $[200(B - A) \div (B + A)]$ are averages of nine unweighted group mean rates of change (based on the same 281 component series), each expressed in units of its 1948–58 average.

Chart 18.6. Further studies are needed to determine the properties of these rate-of-change measures and, particularly, to what extent they can supplement or supplant diffusion indexes. The amplitude-adjusted indexes do show, however, that the last word has not been said on how to measure current business cycle movements.

CHART 18.5

Amplitude-Adjusted Indexes of Leading, Coincident, and Lagging Series, 1948–59



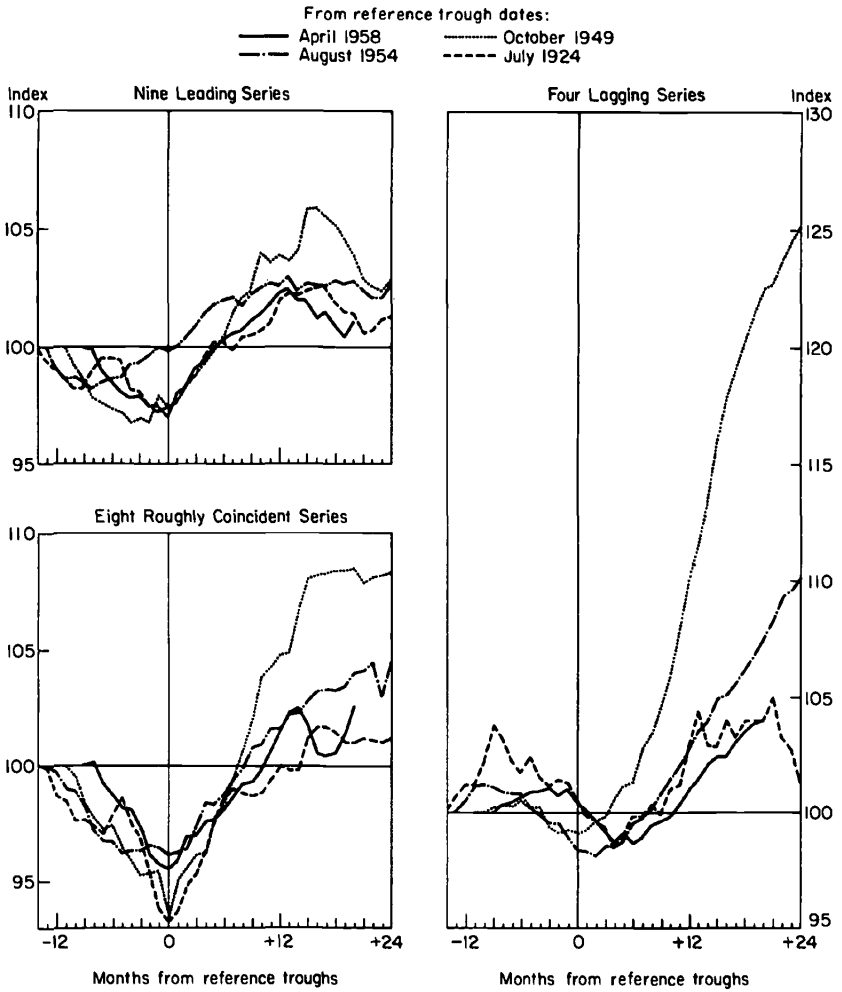
Shaded areas represent business contractions; unshaded areas, expansions.

The scale used for the lagging series above is different from that used for the other series.

See explanatory note after Chart 18.6.

CHART 18.6

Leading, Coincident, and Lagging Series, 1924, 1949, 1954, and 1959 Expansions



See explanatory note.
Latest data plotted: December 1959.

Explanatory Notes for Charts 18.5 and 18.6

The indexes shown in Chart 18.5 are averages of modified, standardized rates of change (see footnote 10) for groups of sensitive business indicators. These rates of change are amplitude-adjusted series that can be combined into indexes that facilitate comparisons of cyclical timing and pattern. There is a separate index for leading series, coincident series, and lagging series. The values for January 1948 are set equal to 100. The leading series in the top curve include series 1.0, 3.2, 4.0, 5.0, 6.0, 7.1, 8.0, 10.0, and 12.2; the roughly coincident curve includes series 13.0, 14.0, 15.0, 15.2, 18.0, 19.0, 20.2 and 21.0; and the lagging curve includes series 23.0, 24.0, 25.0, and the consumer price index. The names of the series corresponding to these numbers are given in Volume II.

The behavior of these indexes during comparable stages of four different business cycles is shown in Chart 18.6. Here four business cycles are shown from peaks to the twenty-fourth month after the troughs. They include the expansions starting in 1924, 1949, 1954, and 1958. The 1924, 1949, and 1954 expansions were selected because they followed contractions of rather similar severity. In Chart 18.6 the trough dates are aligned. The base for computing the percentage change is, however, taken at the level of the previous peak which in each case is set equal to 100. Thus in this chart the indexes show changes in four recent business cycle expansions from reference peak levels over equal periods starting with the reference trough dates.

Thus, in January 1960, when these charts were prepared, December 1959 data for the leading and coincident series used in these indexes had just become available. The interval between April 1958, the date of the previous reference trough, and December 1959 is twenty months. Since the changes from the previous reference peaks seemed most significant, each of the indexes was expressed as a percentage ratio of the previous peak level. Since the data are plotted with the reference troughs all aligned, the expansions all start at the same point on the time scale. The current expansion shows data for the first twenty months of expansion and the earlier expansions for the first twenty-four months. However, the contractions do not all start at the same point on the time scale, because they all differed in duration.

Concluding Notes

These studies of current business conditions, as noted in the above discussion, do not depend upon one single statistical method. A close watch is kept upon series and measures that have in the past been reliable indicators of future business conditions. Rates of change and diffusion indexes are closely observed and compared with the rates of change and diffusion indexes at corresponding periods of earlier recessions. The scope and amplitude of the 1957–58 recession were compared with those of earlier recessions and similar comparisons have been made for the current expansion.

Similarly, reliance is not placed on a small number of economic series. Groups of different series representing many economic activities—well over 300—have already been used, and more will probably be added. These studies have been and will continue to be supplemented by different kinds of statistical analyses of as yet uncovered areas of economic activity and by seasonally adjusted key weekly series.

With the wisdom of hindsight, it will be possible in the future to make a more objective and comprehensive appraisal of this current business cycle study program. In the meantime, it is important to conclude this paper on a note of caution.

It is true that impressive gains have been made in economic analysis in the past few decades. The techniques and data now employed are the product of research that has been carried on by many imaginative and industrious economic analysts over nearly half a century. The statistics are, in general, compiled promptly and accurately by carefully tested methods; they are well stratified by cyclical timing, industry, and geographic area. The electronic computer makes the involved computations with dazzling speed and complete accuracy.

On the other hand, the economic principles governing short-term fluctuations are only partly understood. The structure of the theoretical model upon which methods described above are based is incomplete. For example, further analysis needs to be done to explain why a recession that ultimately becomes severe usually begins with a relatively sharp decline. Also, we need to explain why series which may be expected to lead usually do lead, but sometimes do not. Why does the sequence of turns in economic processes vary from one cycle to another? Again, how should we take account of the fact that the economy of this country is ever changing, with industries, institutions, and geographic areas frequently undergoing alterations in relative importance, so that series that are good indicators at one period may be poor indicators at another?

Furthermore, the statistical techniques for short-term economic analysis are still in the developmental stage. The data used in these studies leave something to be desired. Some of the most important economic magnitudes are available only quarterly, and not enough weekly series are available. The series are often revised, they are subject to various measurement errors, and the underlying trend is more often than not obscured by irregular fluctuations. Consequently the reporting system described above is used only to supplement the more conventional types of current business analysis, not to replace them.

For such reasons, the best economic models, the most reliable data, and the most powerful electronic computers may reduce—but cannot entirely sweep away—the haze that obscures the pattern of future economic fluctuations from our view.

Appendix: Electronic Computer Time Series Dispersion Program[12]

An electronic computer program, which computes a variety of measures showing the behavior of components in relation to aggregates, is used to supply many of the measures described in the text. It is available for the Univac Scientific Computer (1105), and a simplified version is

[12] The Univac Scientific Computer (1105) program was written by George M. Heller and Herman Hess of the Bureau of the Census.

available for the Univac I. A description of the measures computed and a sample print-out of each of the tables follows:

I. DETAILED MEASURES

1. A frequency distribution for each month of the rates of change over any specified interval, such as the rate of change from the preceding month or from the same month a year ago. The class intervals are in uniform units of two percentage points up to plus and minus forty; the open end classes are over plus and under minus 40 per cent.

The program also provides for showing changes from one up to 48 months from a fixed point in time, e.g. a trough or peak. The interval over which the computations are made are not fixed in advance, but specified at the time each run is made.

2. The characteristics of the direction of change of the component series are measured. These measures include the percentage of series rising, the percentage of series falling, and the percentage of series not changing. (A movement between -0.1 and $+0.1$ per cent is considered as showing no change.)

A diffusion index, for which series showing no change are divided equally between the falling and rising groups, is given. This measure is supplemented by a net diffusion index, which shows the percentage of rising series less the percentage of falling series.

The average percentage change for all the series, for the rising series alone, and for the falling series alone are computed. These averages are also converted to a per month basis. The standard deviation of each frequency distribution is shown.

3. A distribution shows for each selected interval the percentage of component series rising, the percentage falling, and the percentage showing no change for one, two, three, four, five, and six or more consecutive months. These figures are supplemented by the average duration of run for the series.

4. The decile rates of change are computed. These measures show the rate of change exceeded by 10 per cent of the series (9^{th} decile), 20 percent of the series (8^{th} decile), etc. The fifth decile is the median.

II. SUMMARY TABLES

1. One summary table brings some of these measures together as time series. The measures shown in this summary table are (1) the diffusion index, (2) the net diffusion index, (3) the cumulated average percentage change of all series starting with 100%, (4) the average percentage change of all series, rising series, and falling series, (5) the average percentage change per month of all series, rising series, and falling series, (6) the standard deviation, and (7) the average duration of run.

2. Another summary table shows a distribution of percentage changes for successive months from peaks or troughs. In this table an asterisk is placed next to the value for the class interval containing the median value. When these asterisks are connected manually, the result is a curve showing median rates of change over successively longer periods as a recession or recovery proceeds.

III. ADDITIONAL COMMENTS

1. An optional routine provides for printing the input data in addition to the dispersion measures; that is, it provides for printing the identification of each series, the original observations and the rates of change over the specified intervals. The input for this program is punched cards. In preparing the punched cards, the special instructions for the Univac seasonal program should be followed. For most purposes series used for the dispersion run should be free of seasonal variations.

2. A single punching error can seriously affect the results of both the seasonal adjustment and the dispersion runs. The punching instructions must, therefore, be painstakingly followed, and the punching carefully verified. At the Census Bureau all cards punched for this run are listed and the listings are checked against the original observations.

3. The standard routine provides for computing the rates of change by a special formula, $200(B - A)/(B + A)$, where A is the value for the first period and B the value for the second period. This formula makes the positive and negative changes symmetrical about 0; they can vary from $+200\%$ to -200%. The results are very similar to those obtained from the conventional formula $100(B - A)/A$, except when there are large positive changes. The A used in the denominator of the conventional formula is replaced by an average of A and B in the alternative formula. An optional routine is also available for obtaining the percentage changes by the conventional formula, $100(B - A)/A$.

4. An optional routine provides for showing the percentage changes in units of a measure of dispersion. This technique makes the amplitudes of each of the different series used in a run about the same. Where this option is taken, averages of different series are meaningful. Under this option, the class intervals used in the frequency distributions are expressed in units of the same measure of dispersion.

5. The standard program provides for unweighted averages of series. An option also provides for weighted series expressed as indexes (as well as in actual units such as dollars). The weights desired may be included on the punched cards, or the average size of a series can automatically be used as its weight.

6. A punched paper tape provides for the selection of options. These must be specified before the program is run.

7. The program could easily be adapted to take tape rather than punched cards as the input. It could also be adapted to obtain different parts of the program separately, but this does not seem worth-while because of the speed of the program. Work charts, similar to the Univac seasonal program charts but on a semilog basis, will be added to the program as soon as resources become available.

8. The running time of the program is as follows: Input takes about ten seconds per series if input data are to be printed and about two seconds per series if the input data are not to be printed. Output takes three seconds per output table with a maximum total of about ten minutes for all possible output tables. In addition, approximately two minutes is required for setup, starting, and other operational steps. The computing is carried on simultaneously with input and output operations so it requires no measurable extra time.

Sample Tables from Actual Print-Out of Detailed Measures of Dispersion Reduced

TABLE I: SEASONALLY ADJUSTED ORIGINAL OBSERVATIONS
ONE OF TWENTY-FOUR COMPONENT SERIES OF TOTAL RETAIL SALES*, JANUARY 1951-JANUARY 1959

RETAIL SALES: JAN. 1951 - JAN. 1959

INPUT DATA SERIES #6548

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	965	886	819	803	807	816	817	840	818	826	861	837
1952	833	820	808	805	859	882	831	896	838	903	884	918
1953	852	859	870	835	902	898	874	868	832	840	857	870
1954	823	823	806	957	840	854	862	854	849	867	870	904
1955	902	843	861	912	889	877	958	901	926	923	914	913
1956	936	879	913	943	940	948	974	971	989	913	960	954
1957	936	942	954	945	974	1004	1054	1057	1039	962	986	1037
1958	996	931	1012	1008	1041	1040	1089	1134	1055	1042	1051	1099
1959	1077											

*DEPARTMENT STORE SALES COMPONENT.

TABLE II: MONTH-TO-MONTH PERCENTAGE CHANGES
ONE OF TWENTY-FOUR COMPONENT SERIES OF TOTAL RETAIL SALES* JANUARY 1951-JANUARY 1959

RETAIL SALES: JAN. 1951-JAN. 1959

PERCENT CHANGES OF INPUT DATA BETWEEN MONTHS SHOWN — SERIES #6548

WEIGHT IS 1000

BEG. MONTH	END MONTH	PCT CHANGE	BEG. MONTH	END MONTH	PCT CHANGE	BEG. MONTH	END MONTH	PCT CHANGE	BEG. MONTH	END MONTH	PCT CHANGE
JAN 51	FEB 51	- 8.1	FEB 51	MAR 51	- 7.5	MAR 51	APR 51	- 1.9	APR 51	MAY 51	+ 0.4
MAY 51	JUN 51	+ 1.1	JUN 51	JUL 51	+ 0.1	JUL 51	AUG 51	+ 2.8	AUG 51	SEP 51	- 2.6
SEP 51	OCT 51	+ 0.9	OCT 51	NOV 51	+ 4.2	NOV 51	DEC 51	- 2.7	DEC 51	JAN 52	- 0.4
JAN 52	FEB 52	- 1.9	FEB 52	MAR 52	- 1.4	MAR 52	APR 52	- 0.3	APR 52	MAY 52	+ 6.7
MAY 52	JUN 52	+ 2.5	JUN 52	JUL 52	- 5.7	JUL 52	AUG 52	+ 7.8	AUG 52	SEP 52	- 6.4
SEP 52	OCT 52	+ 7.7	OCT 52	NOV 52	- 2.1	NOV 52	DEC 52	+ 3.8	DEC 52	JAN 53	- 7.1
JAN 53	FEB 53	+ 0.3	FEB 53	MAR 53	+ 1.7	MAR 53	APR 53	- 4.0	APR 53	MAY 53	+ 8.0
MAY 53	JUN 53	- 0.4	JUN 53	JUL 53	- 2.6	JUL 53	AUG 53	- 0.6	AUG 53	SEP 53	- 4.1
SEP 53	OCT 53	+ 0.9	OCT 53	NOV 53	+ 2.0	NOV 53	DEC 53	+ 1.5	DEC 53	JAN 54	- 5.4
JAN 54	FEB 54	- 0.1	FEB 54	MAR 54	- 1.9	MAR 54	APR 54	+ 6.3	APR 54	MAY 54	- 1.9
MAY 54	JUN 54	+ 1.6	JUN 54	JUL 54	+ 0.9	JUL 54	AUG 54	- 0.9	AUG 54	SEP 54	- 0.5
SEP 54	OCT 54	+ 2.1	OCT 54	NOV 54	+ 0.3	NOV 54	DEC 54	+ 3.9	DEC 54	JAN 55	- 0.2
JAN 55	FEB 55	- 5.0	FEB 55	MAR 55	+ 1.4	MAR 55	APR 55	+ 5.9	APR 55	MAY 55	- 2.5
MAY 55	JUN 55	- 1.9	JUN 55	JUL 55	+ 0.2	JUL 55	AUG 55	- 5.9	AUG 55	SEP 55	+ 2.7
SEP 55	OCT 55	- 0.3	OCT 55	NOV 55	- 0.9	NOV 55	DEC 55	- 0.1	DEC 55	JAN 56	+ 2.5
JAN 56	FEB 56	- 6.1	FEB 56	MAR 56	+ 3.9	MAR 56	APR 56	+ 3.2	APR 56	MAY 56	- 0.3
MAY 56	JUN 56	+ 0.8	JUN 56	JUL 56	+ 2.7	JUL 56	AUG 56	- 0.3	AUG 56	SEP 56	+ 1.8
SEP 56	OCT 56	- 7.6	OCT 56	NOV 56	+ 5.1	NOV 56	DEC 56	- 0.6	DEC 56	JAN 57	- 1.8
JAN 57	FEB 57	- 1.4	FEB 57	MAR 57	+ 3.4	MAR 57	APR 57	- 0.9	APR 57	MAY 57	+ 3.0
MAY 57	JUN 57	+ 3.2	JUN 57	JUL 57	+ 0.7	JUL 57	AUG 57	+ 0.2	AUG 57	SEP 57	- 1.7
SEP 57	OCT 57	- 7.4	OCT 57	NOV 57	+ 2.4	NOV 57	DEC 57	+ 5.1	DEC 57	JAN 58	- 3.7
JAN 58	FEB 58	- 6.7	FEB 58	MAR 58	+ 2.7	MAR 58	APR 58	- 0.3	APR 58	MAY 58	+ 3.2
MAY 58	JUN 58	0.0	JUN 58	JUL 58	+ 4.7	JUL 58	AUG 58	+ 4.1	AUG 58	SEP 58	- 6.9
SEP 58	OCT 58	- 1.2	OCT 58	NOV 58	+ 0.8	NOV 58	DEC 58	+ 4.5	DEC 58	JAN 59	- 2.0

*DEPARTMENT STORE SALES COMPONENT.

TABLE III: FREQUENCY AND PERCENTAGE DISTRIBUTIONS AND OTHER MEASURES: TWENTY-FOUR RETAIL SALES SERIES, JULY-AUGUST 1953
ONE-MONTH-INTERVAL COMPARISON

RETAIL SALES: JAN. 1951-JAN. 1959 — JUL 1953 TO AUG 1953

DIST. OF PCT CHANGES OF IND. SERIES FROM FIRST TO LAST MONTH OF INTERVAL

PERCENT CHANGE	NUMBER OF SERIES	PERCENT OF TOTAL	CUM PCT TO EXTREMES
+40 & OVER			
+38 TO +40			
+36 TO +38			
+34 TO +36			
+32 TO +34			
+30 TO +32			
+28 TO +30			
+26 TO +28			
+24 TO +26			
+22 TO +24			
+20 TO +22			
+18 TO +20			
+16 TO +18			
+14 TO +16			
+12 TO +14			
+10 TO +12			
+ 8 TO +10			
+ 6 TO + 8	1	4.2	4.2
+ 4 TO + 6	1	4.2	8.3
+ 2 TO + 4	1	4.2	12.5
0 TO + 2	1	4.2	16.7
- 2 TO 0	8	* 33.3	83.3
- 4 TO - 2	3	12.5	50.0
- 6 TO - 4	2	8.3	37.5
- 8 TO - 6	2	8.3	29.2
-10 TO - 8	2	8.3	20.8
-12 TO -10	1	4.2	12.5
-14 TO -12	1	4.2	8.3
-16 TO -14	1	4.2	4.2
-18 TO -16			
-20 TO -18			
-22 TO -20			
-24 TO -22			
-26 TO -24			
-28 TO -26			
-30 TO -28			
-32 TO -30			
-34 TO -32			
-36 TO -34			
-38 TO -36			
-40 TO -38			
-40 & UNDER			
TOTAL	24	100.0	

CHARACTERISTICS OF SERIES BY DIRECTION OF CHANGE

	ALL SERIES	RISING GRTR +0.1	FALLING LESS -0.1	NO CHANGE -0.1 TO +0.1
NUMBER	24	4	20	
PERCENT	100.0	16.7	83.3	
AVERAGE PCT CHANGE				
1 MONTH INT.	- 3.3	+ 3.9	- 4.7	
PER MONTH	- 3.3	+ 3.9	- 4.7	
STD. DEVIATION	5.2			

	TOTAL	NET
PERCENT RISING	+16.7	-66.7

PERCENT DIST. OF SERIES BY DURATION AND DIRECTION OF CHANGE

NO. OF MONTHS DURATION	DIRECTION PLUS	DIRECTION MINUS	NO CHANGE
1	8.3	45.8	
2	4.2	12.5	
3	4.2	8.3	
4		4.2	
5		4.2	
6 OR MORE		8.3	
TOTAL	16.7	83.3	
AVERAGE DURATION OF RUN			-1.5

DECILES

1	2	3	4	5	6	7	8	9
-11.2	- 8.2	- 5.8	- 3.6	- 2.0	- 1.4	- 0.8	- 0.2	+ 3.2

TABLE IV: FREQUENCY AND PERCENTAGE DISTRIBUTIONS AND OTHER MEASURES: TWENTY-FOUR RETAIL SALES SERIES, FROM DESIGNATED DATE

RETAIL SALES: JAN. 1951-JAN. 1959 — APR 1958 TO JAN 1959

DIST. OF PCT CHANGES OF IND. SERIES FROM FIRST TO LAST MONTH OF INTERVAL

PERCENT CHANGE	NUMBER OF SERIES	PERCENT OF TOTAL	CUM PCT TO EXTREMES
+40 & OVER			
+38 TO +40			
+36 TO +38			
+34 TO +36			
+32 TO +34			
+30 TO +32			
+28 TO +30			
+26 TO +28			
+24 TO +26			
+22 TO +24	1	4.2	4.2
+20 TO +22			4.2
+18 TO +20			4.2
+16 TO +18	1	4.2	8.3
+14 TO +16	1	4.2	12.5
+12 TO +14	2	8.3	20.8
+10 TO +12			20.8
+ 8 TO +10			20.8
+ 6 TO + 8	4	16.7	37.5
+ 4 TO + 6	3	12.5	50.0
+ 2 TO + 4	4	16.7	66.7
0 TO + 2	3	12.5	79.2
0 TO - 2	1	4.2	20.8
- 2 TO - 4	1	4.2	16.7
- 4 TO - 6			12.5
- 6 TO - 8	1	4.2	12.5
- 8 TO -10	2	8.3	8.3
-10 TO -12			
-12 TO -14			
-14 TO -16			
-16 TO -18			
-18 TO -20			
-20 TO -22			
-22 TO -24			
-24 TO -26			
-26 TO -28			
-28 TO -30			
-30 TO -32			
-32 TO -34			
-34 TO -36			
-36 TO -38			
-38 TO -40			
-40 & UNDER			
TOTAL	24	100.0	

CHARACTERISTICS OF SERIES BY DIRECTION OF CHANGE

	ALL SERIES	RISING, GRTR +0.1	FALLING LESS -0.1	NO CHANGE -0.1 TO +0.1
NUMBER	24	19	5	
PERCENT	100.0	79.2	20.8	
AVERAGE PCT CHANGE				
9 MONTH INT.	+ 4.3	+ 7.0	- 5.2	
PER MONTH	+ 0.5	+ 0.8	- 0.6	
STD. DEVIATION	7.4			

	TOTAL	NET
PERCENT RISING	+79.2	+58.3

DECILES

1	2	3	4	5	6	7	8	9
- 7.2	- 0.4	+ 1.5	+ 2.8	+ 4.0	+ 5.6	+ 6.9	+12.2	+15.2

TABLE V: SUCCESSIVE PERCENTAGE DISTRIBUTIONS OF PERCENTAGE CHANGES FROM DESIGNATED DATE
TWENTY-FOUR RETAIL SALES SERIES, SEPTEMBER 1954-FEBRUARY 1956

RETAIL SALES: JAN. 1951 - JAN. 1959 SUMMARY TABLE 1

PERCENT DISTRIBUTIONS OF PERCENTAGE CHANGES FOR SUCCESSIVE COMPARISONS

PCT CHANGE	AUG54 TO SEP54	AUG54 TO OCT54	AUG54 TO NOV54	AUG54 TO DEC54	AUG54 TO JAN55	AUG54 TO FEB55	AUG54 TO MAR55	AUG54 TO APR55	AUG54 TO MAY55	AUG54 TO JUN55	AUG54 TO JUL55	AUG54 TO AUG55	AUG54 TO SEP55	AUG54 TO OCT55	AUG54 TO NOV55	AUG54 TO DEC55	AUG54 TO JAN56	AUG54 TO FEB56
+40 & OVER													4.2					
+38 TO +40																		
+36 TO +38																		
+34 TO +36																		
+32 TO +34																		
+30 TO +32											4.2	4.2				4.2	4.2	
+28 TO +30											4.2							4.2
+26 TO +28														4.2	8.3	4.2		
+24 TO +26							4.2	4.2						4.2				
+22 TO +24				4.2						4.2		4.2	4.2	4.2	4.2			
+20 TO +22					4.2			8.3	12.5	4.2	8.3	4.2	4.2	4.2	4.2	4.2	4.2	4.2
+18 TO +20				8.3		4.2	4.2					4.2	4.2			4.2	4.2	
+16 TO +18					4.2	4.2				4.2	4.2			4.2		4.2	8.3	4.2
+14 TO +16				8.3		4.2							4.2		4.2		4.2	8.3
+12 TO +14					4.2		4.2	4.2		4.2	16.7		4.2	8.3	12.5	16.7	4.2	8.3
+10 TO +12		4.2	8.3	8.3	8.3		4.2		20.8	4.2	4.2	4.2	12.5	8.3*	16.7	4.2	8.3	4.2
+ 6 TO +10							4.2	12.5	12.5	8.3*	16.7	20.8*	20.8*	20.8	8.3*	12.5*	33.3	4.2
+ 6 TO + 8	8.3	4.2	4.2	8.3		4.2	4.2	16.7*	8.3*	20.8	12.5*	20.8	12.5	12.5	8.3	16.7	4.2	8.3
+ 4 TO + 6	4.2	4.2	20.8*	16.7*	33.3	12.5	12.5*	14.7	20.8	12.5	4.2	25.0	12.5	12.5	16.7	8.3	12.5*	29.2
+ 2 TO + 4	8.3	4.2		12.5	16.7	16.7*	20.8	12.5	4.2	20.8	12.5		8.3	12.5	4.2	4.2		16.7
0 TO + 2 *	29.2	25.0*	29.2	4.2	8.3*	12.5	20.8	4.2	12.5	12.5	8.3	4.2	4.2		4.2	4.2		
0 TO - 2	33.3*	16.7	4.2	4.2	12.5	16.7	8.3	8.3	4.2		4.2	4.2	4.2	4.2	4.2	4.2	8.3	
- 2 TO - 4	12.5	25.0	12.5	8.3		12.5	4.2	4.2				4.2			4.2	4.2		4.2
- 4 TO - 6		4.2	4.2		8.3	8.3	4.2		4.2	4.2								
- 6 TO - 8	4.2	4.2	4.2	8.3			4.2	4.2										
- 8 TO -10		8.3	8.3	4.2				4.2										
-10 TO -12				4.2		4.2												
-12 TO -14			4.2													4.2		
-14 TO -16																	4.2	
-16 TO -18																		
-18 TO -20																		
-20 TO -22																		
-22 TO -24																		
-24 TO -26																		
-26 TO -28																		
-28 TO -30																		4.2
-30 TO -32																		
-32 TO -34																		
-34 TO -36																		
-36 TO -38																		
-38 TO -40																		
-40 & UNDER																		
	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
AVG PCT CHG	+ 0.2	- 0.9	+ 0.5	+ 4.3	+ 4.6	+ 3.5	+ 4.2	+ 5.0	+ 7.7	+ 7.0	+10.3	+ 8.9	+10.2	+10.3	+10.3	+ 9.7	+ 9.7	+ 7.1
PCT RISING	+50.0	+41.7	+60.4	+72.9	+79.2	+75.0	+77.1	+70.2	+91.7	+95.8	+93.8	+91.7	+95.8	+95.8	+91.7	+87.5	+87.5	+91.7

TABLE VI: DIFFUSION INDEXES, CUMULATED PERCENTAGE CHANGES, AND OTHER MEASURES, ONE-MONTH INTERVALS
TWENTY-FOUR RETAIL SALES SERIES, JUNE 1956-JANUARY 1959

RETAIL SALES: JAN. 1951-JAN. 1959 — SUMMARY TABLE 2

1ST MONTH	2ND MONTH	PCT RISING TOTAL	PCT RISING NET	CUM AVG PCT CHG FROM 100	AVG PERCENT CHANGE ALL	AVG PERCENT CHANGE RISES	AVG PERCENT CHANGE FALLS	PER MO. AVG PCT CHANGE ALL	PER MO. AVG PCT CHANGE RISES	PER MO. AVG PCT CHANGE FALLS	STD. DEV.
JUN56	JUL56	+45.8	- 8.3	116.5	+ 0.4	+ 3.9	- 2.6	+ 0.4	+ 3.9	- 2.6	4.4
JUL56	AUG56	+75.0	-50.0	118.8	+ 2.3	+ 3.9	- 2.8	+ 2.3	+ 3.9	- 2.5	4.4
AUG56	SEP56	+56.3	+12.5	117.8	- 1.0	+ 2.4	- 5.5	- 1.0	+ 2.4	- 5.5	4.7
SEP56	OCT56	+27.1	-45.8	116.2	- 1.6	+ 3.3	- 3.4	- 1.6	+ 3.3	- 3.4	3.9
OCT56	NOV56	+75.0	+50.0	118.9	+ 2.7	+ 4.2	- 1.9	+ 2.7	+ 4.2	- 1.9	3.6
NOV56	DEC56	+52.1	+ 4.2	118.9	- 0.0	+ 2.8	- 3.1	- 0.0	+ 2.8	- 3.1	3.6
DEC56	JAN57	+31.3	-37.5	117.2	- 1.7	+ 3.8	- 4.2	- 1.7	+ 3.8	- 4.2	4.5
JAN57	FEB57	+75.0	+50.0	119.0	+ 1.8	+ 3.2	- 2.6	+ 1.8	+ 3.2	- 2.6	3.3
FEB57	MAR57	+54.2	+ 8.3	118.7	- 0.3	+ 2.0	- 3.2	- 0.3	+ 2.0	- 3.2	3.1
MAR57	APR57	+62.5	+25.0	118.9	+ 0.2	+ 3.3	- 5.0	+ 0.2	+ 3.3	- 5.0	5.2
APR57	MAY57	+66.7	+33.3	120.4	+ 1.5	+ 3.8	- 3.1	+ 1.5	+ 3.8	- 3.1	4.4
MAY57	JUN57	+58.3	+16.7	121.6	+ 1.2	+ 3.4	- 1.9	+ 1.2	+ 3.4	- 1.9	3.4
JUN57	JUL57	+79.2	+58.3	123.7	+ 2.1	+ 4.0	- 5.0	+ 2.1	+ 4.0	- 5.0	4.6
JUL57	AUG57	+50.0	0.0	123.6	- 0.1	+ 3.0	- 3.1	- 0.1	+ 3.0	- 3.1	5.3
AUG57	SEP57	+39.6	-20.8	122.6	- 1.0	+ 2.7	- 3.6	- 1.0	+ 2.7	- 3.6	3.9
SEP57	OCT57	+31.3	-37.5	120.2	- 2.4	+ 1.8	- 4.4	- 2.4	+ 1.8	- 4.4	4.1
OCT57	NOV57	+39.6	-20.8	119.3	- 0.9	+ 3.0	- 3.5	- 0.9	+ 3.0	- 3.5	3.7
NOV57	DEC57	+87.5	+75.0	123.1	+ 3.8	+ 4.5	- 1.3	+ 3.8	+ 4.5	- 1.3	3.5
DEC57	JAN58	+37.5	-25.0	121.9	- 1.2	+ 2.8	- 3.8	- 1.2	+ 2.8	- 3.8	3.6
JAN58	FEB58	+20.8	-58.3	117.6	- 4.3	+ 1.6	- 5.8	- 4.3	+ 1.6	- 5.8	5.0
FEB58	MAR58	+56.3	-12.5	118.3	+ 0.7	+ 3.5	- 2.9	+ 0.7	+ 3.5	- 2.9	4.7
MAR58	APR58	+75.0	+50.0	121.7	+ 3.4	+ 5.5	- 3.1	+ 3.4	+ 5.5	- 3.1	5.6
APR58	MAY58	+60.4	+20.8	121.8	+ 0.1	+ 2.2	- 3.1	+ 0.1	+ 2.2	- 3.1	2.9
MAY58	JUN58	+45.8	- 8.3	121.3	- 0.5	+ 2.4	- 3.1	- 0.5	+ 2.4	- 3.1	3.2
JUN58	JUL58	+68.8	+37.5	123.1	+ 1.8	+ 4.0	- 3.2	+ 1.8	+ 4.0	- 3.2	4.4
JUL58	AUG58	+62.5	+25.0	125.0	+ 1.9	+ 4.5	- 2.6	+ 1.9	+ 4.5	- 2.6	4.9
AUG58	SEP58	+33.3	-33.3	123.1	- 1.9	+ 2.1	- 4.0	- 1.9	+ 2.1	- 4.0	3.6
SEP58	OCT58	+87.5	+75.0	125.2	+ 2.1	+ 2.7	- 2.3	+ 2.1	+ 2.7	- 2.3	3.0
OCT58	NOV58	+47.9	- 4.2	124.7	- 0.5	+ 2.9	- 3.6	- 0.5	+ 2.9	- 3.6	4.0
NOV58	DEC58	+75.0	+50.0	128.0	+ 3.3	+ 5.3	- 2.8	+ 3.3	+ 5.3	- 2.6	4.9
DEC58	JAN59	+37.5	-25.0	126.7	- 1.3	+ 2.8	- 3.7	- 1.3	+ 2.8	- 3.7	4.2