Chapter Title: The Forty-second Anniversary of the Leading Indicators

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Chapter 24

The Forty-second Anniversary of the Leading Indicators

SUMMARY

Forty-two years ago Wesley Mitchell and Arthur Burns completed a brief research report that identified types of economic indicators that "have been tolerably consistent in their timing in relation to business cycle revivals and that at the same time are of sufficiently general interest to warrant some attention by students of current economic conditions."[1] This study was the first of a long series of investigations devoted to extending the system of indicators, testing its performance, explaining the interrelationships among the indicators, and putting the system into practicable form for current use. Since the leading indicators receive much public attention nowadays, their reliability is a matter of some importance.

One way to assess reliability is to examine the subsequent performance of an early version of the system. For this purpose we have used the list and classification of indicators established in 1950 and compared their performance before World War II with their performance since 1948. The pre-1938 information was used in developing the 1950 list and classification; the post-1948 information of course was not.

The results demonstrate that taken as a whole the 1950 version of the indicator system lived up to its promise. The leading indicators continued to lead and the laggers to lag at each succeeding turn in the business cycle. The degree of consistency in performance after

1948 was not very different from what it was before 1938. The relationships exhibited in earlier cycles resembled those that appeared in subsequent cycles.

Nonetheless, changes did occur. Certain indicators that appeared to lag in earlier cycles moved more promptly in later ones. Some indicators, especially those expressed in current prices, failed to conform to recent business cycles. These and other changes, particularly the availability of new statistical information, have produced many modifications in the system of indicators that promise to enhance its usefulness and to reduce its limitations as a guide to the future.

ORIGIN OF THE NBER LEADING INDICATORS

For four years the U.S. economy had been recovering from a depression. Nearly as many people were then employed as had been at the peak prior to the slump, but unemployment was still high, and the price level was rising again. In an effort to keep up with rising government spending social security taxes were raised. Concerned about inflation, the Federal Reserve raised reserve requirements sharply. Interest rates shot up. By May the recovery had stopped dead in its tracks, and one of the steepest recessions in history began, erasing much of the gain of the four year recovery.

Let me hasten to note that the period just described, despite a superficial resemblance, is not 1979. It was 1937. The recovery was from the Great Depression, and it lasted from March 1933 until May 1937. By coincidence, the most recent recovery also began in March—that is, in March 1975, although the recession that preceded it was brief and mild by comparison with the 1929–1933 decline. Whether the recovery stops in 1979, as it did in 1937, we are far better equipped today to detect a recession in its early stages, to measure its extent and consequences, and hence to take steps promptly to deal with it.

This is partly because of what happened in 1937. In the late summer Secretary of the Treasury Henry Morgenthau, Jr., asked the National Bureau of Economic Research (NBER), a private organization devoted to objective studies of business cycles and other economic problems, to draw up a list of statistical series that would best indicate when the recession would come to an end. Wesley C. Mitchell, then the NBER's director of research and a renowned student of business cycles, enlisted the help of Arthur F. Burns, who later headed the NBER and still later became chairman of the Federal Reserve. In six weeks the job was done. The report that was pre-

sented to the Secretary set forth a list of the most reliable indicators of cyclical revivals, explained how they were selected, and included a record of their past performance. It was published in May 1938.[2]

Thus was born the first set of leading, coincident, and lagging indicators that are now widely used to forecast, detect, measure, and appraise recessions and recoveries. In the summer of 1938 they were put to their first test. The recovery began in June, and the first signs of its appearance were registered in the leading indicators that Mitchell and Burns had identified.

Mitchell and Burns drew on an encyclopedic knowledge of the history and theory of business cycles as well as on an enormous stock of empirical information that had been assembled since the 1920s at the NBER. It was a resource that could be called upon as needed, as Secretary Morgenthau recognized. During the next four decades the continuing studies of business cycles at the NBER, in the U.S. Department of Commerce, and elsewhere in this country and abroad led to many improvements in the system of indicators. They were subjected to a series of tests of performance as new business cycles came upon the scene and as new techniques for managing the economy were applied.

SUBSEQUENT PERFORMANCE OF THE
1950 LIST OF INDICATORS

The degree of confidence that any method of analysis attains, and deserves, depends upon its performance after it has been developed. It must be subjected to trial with new data, not used at the time the method was devised and preferably not even available at that time. This kind of test of the leading indicators has indeed been made more than once. In 1950 I examined the performance of the Mitchell-Burns list of indicators at the 1937 peak and 1938 trough of the business cycle, since the data they had used in their analysis ended with the 1933 trough. The test broadly supported their results, but many new series had become available, new findings from research suggested additional materials, and the analysis needed to be extended to cover downturns as well as upturns. Hence a new list and classification of indicators, based on records available through 1938, was published in 1950.[3]

Ten years later, in 1960, another review was undertaken, and in 1966 still another, both under the auspices of the NBER.[4] In 1972 the Department of Commerce initiated an extensive review, publishing the results in 1975.[5] Some of the indicators originally selected by Mitchell and Burns have survived all these tests of performance.

The length of the average workweek in manufacturing establishments and the index of common stock prices are examples. Others have been dropped altogether or replaced by similar series, and new series have been added. It is of some interest, however, to take a long look back to see how the initial system behaved in subsequent business cycles up to the present. For this purpose it will be more productive to concentrate on the 1950 list and classification of indicators rather than the 1938 list of Mitchell and Burns. The 1950 study, as already noted, covered both peaks and troughs, and the classification system bears a closer resemblance to the system now used. Furthermore, current data for each of the series in the 1950 list, or close equivalents, are published in the Commerce Department's monthly *Business Conditions Digest* and hence are conveniently available. The data record employed in the 1950 study ended with the 1938 business cycle trough. The test will pertain to the period from 1948 to 1975, during which time six business cycles occurred, with peaks in 1948, 1953, 1957, 1960, 1969, and 1973 and troughs in 1949, 1954, 1958, 1961, 1970, and 1975.

The principal question to be examined is whether, at these twelve turning points in the economy, the indicators selected and classified in 1950 lived up to the performance suggested by their record prior to 1938. Did the leading indicators lead and the lagging indicators lag? Was their behavior as consistent as their previous record would lead one to expect? What deficiencies became evident and why? The answers can tell something about the effectiveness of the method used to develop the information, as well as the degree of historical continuity in the economic processes that give rise to business cycles.

In 1950, when I began this research, business cycles had been puzzling scholars for more than a century, and efforts to prevent panics, crises, and depressions had long engaged the attention of lawmakers and government officials. Mitchell and others had studied a large number of hypotheses, theories, or models of how business cycles came about. No single theory had proved adequate for all time or all countries, and the evidence bearing upon the phenomenon was scattered and lacked uniform treatment. Mitchell had come to believe that the most promising line of attack was to organize systematically and comprehensively the statistical evidence for a long period of time and for several countries and then to use these data to develop an accurate description of business cycle phenomena as well as to test various hypotheses and to suggest new ones.

As a result, the NBER in 1950 had a large collection of economic time series in monthly, quarterly, or annual form extending back in time as far as each series could be compiled and pertaining to the types of economic process that previous investigators believed rele-

vant to the generation of business cycles. The series had been classified into economic groups deemed most useful in explaining differences in cyclical behavior or in accounting for the influence of one economic variable on another. Finally, a standard set of measures of cyclical behavior had been calculated for each series for the period it covered. The measures showed how consistently the series conformed to business cycles, whether they led or lagged and by how much, what rate of change and pattern of movement they exhibited in successive cycles and on the average, and so on. From these measures one could trace the relationships among numerous economic processes during the periods of prosperity and depression that the data covered, examine what changes had occurred in these relationships, and develop a systematic, reasoned account of past business cycles.

By summarizing a portion of this information, I was able to identify, among these relevant types of economic process, those that had shown highly consistent conformity to business cycles and dominant tendencies either to lead, to coincide with, or to lag behind the turns in the economy as a whole. I used statistical significance tests as a way of reducing the likelihood that a certain record had been achieved by chance. It became clear that there were systematic sequences in the movements of different economic variables, such as orders, production, employment, inventories, prices, interest rates, and so on, and that these sequences had persisted over many business cycles during the past half century or more. It was also clear that some changes had occurred in the way the economy worked and that they had affected and doubtless would continue to affect the observed sequences. Many of the sequences and the changes in them could be readily explained or at least rationalized, but many were of a complex nature that defied simple explanation. The riddle of the business cycle had not been solved. As a result, although the persuasiveness of the explanation and the statistical evidence offered grounds for some confidence that the sequences would persist in the future, how much and exactly what would persist and what would disappear, and when, were the great unknowns.

The types of economic process identified and classified in this way and the particular time series selected to represent them are shown in Table 24–1. In virtually every instance, several indicators were available to represent a given type of process. For example, for employment the most comprehensive available series was (and still is) total civilian employment, based upon data from the household survey. But estimates of nonfarm employment are also compiled from reports by establishments. They cover a much larger sample of employees and are documented by payroll records. Hence the latter series is

Table 24-1. The 1950 List of Leading, Coincident, and Lagging Indicators and their Current Equivalents.

No.	Original Series in 1950 List	BCD No.	Corresponding Series Currently in Business Conditions Digest
	Leading Group		
1.	Liabilities of business failures	14.	Same
2.	Dow-Jones index of industrial common stock prices	19.	Standard and Poor's index of 500 common stock prices
3.	New orders, durable goods, value	6.	Same
4.	Residential building contracts, floor space	29.	New building permits, private housing units, number
5.	Commercial and industrial building contracts, floor space	9.	Same
6.	Average workweek, manufacturing	1.	Same
7.	New incorporations, number	13.	Same
8.	Wholesale price index, twenty-eight basic commodities	23.	Industrial materials price index, thirteen commodities
	Roughly Coincident Group		
9.	Employment in nonagricultural establishments	41.	Same
10.	Unemployment	37.	Same
11.	Corporate profits after taxes	16.	Same
12.	Bank debits outside New York	56.	Manufacturing and trade sales, value
13.	Freight car loadings	49.	Value of goods output in 1972 dollars
14.	Industrial production index	47.	Same
15.	Gross national product, value	200.	Same
16.	Wholesale price index, industrial commodities	335.	Same
	Lagging Group		
17.	Personal income, value	223.	Same
18.	Sales by retail stores, value	54.	Same
19.	Consumer installment debt, value	66.	Same
20.	Bank rates on business loans	67.	Same
21.	Manufacturers' inventories, book value	71.	Manufacturing and trade inventories, book value

Source: Geoffrey H. Moore, *Statistical Indicators of Cyclical Revivals and Recessions*, Occasional Paper 31 (New York: National Bureau of Economic Research, 1950), Table 12.

generally superior in its performance as an economic indicator and was selected to represent the employment process.

Fifteen of the twenty-one series selected as indicators in 1950 are still carried in *Business Conditions Digest*. More or less close relatives of the remaining six series can also be found in *BCD*, as Table 24-1 shows. Because these series represent the same types of process and are readily available in a computer data bank, I have used them in testing the subsequent performance of the 1950 list.

Table 24-2 summarizes the lead-lag performance at each business cycle peak and trough since 1948 for the groups of leading, coincident, and lagging indicators selected in 1950. The twenty-one series were classified in the three groups according to their performance prior to 1938. The leading group (eight series) shows a mean lead at each business cycle turn except the last trough (March 1975). The lagging group (five series) shows a mean lag at each turn except the initial trough (October 1949). The coincident group (eight series) shows some tendency to lead at peaks but is virtually coincident at troughs. Since several of the coincident series were used, along with others, to determine the business cycle peak and trough dates, it is not surprising that they should roughly coincide with these dates. But the sequence of the turns in the three groups is not determined by the business cycle dates, and the sequence is in the expected direction for all but one of the twelve dates, the one exception being the March 1975 trough, where the averages for the leading and the coincident groups coincide.

Table 24-2 also shows that the proportions of timing comparisons that are in the appropriate class in 1948–1975 are not very different from the proportions in the period prior to 1938. At peaks, for example, 89 percent of the timing comparisons in the leading group during 1948–1975 were leads, as compared with 80 percent for the same group prior to 1938. At troughs, the 1948–1975 percentage of leads was seventy-one, compared with 81 percent for the pre–1938 period. For all three groups of series together, at both peaks and troughs, the percentage of timing comparisons that turned out to be in the appropriate class was almost exactly the same after 1948 (75 percent) as before 1938 (77 percent).

Another aspect of the record that is important to the user of indicators is the likelihood that the indicator will not register a turning point in the vicinity of the business cycle turn or that it will register a turning point when no business cycle turn occurs. The record of the 1950 list of indicators with respect to the first of these contingencies is shown in Table 24-3.

Table 24-2. Subsequent Performance of Three Groups of Indicators Selected and Classified in 1950.

| Business Cycle | | Average Lead (−) or Lag (+), in Months | | | | | |
| | | At Peaks | | | At Troughs | | |
Peak (1)	Trough (2)	Leading Group (3)	Roughly Coincident Group (4)	Lagging Group (5)	Leading Group (6)	Roughly Coincident Group (7)	Lagging Group (8)
November 1948	October 1949	−15	−3	+2	−6	−1	0
July 1953	May 1954	−13	−2	+2	−4	+1	+2
August	April	−21	−6	+2	−2	0	+2
April 1960	February 1961	−9	−4	+2	−1	+3	+4
December 1969	November 1970	−8	−5	+2	−2	0	+15
November 1973	March 1975	−6	+6	+11	0	0	+9
Average 1948–1975		−12	−2	+3	−2	+1	+4
Expected value, based on prior record (through 1938)		−6	0	+5	−5	−2	+3
Timing comparisons, 1948–1975 (number)							
Leads		40	28	4	32	13	6
Rough coincidences		6	26	10	28	36	11
Lags		5	6	15	5	13	16
Total[a]		45	43	22	45	43	22

Percentage of timing comparisons in appropriate class, 1948–1975	89	60	68	71	84	73
Expected percentage, based on record to 1938	80	72	88	81	67	72

Note: The indicators were selected and classified into leading, roughly coincident, and lagging groups (eight series, eight series, and five series, respectively) in Geoffrey H. Moore, *Statistical Indicators of Cyclical Revivals and Recessions*, Occasional Paper 31 (New York: National Bureau of Economic Research, 1950). The prior performance of these indicators or substantially equivalent series during business cycles through 1938 is shown ibid., pp. 64–65. The record for 1948–1975 is based on the same or substantially equivalent series, all of which are shown currently in *Business Conditions Digest*, a monthly publication of the U.S. Department of Commerce (see Table 24–1).

aTotal is the sum of the leads, exact coincidences (not shown), and lags. Rough coincidences include leads or lags of three months or less, as well as exact coincidences; hence the sum of the three classes exceeds the total.

Source: National Bureau of Economic Research, January 1979.

Table 24-3.   Percentage of Business Cycle Turns Skipped: 1950 List of Indicators.

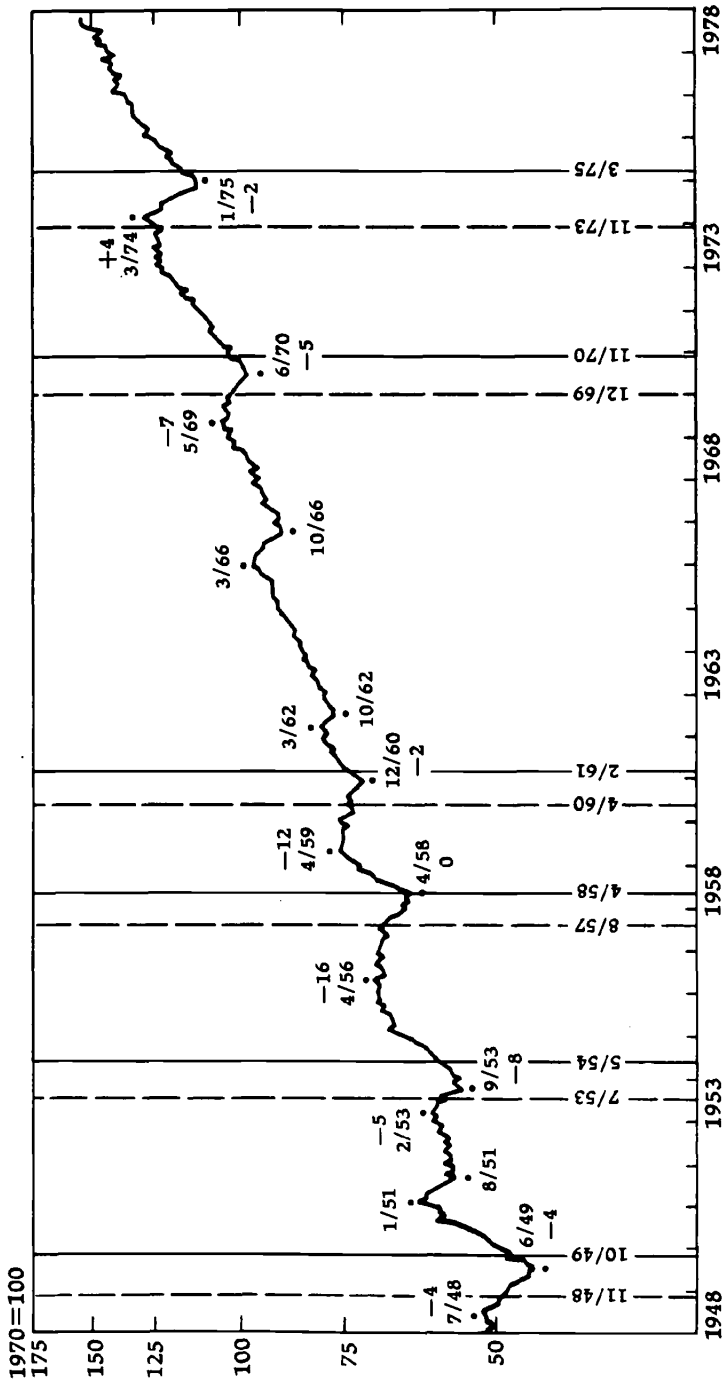| Business Cycle Peaks and Troughs	Leading Group (8 series)	Coincident Group (8 series)	Lagging Group (5 series)
Number covered			
Before 1938	200	100	39
1948–1975	96	96	60
Percentage skipped			
Before 1938	6	8	13
1948–1975	6	10	27

Source: National Bureau of Economic Research, January 1979.

The record, both before and after 1938, reflects the relative sensitivity of the series, with the leading series being most sensitive and hence skipping few cycles, while the lagging series are the least sensitive and skip more cycles. In the leading and coincident groups there was little change in performance between the two periods, but in the lagging group more than twice as large a percentage of turns were skipped in the recent period. One of the reasons is that business cycles have been milder in the period since 1948 than before. Another is that four of the five lagging series are expressed in current dollars, and inflation has pulled such series upward even during recessions.

For the second contingency, the problem of false signals, a similar record is more difficult to obtain. The term "false signal" is not easy to define, and the 1950 study did not contain this information. Later work has shown, however, that the leading indicators are more subject to extra cycles that do not match the business cycle chronology, while the lagging indicators, again reflecting their relative insensitivity, seldom exhibit extra cycles.[6] This difference continued to prevail after 1948, as the following materials demonstrate.

Figures 24-1 through 24-3 present another form of summary of the performance of the 1950 list of indicators during 1948–1975. Here the three groups of indicators are combined into indexes by the method that the Department of Commerce currently uses to construct its leading, coincident, and lagging indexes.[7] The indexes move down during each recession, up during each expansion. The sequences among their turning points, identified by the use of a computer program, are with rare exceptions in accordance with the patterns expected when the selection of indicators was made in 1950 (see Table 24-4).[8]

Figure 24-1. Composite Leading Index, Eight Series, 1950 List of Indicators.

Note: All turning points except March and October 1962 were identified by computer program. The broken vertical lines are business cycle peaks; solid lines are troughs. Leads (–) and lags (+) in months are shown above and below turning point dates.

Figure 24–2. Composite Coincident Index, Eight Series, 1950 List of Indicators.
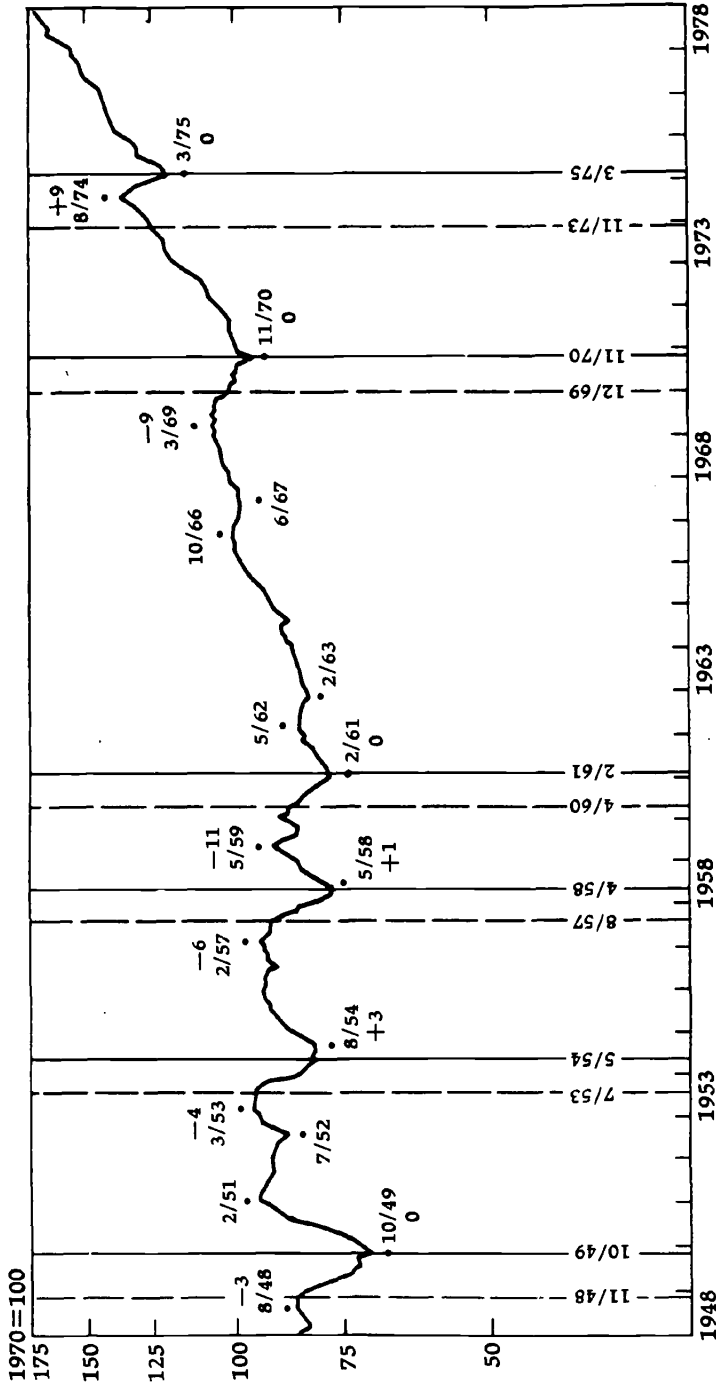
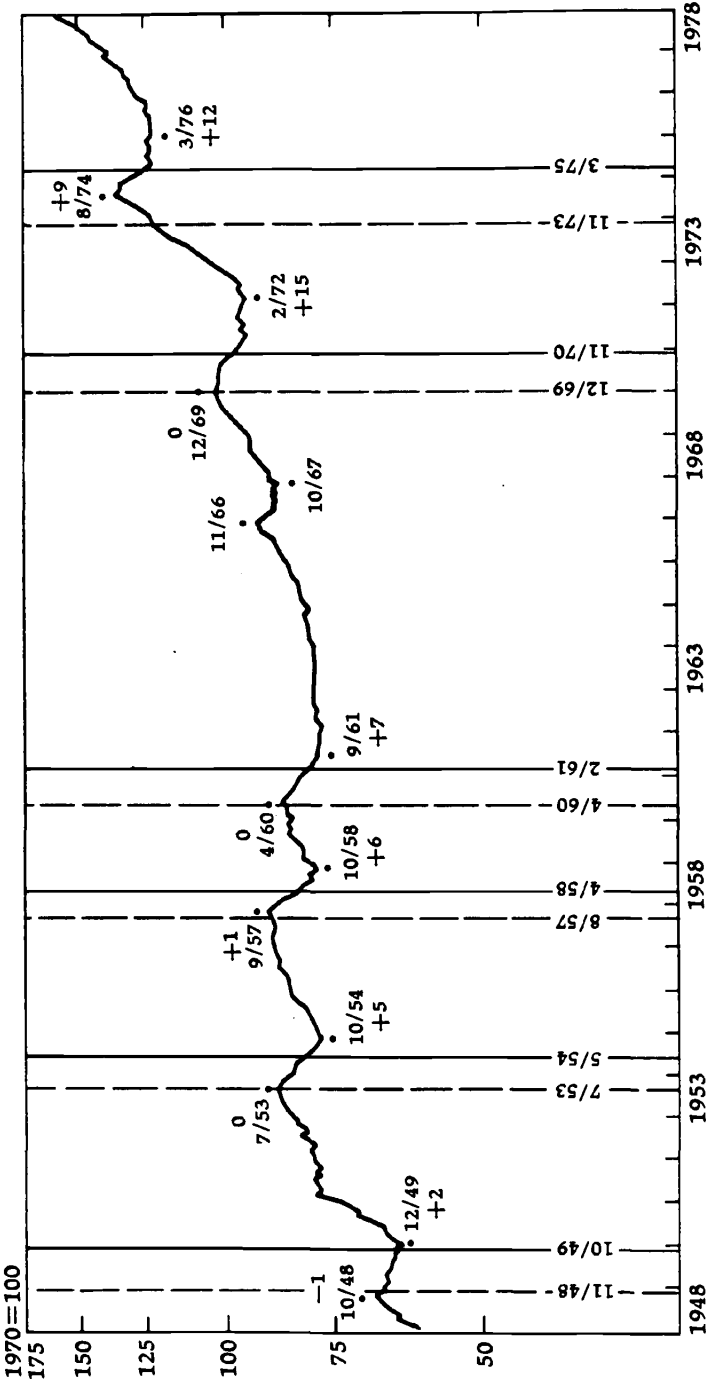*Note*: All turning points were identified by computer program. The broken vertical lines are business cycle peaks; solid lines are troughs. Leads (−) and lags (+) in months are shown above and below turning point dates.

Figure 24-3. Composite Lagging Index, Five Series, 1950 List of Indicators.

Table 24-4. Leads and Lags at Business Cycle Peaks and Troughs, Two Sets of Composite Indexes, 1948–1975.

Business Cycle		Lead (−) or Lag (+), in Months											
		Indexes Based on 1950 List						Indexes Based on 1975 List					
		Leading		Coincident		Lagging		Leading		Coincident		Lagging	
Peak (1)	Trough (2)	P (3)	T (4)	P (5)	T (6)	P (7)	T (8)	P (9)	T (10)	P (11)	T (12)	P (13)	T (14)
November 1948	October 1949	−4	−4	−3	0	−1	+2	−10	−4	−1	0	+3	+5
July 1953	May 1954	−5	−8	−4	+3	0	+5	−4	−6	−2	+2	+2	+5
August 1957	April 1958	−16	0	−6	+1	+1	+6	−23	−3	−6	0	+1	+4
April 1960	February 1961	−12	−2	−11	0	0	+7	−11	−2	−3	0	+2	+9
December 1969	November 1970	−7	−5	−9	0	0	+15	−11	−8	−2	0	+2	+15
November 1973	March 1975	+4	−2	+9	0	+9	+12	−5	−1	0	0	+10	+13
Average		−7	−4	−4	+1	+2	+8	−11	−4	−2	0	+3	+8
Standard deviation		7	3	7	1	4	5	7	3	2	1	3	5
Peaks and troughs													
Average		−5		−2		+5		−7		−1		+6	
Standard deviation		5		5		5		6		2		5	
Correlation coefficient ᵃ		+0.80		+0.69		+0.95							

ᵃWith the corresponding leads and lags in columns 9 to 14.

Sources: Columns 1 to 8: National Bureau of Economic Research; columns 9 to 14, *Business Conditions Digest*, various issues, p. 10.

In addition to the six recessions identified in the charts, three periods when the indexes declined are not recognized as recessions—namely, 1951–1952, 1962–1963, and 1966–1967. The usual sequences are observed at these turns also (except that the lagging index did not decline in 1951–1952 or 1962–1963). Each of these periods has been identified as a period of slowdown in a chronology of growth cycles, although some of the sensitive leading indicators experienced declines as large as those during the business cycle recessions (see the section following).

During a period as long as 1948–1975, some tendency for the "quality" of the indicators to deteriorate might be expected. Among particular indicators there have been many instances of such deterioration or at least changes in behavior. Railroad freight car loadings, for example, have not kept up with the trend of the economy, partly because of the increasing share of freight hauled by trucks, partly because the production of goods has grown more slowly than services. Inner tube production, one of the indicators in the Mitchell-Burns list, used to be an interesting indicator because of its sensitivity to the new car market and the tire repair business. The advent of the tubeless tire has made the inner tube almost a collector's item, found mostly around swimming holes. There is a possibility, also, of selection bias and regression toward the mean. The top performers selected on the basis of a sample of information covering a certain period are not all likely to remain at the top in a second sample covering a different period. Some were at the top by chance in the first sample and are unlikely to remain there in the next. One can guard against this by making the first sample as large as possible, by applying significance tests in identifying the top performers, and by using other information that explains why they were at the top or that supports the choice indirectly. These safeguards were employed in all the indicator studies, but the possibility of regression bias still remains, as well as deterioration because of economic change.

The lead-lag entries in Table 24–2 give some support to the hypothesis of detorioration. In particular, the average leads of the leading group of indicators have diminished at both peaks and troughs. But this is not decisive, for several reasons. One is that the corresponding entries in Table 24–4, columns 3 and 4, for the composite leading index based on the 1950 list do not show as clear a trend. A stronger test, however, can be made by using the entries for the composite leading index based on the 1975 list, also in Table 24–4. Because the 1975 list was selected toward the end of the period, one would not expect a trend toward deterioration in these observations, and because they are correlated with the entries for the 1950 list

(see the correlation coefficients in Table 24-4), they provide a means for allowing for some of the cycle-to-cycle variation in the leads and lags of the 1950 list. A simple way to do this is to subtract the entries in columns 9 and 10 from those in columns 3 and 4, which is equivalent to measuring the leads and lags of the 1950 list against the 1975 list. On this basis the entries in Table 24-4 give some support to the hypothesis of deterioration in the 1950 list, in terms of a trend toward shorter leads or longer lags than in its 1975 counterpart.[9] The entries in Table 24-2, adjusted in a similar manner, give stronger support.[10]

A further consideration with respect to deterioration is that the lags of the lagging group appear to have a tendency to lengthen, especially at troughs. Coupled with the shortening leads of the leading group, this means that the interval between the turns in the leaders and those in the laggers has not diminished. More generally, the sequences among the turns in the three groups of indicators do not reveal strong evidence of deterioration, although at troughs the intervals between the turns in the leading and the coincident groups may have shortened and those between the coincident and the lagging groups may have lengthened.

Table 24-5 summarizes the pre-1938 and post-1948 performance of each of the twenty-one indicators selected in 1950. About two-thirds of the series behaved in substantially the same way in the later period as in the earlier one. That is, the later information supports the earlier classification. Seven of the eight leading indicators are currently classified in *Business Conditions Digest* as leading at both peaks and troughs. The one exception, contracts for commercial and industrial building, is now considered leading at peaks and coincident at troughs. Corporate profits, in the coincident group in 1950, is now classified as a leading indicator. Even in the pre-1938 period, however, profits exhibited some tendency to lead by short intervals (note the average lead of two months at both peaks and troughs). Unemployment is no longer considered a coincident indicator, because of its tendency to lead at peaks and to lag at troughs. Personal income and retail sales, originally classified in the lagging group because they exhibited short lags in the pre-1938 period, have rarely done so since 1948. In addition, inflation has prevented these series from declining in some of the milder recent recessions. For the same reason, the wholesale price index for industrial commodities has not performed as a useful coincident indicator since 1960.

ADDITIONAL TESTS OF THE INDICATOR SYSTEM

Clearly, the 1950 list and classification of indicators has continued to exhibit most of the properties it had when it was established. To users of this system of analysis this result will come as no surprise. As already noted, several reviews of this sort have been made, although none of them tested the 1950 list for the entire 1948–1975 period. Moreover, other kinds of tests have been made. One examines the behavior of the same data in other countries. Investigators in Canada, Japan, Italy, the United Kingdom, Australia, and New Zealand have done this, and within the past few years Philip Klein and I have compiled and analyzed comparable sets of indicators for six countries other than the United States. For this purpose we used the 1966 list rather than the 1950 list of indicators, but many of the same or similar series are in both lists.[11]

Another kind of test uses the same data but in a manner different from that originally contemplated. The use of the leading indicators to forecast the magnitude of change in economic activity is an example, since information on magnitude of change was not used in the 1950 study of indicators. I began carrying out one test of this sort during the recession of 1953–1954 and followed it up again in 1957–1958 and in subsequent recessions. The idea was to compare the severity of the current recession shortly after it began with that of preceding recessions, using the initial changes in the leading and coincident indicators. The leading indicators generally gave earlier indications of the relative severity of the recession than the coincident indicators did.[12] Another test of this sort uses the changes in the leading indicators in a regression model to forecast subsequent changes in the coincident indicators. In these models the leading indicators have exhibited some ability to forecast the magnitude of change in GNP, industrial production, or foreign trade one or two quarters ahead.[13]

Yet another way to test the data is to compare the turning points in the lagging series with the opposite turns in the leading series. The logic of this comparison was recognized in the 1950 study (as well as in the Mitchell-Burns study that preceded it), but the information was not used in selecting the lagging or leading indicators. Briefly, the logic is that many of the lagging indicators represent costs of production (labor costs, interest rates) or factors bearing upon costs (inventories) and that their movements can have an inverse impact upon the leading indicators (new orders, housing starts, construction contracts). This potential inverse effect leads one to expect that up-

Table 24-5.   Pre-1938 and Post-1948 Record of Twenty-One Indicators Selected in 1950.

No.	Series (1)	Mean Lead (−) or Lag (+), in Months				Percentage of Timing Comparisons in Appropriate Class			
		At Business Cycle Peaks		At Business Cycle Troughs		At Business Cycle Peaks		At Business Cycle Troughs	
		Through 1938 (2)	1948–1975 (3)	Through 1938 (4)	1948–1975 (5)	Through 1938 (6)	1948–1975 (7)	Through 1938 (8)	1948–1975 (9)
	Leading Group								
1.	Liabilities of business failures	−10	−21	−8	−3	85	100	93	80
2.	Common stock price index	−6	−9	−7	−5	80	100	80	100
3.	New orders, durable goods	−7	−7	−5	−2	88	83	83	67
4.	Residential building contracts	−6	−15	−4	−5	80	100	83	83
5.	Commercial and industrial building contracts	−5	−10	−2	+1	80	60	67	20
6.	Average workweek, manufacturing	−4	−11	−3	−2	75	100	60	67
7.	New incorporations	−2	−14	−4	−5	71	100	79	100
8.	Wholesale price index, basic commodities	−3	−10	−3	0	78	67	80	50
	Average, eight series	−6	−12	−5	−2	80	89	81	71
	Roughly Coincident Group								
9.	Employment in nonfarm establishments	0	+1	−3	+1	58	67	58	100
10.	Unemployment	n.a.	−7	n.a.	+4	n.a.	33	n.a.	67
11.	Corporate profits after taxes	−2	−7	−2	−2	75	17	80	67
12.	Bank debits outside New York	+2	−1	−4	−1	69	67	60	83
13.	Freight car loadings	0	−1	−1	0	83	83	83	100
14.	Industrial production index	+1	−1	−2	0	100	50	83	100
15.	Gross national product	n.a.	−1	n.a.	−1	100	100	n.a.	100
16.	Wholesale price index, industrial commodities	−4	−1	+4	+9	67	100	60	33
	Average, eight series	0	−2	−2	+1	72	60	67	84

Lagging Group

17. Personal income	+4	+1	0	-2	100	33	25	0
18. Sales by retail stores	+4	-2	+2	-2	80	0	60	25
19. Consumer installment debt	+5	+8	+4	+3	100	100	100	100
20. Bank rates on business loans	+6	+3	+5	+10	75	83	100	100
21. Manufacturers' inventories	+6	+5	+8	+4	100	100	100	100
Average, five series	+5	+3	+3	+4	88	68	72	73

n.a.: Not available. For series 10 and 15 no record of timing prior to 1938 is shown in the source; the selection of these series was based on other related series.

Note: See note to Table 20-2. The percentage of timing comparisons in appropriate class (columns 6 to 9) means, for the leading group, the percentage that are leads; for the coincident group, the percentage that are rough coincidences (exact coincidences and leads or lags of three months or less); for the lagging group, the percentage that are lags.

Source: National Bureau of Economic Research, January 1979.

turns in the lagging indicators will precede downturns in the leading indicators and that downturns in the lagging indicators will precede upturns in the leading indicators. Moreover, if the connection is sufficiently close, it should help account for the variation from cycle to cycle in the length of leads of the leading indicators.

Although the twenty-one indicators in the 1950 list were not specifically examined for this property at the time that they were selected, the larger list of indicators studied at that time (seventy-five leading, twenty-nine coincident, and thirty lagging) did exhibit the relationship. Whether the subsequent behavior of the 1950 list conformed to the earlier behavior of this larger list can therefore be determined (see Table 24-6).[14] At all but two of the forty-one turning points since 1885 the upturns in the lagging indicators have preceded the downturns in the leading indicators, and the downturns in the lagging indicators have preceded the upturns in the leading indicators. The two exceptions occurred in 1904 and 1908, when the lagging group reached its peak in the same month that the leading group reached its trough. For nearly seventy years, in other words, there has been no exception to the rule.

Table 24-6 also shows that some of the leads in the inverted lagging series are exceptionally long, and in those instances, a close connection with the leads in the leading series is not plausible. At the December 1969 business cycle peak, for example, the upturn in the lagging group that occurred ninety months before the peak could have little bearing on the downturn in the leading group that occurred nearly seven years later, ten months before the peak. Yet it is fair to say, on the basis of the entire record covering a ninety year span, that these instances are exceptions and that by and large the variability of the intervals between the opposite turns in the leading and lagging groups is not very different from that between the similar turns (see the note to Table 24-6). In this respect the record since 1948 resembles the record prior to 1938.

One factor that helps to account for the variability in the intervals just described is the influence of long-run growth or the occurrence of some extraneous event such as a war on the length of leads and lags. The upward trend in the economy affects both leading and lagging indicators and makes for long expansions and short contractions. When both the leading and lagging series are treated positively, the trend has a similar effect on both, tending to delay peaks and to advance troughs. But when the lagging series are treated invertedly, the trend is inverted also. This tends to increase the intervals between the troughs in the lagging series and the subsequent peaks in the leading series and to reduce the intervals between peaks in the laggers and

the subsequent troughs in the leaders. The effect is exaggerated whenever the trend has a dominant effect relative to the cyclical movement of the series.

By adjusting the series for the long-run trend this effect can be eliminated. In recent years this method of cyclical analysis has come to be known, here and abroad, as the growth cycle approach. The 1950 list of indicators can also be analyzed in this manner by trend adjusting the composite indexes constructed from them. The trend-adjusted indexes (Figure 24–4) conform closely to the NBER chronology of growth cycles, and the timing sequences follow the expected pattern (Table 24–7).

The trend-adjusted coincident index based on the 1950 list displays the rare property of coinciding precisely at every one of the nine growth cycle troughs since 1949 (see column 8). It deviates more from the peaks, especially in 1960, where the peak prior to the 1959 steel strike was higher than the peak that followed the strike, and in 1973, where the inclusion of aggregates expressed in current dollars, together with rapid inflation, delayed the peak in the composite index until August 1974. The trend-adjusted leading index led all but three of the growth cycle turns, and the lagging index lagged all but three. When the lagging index is inverted, however, it leads at every turn and by intervals that exceed the leads in the leading index at every turn but one. The variability of the leads in the inverted lagging index, as measured by the standard deviation, is no greater than the variability of the lags in the same index treated positively or of the leads in the leading index. Moreover, the leads in the inverted lagging index are correlated with those in the leading index, supporting the hypothesis that rapid increases in the lagging indicators have deterrent effects on the leading indicators, while slow increases or declines have stimulating effects.

The behavior of the trend-adjusted indexes based on the 1975 list of indicators, which is also recorded in Table 24–7, supports the same inference. Indeed, the correlation just referred to is stronger in the leads based on the 1975 list. Furthermore, there is a high correlation between the timing observations based on the 1975 list and those based on the 1950 list. There is also little evidence of the possible deterioration in the timing behavior of the 1950 list when judged by comparison with the 1975 list, a matter that was explored above in terms of data unadjusted for long-term trends. The growth cycle performance of both sets of indexes is extraordinarily similar.

Table 24-6. Cyclical Timing of Leading and Lagging Indicators, 1885–1975 (number of months).

Business Cycle Peak (1)	Lead (−) or Lag (+) at Business Cycle Peaks — Median Trough, Lagging Group (2)	Median Peak, Leading Group (3)	Median Peak, Lagging Group (4)	Business Cycle Trough (5)	Lead (−) or Lag (+) at Business Cycle Troughs — Median Peak, Lagging Group (6)	Median Trough, Leading Group (7)	Median Trough, Lagging Group (8)	Interval from — Trough, Lagging to Peak, Leading (9)	Peak, Leading to Peak, Lagging (10)	Peak, Lagging to Trough, Leading (11)	Trough, Leading to Trough, Lagging (12)
Mar. 1887	−20	−3	+6	May 1885	n.a.	−6	+2	n.a.	n.a.	n.a.	8
July 1890	−14	−5	+5	Apr. 1888	−7	−2	+13	17	9	5	15
Jan. 1893	−8	−5	+6	May 1891	−5	−4	+12	9	10	1	16
Dec. 1895	−14	−5	+5	June 1894	−11	−4	+4	3	11	7	8
June 1899	−6	−1	+10	June 1897	−13	−9	+18	9	10	4	27
Sept. 1902	−15	−4	+14	Dec. 1900	−8	−5	+6	5	11	3	11
May 1907	−27	−16	+6	Aug. 1904	−9	−9	+6	11	18	0	15
Jan. 1910	−11	−4	+7	June 1908	−6	−6	+8	11	22	0	14
Jan. 1913	−14	−3	+8	Jan. 1912	−17	−13	−2	7	11	4	11
Aug. 1918	−34	−20	+1	Dec. 1914	−14	−1	+10	11	11	13	11
Jan. 1920	−9	−2	+6	Apr. 1919	−7	−3	0	14	21	4	3
May 1923	−13	−4	+4	July 1921	−12	−5	+9	7	8	7	14
Oct. 1926	−24	−11	−1	July 1924	−10	−6	+3	9	8	4	9
June 1929	−15	−5	+2	Nov. 1927	−14	−4	+4	13	10	10	8
May 1937	−50	−2	+3	Mar. 1933	−43	−5	0	10	7	38*	5
Feb. 1945	n.a.	n.a.	n.a.	June 1938	−10	−4	+10	48*	5	6	14
Nov. 1948	n.a.	−11	+2	Oct. 1945	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
July 1953	−45	−8	+3	Oct. 1949	−9	−5	0	n.a.	13	4	5
Aug. 1957	−38	−20	+2	May 1954	−7	−2	+1	37*	11	5	3
Apr. 1960	−23	−11	+2	Apr. 1958	−6	−1	+1	18	22	5	2
Dec. 1969	−90	−10	+2	Feb. 1961	−8	−2	+4	12	13	6	6
Nov. 1973	−21	−8	+11	Nov. 1970	−9	−2	+15	80*	19	7	17
				Mar. 1975	−5	0	+4	13		5	4

|										
Average										
1885–1938	−18	−6	+5	−12	−5	+6	12	11	7	12
1948–1975	−43	−11	+4	−7	−2	+4	32	15	5	6
Standard deviation										
1885–1938	12	5	4	9	3	5	10	5	9	6
1948–1975	28	4	4	2	2	6	29	4	1	5

n.a.: Not available.

Note: If the four extreme items identified by asterisks(*) are excluded, the averages and standard deviations are:

	Column			
	(9)	*(10)*	*(11)*	*(12)*
Average				
1885–1938	10	11	5	12
1948–1975	14	15	5	6
Standard deviation				
1885–1938	4	5	4	6
1948–1975	3	4	1	5

Sources: 1885–1938: Geoffrey H. Moore, *Statistical Indicators of Cyclical Revivals and Recessions*, Occasional Paper 31 (New York: National Bureau of Economic Research, 1950), Table 11, based on seventy-five leading and thirty lagging indicators; 1948–1975: Based on eight leading and five lagging indicators, 1950 list.

Figure 24-4. Three Trend-adjusted Composite Indexes, 1950 List of Indicators.
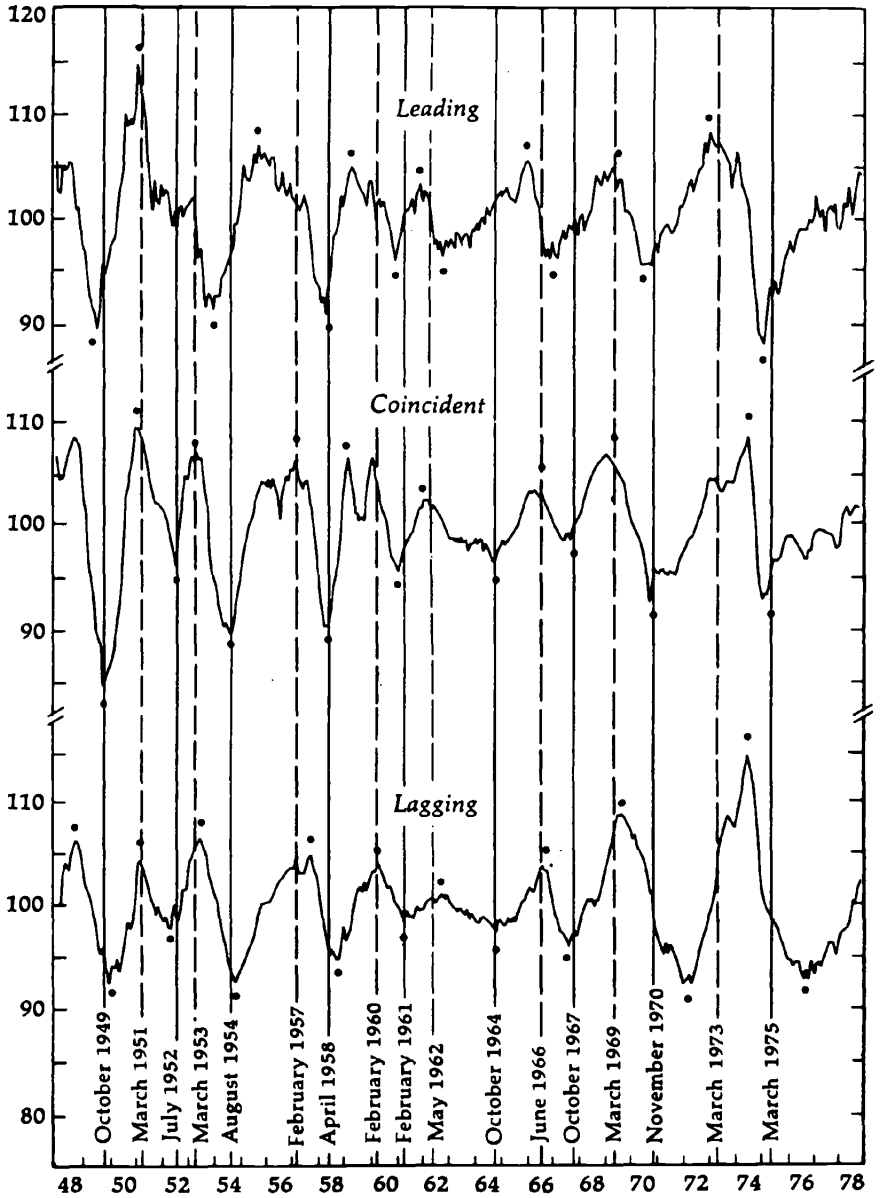
Note: The broken vertical lines are peaks and the solid lines are troughs in NBER growth cycle chronology.

Table 24-7. Leads and Lags at Growth Cycle Peaks and Troughs, Two Sets of Trend-adjusted Composite Indexes, 1948-1975.

Growth Cycle		Lead (−) or Lag (+), in Months															
		Indexes Based on 1950 List								Indexes Based on 1975 List							
		Lagging Inverted		Leading		Coincident		Lagging		Lagging Inverted		Leading		Coincident		Lagging	
Peak (1)	Trough (2)	P (3)	T (4)	P (5)	T (6)	P (7)	T (8)	P (9)	T (10)	P (11)	T (12)	P (13)	T (14)	P (15)	T (16)	P (17)	T (18)
July 1948	Oct. 1949	−b	−14	−6a	−4	+1	0	+1	+2	−b	−14	−6a	−4	−1	0	+1	+5
Mar. 1951	July 1952	−15	−17	−2	−b	−2	0	−1	−4	−12	−b	−7	−8	−2	0	−b	−b
Mar. 1953	Aug. 1954	−12	−14	−b	−8	+2	0	+3	+2	−b	−11	0	−7	0	0	+6	+8
Feb. 1957	Apr. 1958	−28	−7	−17	0	0	0	+7	+5	−22	−7	−17	−3	−14	+1	+7	+7
Feb. 1960	Feb. 1961	−17	−10	−10·	−2	−9	0	+2	+2	−15	−8	−10	−2	−8	0	+4	+10
May 1962	Oct. 1964	−13	−24	−5	−24	−3	0	+5	+1	−5	−b	−3	−28	−b	−b	−b	−b
June 1966	Oct. 1967	−19	−13	−5	−10	0	0	+3	0	−b	−9	−3	−8	+4	−3	+7	0
Mar. 1969	Nov. 1970	−17	−15	+2	−2	0	0	+5	+19	−17	−13	−2	0	+7	0	+7	+15
Mar. 1973	Mar. 1975	−9	−7	−1	0	+17	0	+17	+20	−13	−6	−1	−1	+8	0	+18	+21
Mean		−16	−13	−6	−6	+1	0	+5	+5	−14	−10	−5	−7	−1	0	+7	+9
Standard Deviation		6	5	6	8	7	0	5	8	6	3	5	8	7	1	5	7

Note: The 1950 list indexes were trend-adjusted by the phase-average method. The 1975 list indexes were trend-adjusted by eliminating the "target trend," 0.282 percent per month.

a Measured from highest value in available data, which begin in January 1948.

b No corresponding cyclical turn.

CHANGES IN THE INDICATOR SYSTEM
SINCE 1950

Strictly speaking, only three of the twenty-one indicators selected by the NBER in 1950 are among the twenty-two indicators selected by the Commerce Department in 1975. They are the average workweek in manufacturing, which is a leading indicator in both lists, and non-farm employment and industrial production, which are coincident indicators in both lists (see Table 24-8). Many of the remaining series in the two lists, however, are substantially equivalent in terms of the concept represented. Indeed, by the criterion of substantial equivalence, all of the leading indicators in the 1950 list are represented in the 1975 list. In the coincident and lagging groups there is more variation between the two lists.

The principal changes in the 1975 list are as follows:

1. Most of the series in the 1975 list are in deflated form. Although there are occasions or purposes for which current dollar value series are important, in times of rapid inflation it is useful to distinguish physical from nominal changes. This was not done systematically when the 1950 list was constructed.

2. The series on new orders and contracts for plant and equipment, constructed initially by Victor Zarnowitz,[15] is an improvement over the two series in the 1950 list that overlap it in content—new orders for durable goods and contracts for commercial and industrial construction. The new series can be better matched conceptually with plant and equipment investment expenditures. The idea for such a series, however, was put forward in the report on indicators by Mitchell and Burns in 1938.

3. The series on net business formation, which takes into account both the formation of new firms and the discontinuance of existing firms, improves upon the two series in the 1950 list that are related to it—new incorporations and liabilities of business failures. The failure series, however, possesses some value in its own right because of its bearing on profits, which are not represented at all in the 1975 list (see below).

4. Personal income and retail sales, both of which were used in current value form in the 1950 list and classified as lagging indicators, are deflated and otherwise modified in the 1975 list and classified as coincident. Transfer payments such as social security and unemployment benefits are omitted from personal income in the 1975 series. Since some types of transfer payments move in a countercyclical manner and the total has been growing rapidly, personal

Table 24-8. Comparison of the 1950 and 1975 Lists of Leading, Coincident, and Lagging Indicators.

BCD No.	Original Series in 1950 List	BCD No.	Corresponding or New Series in 1975 List
	Leading Group		
1.	Average workweek, manufacturing	1.	Same
	* * *	3.	Layoff rate, manufacturing
6.	New orders, durable goods, value	8.	New orders for consumer goods and materials, in 1972 dollars
	* * *	32.	Vendor performance
13.	New incorporations, number	12.	Net business formation
9.	Commercial and industrial building contracts, floor space	20.	Contracts and orders for plant and equipment, in 1972 dollars
n.a.	Residential building contracts, floor space	29.	New building permits, private housing units, number
	* * *	36.	Net change in inventories on hand and on order, in 1972 dollars
n.a.	Wholesale price index, twenty-eight basic commodities	92.	Change in sensitive prices
n.a.	Dow-Jones index of industrial common stock prices	19.	Standard and Poor's index of 500 common stock prices
14.	Liabilities of business failures		* * *
	* * *	104.	Percent change in liquid assets
	* * *	105.	Money supply (M_1), in 1972 dollars
	Roughly Coincident Group		
41.	Employment in nonagricultural establishments	41.	Same
37.	Unemployment, number of persons		* * *
16.	Corporate profits after taxes		* * *
n.a.	Bank debits outside New York	57.	Manufacturing and trade sales, in 1972 dollars
47.	Industrial production index	47.	Same
200.	Gross national product		* * *
335.	Wholesale price index, industrial commodities		* * *
	* * *	51.	Personal income less transfer payments, in 1972 dollars
	Lagging Group		
223.	Personal income, value		* * *
54.	Retail sales, value		* * *
66.	Consumer installment debt, value	95.	Ratio, consumer installment debt to personal income
	* * *	72.	Commercial and industrial loans outstanding
67.	Bank rates on business loans	109.	Prime rate charged by banks
n.a.	Manufacturers' inventories, book value	70.	Manufacturing and trade inventories, in 1972 dollars
	* * *	91.	Average duration of unemployment
		62.	Labor cost per unit of output, manufacturing

n.a.: Not available.
Source: See note to Table 24-2.

income exclusive of transfer payments has wider cyclical movements and closer conformity to the business cycle. This treatment, of course, does not mean that the broader concept of income is not useful or indeed more relevant in analyzing income-consumption relationships. Retail sales are combined with manufacturers' and wholesalers' sales in a comprehensive series on the physical volume of trade in the 1975 list. This aggregate had not been constructed in 1950, although the series on bank debits was often used to represent the total volume of trade.

5. The 1975 list contains only monthly series, whereas the 1950 list included three quarterly series—corporate profits, gross national product, and bank rates on business loans (the bank rate series became available monthly only in 1977). The omission of quarterly series is both an advantage and a disadvantage. As a component of a monthly composite index, a quarterly series must be interpolated to be included, and as a rule the figures will not be as up to date as the monthly series. Hence the index will be subject to revision when the quarterly figures become available, and in any case the interpolation is an arbitrary procedure. On the other hand, the exclusion of quarterly series may mean the omission of a significant economic variable. Probably the most serious omission in the 1975 list is profits. GNP is partly represented by other series in the coincident group, and bank rates are reflected in the prime rate, which is the monthly series included in the 1975 list.

6. No series on inventory change was included in the 1950 list of leading indicators, whereas the 1975 list includes the change in inventories on hand and on order. In view of the importance of inventory change as a factor in business cycles, this is clearly a major improvement. Of note, also, is the inclusion of the change in the volume of goods on order, following the work of Ruth Mack and others.[16] From the buyer's point of view, outstanding orders must be considered part of the available inventory and subject to close control through the placement or cancellation of orders. Another series in the 1975 list that adds to the information on ease or tightness of market conditions is vendor performance, an indicator pertinent to the speed with which orders are being filled.

7. The 1975 list contains two series on the volume of means of payment—the money supply expressed in constant prices and the rate of change in liquid assets. Concepts of this sort have long had a place in business cycle theory, and interest in them has broadened since 1950. The deflated money supply (M_1) has fallen victim to obsolescence since 1975, however, as ways of economizing on the use of money have had substantial effects on its behavior. Hence the

inclusion of this indicator in the 1975 list has been a mixed blessing, and in 1979 it was replaced by a broader concept of money, M_2.

In addition to the improvements in the list of indicators available to analysts during the past quarter century, many new devices to aid the analyst have been developed. Seasonal adjustment is now routinely accomplished, thanks largely to the development by Julius Shiskin of a computer program for this purpose. Shiskin was also responsible for the development of the composite index as a method of summarizing the behavior of a group of indicators that are homogeneous with respect to cyclical behavior but heterogeneous with respect to unit of measurement.[17] Charlotte Boschan was largely responsible for devising computer programs that identify cyclical peaks and troughs in time series, that construct patterns of change in time series during successive periods of recession or of recovery, and that measure long-run trends and growth cycles.[18] These aids to analysis have been of enormous value in providing prompt, relevant, comparable, and readily understood measures of economic performance. Without these aids the various publications that present current information on the state of the business cycle, such as *Business Conditions Digest* in the United States, *Japanese Economic Indicators* in Japan, and *Economic Trends* in the United Kingdom, would be far less instructive than they are.

FUTURE DEVELOPMENTS IN INDICATOR ANALYSIS

Public attention to economic indicators and their analysis in the United States as well as in other countries is widespread and growing. Part of the credit for this belongs to the government publications just mentioned, as well as to the news columns, magazine articles, TV coverage, and numerous private reports on the business outlook. Part belongs to the improvements in the quality, relevance, coverage, and timeliness of statistics pertaining to the economy. Credit must also be given to the continuing research effort devoted to the analysis of economic indicators. Without such research, any system of indicators would soon become obsolete and fall into disrepute.

But the fundamental fact that both justifies and sustains the public attention to economic indicator analysis is the continuity in the cyclical behavior and interrelationships of economic variables. We can learn and have learned from the past. The business cycle experience of the United States before World War II has proved a useful guide to business cycles since then. It is this historical continuity that

underlies the basic and persistent consistency in the behavior of a set of indicators during the twenty-five years since they were selected. No one could be certain of this behavior in 1950. Only by looking back is it easy to see both the continuity and the significant changes.

Today we can no more foresee the future of economic indicator analysis than we could in 1950. We can, however, confidently predict that it will be useful to keep abreast of changes in economic behavior and to keep devising and testing new methods of analysis. Research along these lines has paid good dividends in the past and probably will do so in the future. As new ideas and new findings are generated by research, they can be applied to the current scene, spurring interest and broadening understanding.

Two relatively recent developments suggest some directions that this research might take. One is the application of indicators on a global scale. Researchers in many countries are pursuing active research programs that apply the techniques of indicator analysis to data for their own country. Application to the analysis of foreign trade flows is in its infancy, but the infant shows promise. Application to the analysis of the external markets of the developing nations, as well as to internal aspects of their economies, is also in its infancy, but the infant is alive and well. Two international agencies— the Organization for Economic Cooperation and Development in Paris and the European Economic Community in Brussels—are starting to develop expertise in indicator analysis, and this may encourage a wider research effort among their member countries and elsewhere.

The second recent development is the application of indicator analysis to the subject of inflation. Swings in the rate of inflation have not attracted the sustained attention of researchers to the same extent that business cycles have. The interest has been more episodic, associated with periods of wartime inflation, hyperinflation, crisis, and panic. Perhaps the present period of inflation is merely another episode, but even if it proves to be such, the application of indicator analysis to the process of inflation will add to public understanding of it.

Chronologies of the rate of inflation, constructed for different countries by methods similar to those used in constructing business cycle chronologies, have much to teach about where and when inflation is subsiding or accelerating. One of the lessons, for example, is that none of the major industrial countries of the West has experienced a decline in its rate of inflation without also undergoing, at about the same time, a slowdown or recession in real economic growth. Studies of the types of prices, costs, or other factors that are most sensitive to or influential in the process of inflation may

yield leading indicators of inflation analogous to the leading indicators of business cycles. One of the more obvious bits of evidence attesting to the need for a wider appreciation of such inflation indicators is simply this: the record of economic forecasts of inflation reveals a distinct lag in the forecasts relative to the actual rate of inflation.[19] In part, at least, this lag may be attributable to the fact that forecasters have concentrated too much of their attention upon variables such as capacity utilization rates that do not have a good record in leading or anticipating the rate of inflation. There seems to be no inherent reason why price forecasts should be more susceptible to lags than, say, output forecasts. Yet they have been. The construction of a system of inflation indicators similar to the system that already exists for output may help to improve the record of inflation forecasts.

Extension of the indicator approach on a global scale and its extension to the problem of inflation are but two of the directions requiring research effort. Many other problems, small and large, demand attention. A fully "deflated" set of indicators has not been developed; a satisfactory monthly price-cost ratio is needed; a comprehensive monthly series on credit extensions is not available; measures of the money supply have been suffering from obsolescence; and so on. New methods of seasonal adjustment that require less revision when additional data become available must be tested. "Index models" and "stage of process models" that combine the indicator and econometric approaches may make both more fruitful. If these and other researches prosper, there may be less resemblance between the indicator system forty years hence and the present system than there is between the present system and the one devised when Mitchell and Burns began their work forty-two years ago.

NOTES TO CHAPTER 24

1. Wesley C. Mitchell and Arthur F. Burns, *Statistical Indicators of Cyclical Revivals*, Bulletin 69 (New York: National Bureau of Economic Research, 1938). Reprinted in Moore, *Business Cycle Indicators*, 1961.

2. Ibid.

3. Geoffrey H. Moore, *Statistical Indicators of Cyclical Revivals and Recessions*, Occasional Paper 31 (New York: National Bureau of Economic Research, 1950).

4. Geoffrey H. Moore, ed., *Business Cycle Indicators* (New York: National Bureau of Economic Research, 1961); and Geoffrey H. Moore and Julius Shiskin, *Indicators of Business Expansions and Contractions*, Occasional Paper 103 (New York: National Bureau of Economic Research, 1967).

5. Victor Zarnowitz and Charlotte Boschan, "Cyclical Indicators: An Evaluation and New Leading Indicators," *Business Conditions Digest* (U.S. Department of Commerce), May 1975; and Victor Zarnowitz and Charlotte Boschan, "New Composite Indexes of Coincident and Lagging Indicators," *Business Conditions Digest*, November 1975.

6. Moore, *Business Cycle Indicators*, pp. 52–53.

7. The most nearly comparable set of indexes for the pre-1938 period is in Julius Shiskin, *Signals of Recession and Recovery*, Occasional Paper 77 (New York: National Bureau of Economic Research, 1961), pp. 50, 54. The leading and coincident indexes cover 1919–1940, the lagging index 1929–1949. However, the components do not precisely match the 1950 list of indicators. Another compilation, covering the eight leading and eight roughly coincident series in the 1950 list, 1919–1954, is in the form of diffusion indexes (percent of series rising). See Moore, *Business Cycle Indicators*, pp. 270, 272.

8. The exceptions are at the December 1969 peak, where the coincident index has a longer lead than the leading index, and the November 1973 peak, where the coincident and lagging indexes lag by the same number of months.

9. The correlation coefficient between time and the adjusted leads at peaks (column 3 minus column 9) is +0.28; at troughs (column 4 minus column 10), +0.18; and at peaks and troughs together, +0.13. Hence the trend accounts for a very small, statistically insignificant portion of the variation. Nevertheless, the coefficients have the expected positive sign.

10. The correlation coefficients between time and the adjusted leads at peaks (Table 24-2, column 3 minus Table 24-4, column 9) is +0.73; at troughs, +0.56; at peaks and troughs together, +0.64.

11. See Chapter 6 of this book.

12. Geoffrey H. Moore, "Economic Indicator Analysis during 1969–1972," in *Nations and Households in Economic Growth*, Paul David and Melvin Reder, eds. (New York: Academic Press, 1974); and Geoffrey H. Moore, "Slowdowns, Recessions and Inflation," *Explorations in Economic Research* 2, no. 2 (Spring 1975).

13. Victor Zarnowitz and Beatrice Vaccara, "How Good Are the Leading Indicators?" *1977 Proceedings of the Business and Economic Statistics Section* (American Statistical Association, 1977); and Chapter 5 of the first edition.

14. For additional references, see Chapter 23.

15. Victor Zarnowitz, *Orders, Production, and Investment: A Cyclical and Structural Analysis* (New York: National Bureau of Economic Research, 1973).

16. Ruth P. Mack, *Information, Expectations, and Inventory Fluctuation: A Study of Materials Stock on Hand and on Order* (New York: National Bureau of Economic Research, 1967).

17. Shiskin, *Signals of Recession and Recovery*.

18. Gerhard Bry and Charlotte Boschan, *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs* (New York: National Bureau of Economic Research, 1971).

19. See Chapters 11 and 26 of this book.