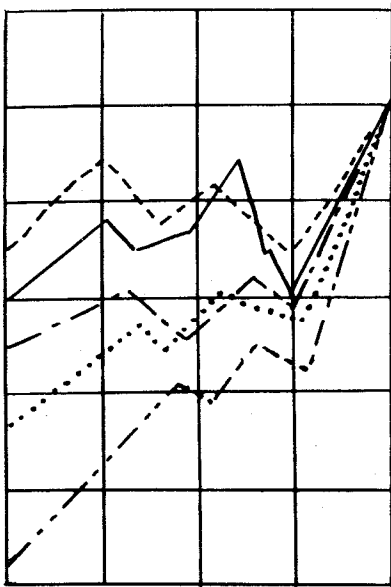




EARLY WARNING SIGNALS FOR THE ECONOMY

Geoffrey H. Moore *Bureau of Labor Statistics*

Julius Shiskin *Office of Management and Budget*

DURING THE sharp business setback of 1937-38, the National Bureau of Economic Research (NBER) was asked by the Secretary of the Treasury, Henry Morgenthau, to devise a system that would signal when the setback was nearing an end.

At that time, quantitative analysis of economic performance in the U.S. was still in a rudimentary stage. The Government's National Income and Product Accounts, today the foundation of so much economic analysis, were just being established. A number of statistical series, including unemployment rates, were being developed or refined by public agencies trying to provide information that would be useful in fighting the Depression. Among business, labor, and academic groups, there was a surge of interest in obtaining better economic intelligence as a guide to policy making.

Under the leadership of Wesley C. Mitchell and Arthur F. Burns, the private, nonprofit NBER had since the twenties assembled and analyzed a vast amount of monthly, quarterly, and annual economic data on prices, employment, production, and so on as a basis for the NBER's major research effort to gain a better understanding of business cycles. From these statistical series, it selected 21 that, on the basis of past performance (dating as far back as 1854), promised to be fairly reliable indicators of business revival. This list was made available to the U.S. Treasury late in 1937 in response to its request and published in May 1938.

This, in brief, is the origin of the statistical indicators so widely used today in analyzing the economic situation, determining what factors are favorable or unfavorable, and forecasting short-run developments.

Since then, the availability, study, and use of economic indicators has been vastly expanded under the leadership of the National Bureau and other public and private agencies.

Especially during a period of change in business activity the indicators, and analyses based on them, are front page news. A drop or rise in the number of persons unemployed, a change in the rate of the nation's total output, a movement up or down in the indexes of consumer or wholesale prices, a rise or fall in new orders for goods—all of these command nationwide attention. Among professional economists interested in the future performance of the economy, indicators have become a major tool of economic forecasting. In this essay, we shall discuss what these statistical measures are and how they are used.

THE INDICATORS IN BRIEF

The indicators have been classified into three groups: those that provide advance warning of probable changes in economic activity, the *leading* indicators; those that reflect the current performance of the economy, the *coincident* indicators; and those that confirm changes previously signaled, the *lagging* indicators.

Coincident Indicators. The most familiar type of indicator, the coincident, measures current economic performance. Gross National Product, industrial production, personal income, employment, unemployment, wholesale prices, and retail sales are examples. Comprehensive in coverage, these indicators show how well the economy is faring in certain important respects. Their movements coincide roughly with, and indeed provide a measure of, aggregate economic activity. They tell us whether the economy is currently experiencing a recession or a slowdown, a boom or an inflation.

A number of government agencies cooperate in the gathering and compilation of these statistics. To produce the Wholesale Price Index, for example,

the Bureau of Labor Statistics gathers by mail questionnaire each month about 7000 price quotations on more than 2000 commodities covering the output of manufacturing, agriculture, forestry, fishing, mining, gas and electricity, and public utility industries.

The Census Bureau conducts a monthly survey of 50,000 households to obtain information on employment and unemployment. This survey provides such indicators as the unemployment rate and the total number of persons employed. Indicators of the number of employees on nonagricultural payrolls and total number of man-hours worked are obtained from reports by 160,000 business establishments to the Bureau of Labor Statistics.

The Office of Business Economics of the Department of Commerce is the keeper of a number of statistical series of current economic performance. The most significant is the Gross National Product, which is the total of all goods and services produced by the economy, reported quarterly both in current dollars and adjusted for changes in the price level.

The Federal Reserve Board compiles the Index of Industrial Production, another important coincident indicator.

Leading Indicators. In view of the great impact that economic developments have upon our daily lives and upon long-term economic progress, there is intense interest in indicators that signal in advance a change in the basic pattern of economic performance. Examples are new orders for durable goods, construction contracts, formation of new business enterprises, hiring rates, and the average length of the workweek. These indicators move ahead of turns in the business cycle, primarily because decisions to expand or curtail output take time to work out their effects, while the factors that govern these decisions also take time to produce their influences. The early warning signals provided by leading indicators help to forecast short-term trends in the coincident series and help policy makers to take timely steps to avert, or at least to moderate, unfavorable economic trends.

Many of the leading indicators are produced by the same agencies or surveys that yield the coincident indicators. Thus, the average workweek of production workers, the hiring rate, and layoff rate are figures from the Bureau of Labor Statistics employment survey. The value of manufacturers' new orders for durable goods is compiled by the Census Bureau from the same survey that produces monthly statistics on inventories and shipments.

A number of leading indicators are compiled by private firms. For example, the index of the total value of construction contracts is prepared by the McGraw-Hill Information Systems Co. The number of new business incorporations is provided by Dun and Bradstreet, Inc., and the index of stock prices by Standard and Poor's Corp.

Leading indicators are used more and more widely by business, government, and academic economists in analyzing and forecasting business conditions. In

a recent survey by the American Statistical Association, 261 forecasters were asked what principal methods they used, and 103 checked "lead indicators." One of the information sources on which business analysts depend is *Business Conditions Digest* (BCD), a monthly publication of the U.S. Department of Commerce that charts leading and other indicators.

The use of leading indicators has spread to individual states and to foreign countries. New Jersey is one of several states issuing monthly reports on the current position of leading indicators for the state. The Canadian and Japanese governments each have developed reports similar to BCD, and studies of leading indicators have been made for Great Britain, Germany, France, Italy, and Australia. As a result of this widening interest, we are more and more likely to read in newspapers, magazines, and business advisory publications about developments in the leading indicators.

Lagging Indicators and Others. Still another type of indicator is described as lagging. The fluctuations of these indicators usually follow, rather than lead, those of the coincident indicators. Examples are labor cost per unit of output, long-term unemployment, and the yield on mortgage loans.

Finally, there are important economic activities that have not behaved in a sufficiently consistent manner to be appropriately classified as leading, coincident, or lagging, but are nevertheless relevant to an overall appraisal of the current situation of the economy and prospective trends. Examples are government expenditures and the balance of payments.

CHARACTERISTICS OF INDICATORS

The selection of indicators has been guided by two considerations. First, does the measured process play a significant role in a widely accepted explanation of short-term economic fluctuations? While the recurrence of successive waves of rapid growth and slower growth or decline in business activity is generally acknowledged, many different explanations of the underlying causes have been advanced. Some economists lay primary stress on the relations between investments in inventory and fixed capital, on the one hand, and final demand, on the other (John Maynard Keynes, Paul Samuelson). Others assign a central role to the supply of money and credit (Milton Friedman). Still others look for clues in the relationships among prices, costs, and profits (W. C. Mitchell, A. F. Burns). All these factors undoubtedly influence the course of business activity, and some may be more important at one time than another, but there is no general agreement on which is the most important. Hence it is prudent to consider a variety of indicators that reflect all the processes.

The second consideration in selecting indicators has been their empirical record. How closely correlated are the fluctuations in a given series with those in aggregate economic activity? How consistent has been the timing

record of a given series compared to aggregate economic activity; that is, does it consistently lead, coincide with, or lag aggregate economic activity? Specified criteria have been applied to the hundreds of economic series from which a list of indicators could be selected. These pertain to the economic significance of the series, its historical record, and various properties affecting its reliability as a current statistic.

In recent years, most of the research and testing in this field has been carried on by the National Bureau of Economic Research. Since publishing its first list in 1938, the Bureau has revised the list in 1950, 1960, and 1966. The most recent list appears in a book by the authors of this essay, published by the NBER in March 1967, under the title *Indicators of Business Expansions and Contractions*. Many of these indicators have been used for years in appraising economic conditions, but 13 were incorporated for the first time in the latest list. Among these new indicators are job openings at U.S. Employment Service offices, delinquency rates on installment loans, export orders for durable goods, and man-hours of nonagricultural employment. Up-to-date figures on these indicators and other related series are published each month in *Business Conditions Digest*.

An understanding of the role of the selected indicators in initiating or reacting to short-term economic fluctuations is aided by the two principles of classification used in presenting the current list of 88 indicators. First is a grouping by *cyclical timing*, as explained above, with 36 leading, 25 coincident, and 11 lagging indicators (16 are not classifiable by timing). The second type of classification is by *economic process*, in which series that pertain to different stages or aspects of the same process are grouped together.

All series are cross-classified according to these two principles. Thus, the cross-reference system shows, under the employment and unemployment category, five leading series representing marginal employment adjustments such as the hiring rate and the workweek (which varies with the amount of overtime worked), eight coincident indicators representing existing job vacancies and comprehensive measures of employment and unemployment, and one lagging indicator representing long-term unemployment. The capital investment category includes ten leading indicators representing the formation of business enterprises and new investment commitments, two coincident indicators representing the backlog of capital investment, and two lagging indicators representing current investment expenditures. Other economic process categories include production, income, consumption and trade; inventories and inventory investment; prices, costs and profits; money and credit; foreign trade and payments; and federal government activity. Together they provide a rather comprehensive view of the economic system.

Another innovation of the National Bureau publication is a method of assigning numerical scores, or *weights*, to each indicator, ranging from 0 to 100. The scoring plan covers six major elements: economic significance, sta-

tistical adequacy, historical conformity to business cycles, cyclical timing record, smoothness, and promptness of publication. The ratings throw into clearer perspective the characteristic behavior and limitations of each indicator, aid in their classification and incidentally suggest ways to improve them for purposes of short-term forecasting (see Table 1). For example, the low score of series 31 (change in inventories) for smoothness (column 6) is a warning that sharp erratic movements from month to month are to be expected and that it may take several months to discern a new trend.

The short, substantially unduplicated list of 26 principal indicators shown in Table 1 provides a convenient way of summarizing the current situation and outlook. This list includes 12 leading, 8 roughly coincident, and 6 lagging indicators. The series selected for each of these groups have high scores and cover a broad range of economic processes.

SUMMARY INDEXES

In studying the current economic situation, we can proceed by examining numerous and varied aspects of the economy so as to be sure that all the relevant points are covered or by examining just a few selected indicators that make it easy to grasp the overall trends. Most business analysts move back and forth from a detailed examination of many sectors to a broad view of the overall situation, and there is a feedback of information and insight from one view to the other. The indicator scheme just described makes it appropriate to ask whether a broader type of summary, combining indicators with similar short-term timing behavior, but pertaining to different aspects of activity, can be constructed.

The National Bureau studies make it possible to do this; that is, series that usually lead in the business cycle can be combined into one index, coincident series into another, and lagging series into a third. Similarly, within the leading group alone, series that represent orders or commitments for capital investment projects can be combined into one index, those representing inventory investment or materials purchasing into a second, and those representing sensitive flows of money or credit into a third. A suitable set of weights to be used in combining the series is provided by the scores referred to earlier.

In the sense that they are not expressed in a common unit such as dollars or tons, the series selected for inclusion in each of the indexes are heterogeneous. In the special sense that they measure related aspects of business change, are sensitive to business cycles, and experience similar timing behavior during cyclical fluctuations, they are homogeneous, however. In this respect, some of the best known aggregates are heterogeneous. For example, Gross National Product includes the change in inventories, a leading indicator; consumption expenditures, a coincident indicator; and investment expenditures, a lagging indicator.

TABLE 1. Scores for 26 Economic Indicators on 1966 NBER Short List

CLASSIFICATION AND SERIES TITLE	SCORES, SIX CRITERIA *					
	Average Score*	Economic Significance	Statistical Adequacy	Conformity	Timing	Smoothness
Leading indicators (12 series)						
1. Avg. workweek, prod. workers, mfg.	66	50	65	81	66	60
4. Nonagrl. placements	68	75	63	63	58	80
12. Index of net business formation	68	75	58	81	67	80
6. New orders, dur. goods indus.	78	75	72	88	84	60
10. Contracts and orders, plant and equip.	64	75	63	92	50	40
29. New building permits, private housing units	67	50	60	76	80	80
31. Change in book value, mfg. and trade inventories	65	75	67	77	78	40
23. Industrial materials prices	67	50	72	79	44	80
19. Stock prices, 500 common stocks	81	75	74	74	87	100
16. Corporate profits after taxes, Q	68	75	70	79	76	100
17. Ratio, price to unit labor cost, mfg.	69	50	67	84	72	25
113. Change in consumer instal. debt	63	50	79	77	60	60
Roughly Coincident Indicators (8 series)						
41. Employees in nonagrl. establishments	81	75	61	90	87	100
43. Unemployment rate, total (inverted)	75	75	63	96	60	80
200. GNP in current dollars, Q	80	75	75	92	82	100
205. GNP in constant dollars, Q	73	75	75	91	58	50
47. Industrial production	72	75	63	94	38	80
52. Personal income	74	75	73	89	43	100
56. Mfg. and trade sales	71	75	68	70	80	40
54. Sales of retail stores	69	75	77	89	12	100
Lagging indicators (6 series)						
44. Unempl. rate, persons unempl. 15+ weeks (inverted)	69	50	63	98	52	80
61. Bus. expend., new plant and equip., Q	86	75	77	96	94	100
71. Book value, mfg. and trade inventories	71	75	67	75	66	40
62. Labor cost per unit of output, mfg.	68	50	70	83	56	80
72. Comm. and indus. loans outstanding	57	50	47	67	20	100
67. Bank rates on short-term bus. loans, Q	57	50	55	82	47	25

Source: "Indicators of Business Expansions and Contractions," 1967, New York: National Bureau of Economic Research, Inc.

* The scores run a scale from 0 to 100. For example, a series with a random relation to business cycles would be expected to score 0 for conformity and timing (columns 4 and 5). The average score is an average of the six criteria scores with smoothness and currency weighted one-half each.

The procedure used in constructing the indexes allows for the fact that some indicators, such as new orders, typically move in wide swings while others, such as the average workweek, experience narrow (but, nevertheless, significant) fluctuations. Each indicator is adjusted in such a way that, apart from its weight, it has the same opportunity to influence the index as any other indicator. The indexes themselves are adjusted in a similar manner, with the result that their swings are of the same order of magnitude on the average (namely, 1.0% per month) and can be compared readily. For example, if the most recent monthly increase in an index is 2.0, it is rising twice as fast as its average rate of change in the past; if the increase is 0.5, it is rising only half as fast as the historical average.

The index for the leading group is also subject to a further adjustment, designed to make its long-run trend the same as that of the index of coincident series. The major difference that remains is in cyclical timing, with the leading index typically moving first, the coincident index next, and the lagging index last, as can be seen in Figure 1, a type of chart currently published in *Business Conditions Digest*.

It is noteworthy that when the scoring system used to provide weights for the individual indicators is applied to the indexes themselves, the scores earned by the indexes are higher than those for any of the component indicators. In this sense, the indexes are a superior form of indicator. But to understand and interpret their movements, close study of the components is essential.

HOW THE INDICATORS HAVE PERFORMED

One of the uses to which the leading index can be put is to make explicit forecasts for short periods ahead of GNP, total employment, or other variables. Some tests of a simple method for doing this have been made, with promising results. For instance, when data for the third quarter become available, say in October, the percentage change in GNP (in current dollars) between the current calendar year and the next can be forecast by observing the percentage change in the leading index between the third quarter and the *preceding* fiscal year.

Annual forecasts obtained in this manner compare favorably in accuracy with what most forecasters have been able to achieve. During 1962-68, the average error in the GNP forecasts contained in the *Economic Report of the President* was 1.3 percentage points, while during this period the leading index method would have produced an average error of about 1.0 percentage points. In 1968, this superiority was not maintained because the forecast of increase in GNP obtained from the leading index was about 6%, the *Economic Report* (February 1968) put it at nearly 8%, but the actual change turned out to be 9%. For 1969, the leading index (using data through September

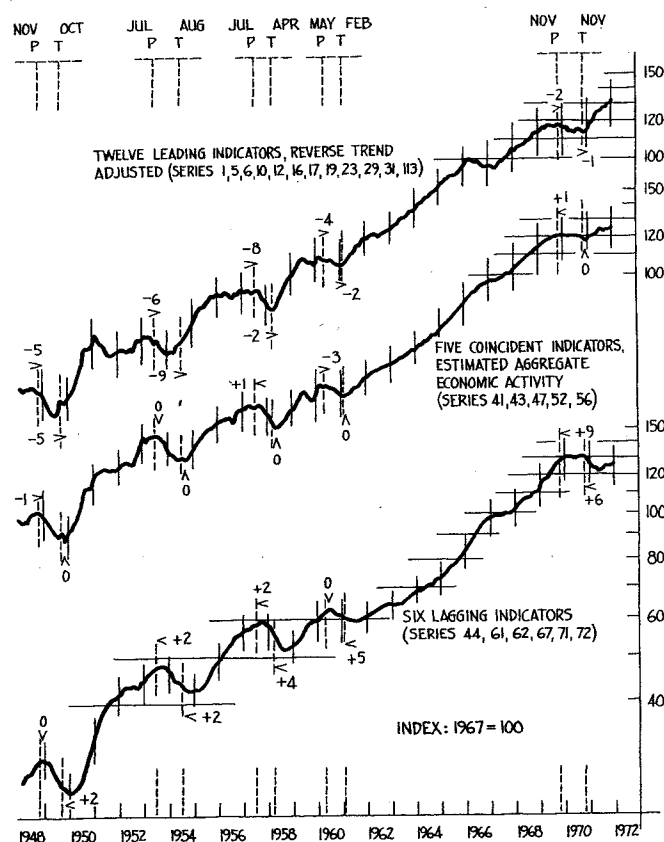


FIGURE 1

Composite indexes. Dates at top of chart are reference peak and trough dates when expansion ended and recession began (P) and when recession ended and expansion began (T). Numbers on chart are length of lead (—) or lag (+), in months, from index peak or trough to reference peak or trough. Source: U.S. Bureau of the Census

1968) forecast an increase in GNP in the neighborhood of 7%, significantly lower than the actual increase in 1968. The *Economic Report* (January 1969) also forecast 7%. The actual increase was about 7.5%. The leading index forecasts can be revised monthly as additional data become available.

The method clearly is no substitute for a carefully reasoned approach

to the economic outlook. It merely helps to summarize the information contained in the leading indicators regarding the near-term future course of GNP or other variables that are systematically related to the business cycle. Hence it provides the forecaster with information useful in developing his actual forecast. It can be used also as a standard against which to judge past efforts and might be of assistance in improving upon them, but it is not a recipe that will tell the forecaster everything he should know.

SUMMING UP

A few concluding observations may be helpful to those who would use these indicators as an aid in interpreting current trends.

(1) The change in pace of the leading indicators foreshadows increasing strength or weakness in aggregate economic activity. Sometimes weakness in the leading indicators is followed by a recession, that is, an extended, substantial, and broadly diffused decline in aggregate economic activity, as in 1957–58. At other times, however, a decline in the leaders is followed only by a slowdown in the rate of expansion of aggregate economic activity, as in 1962 and 1967 (see Figure 1). Indeed, if the response of government policy to a decline in the leading indicators is prompt and vigorous enough, there may be no unfavorable developments in aggregate activity at all.

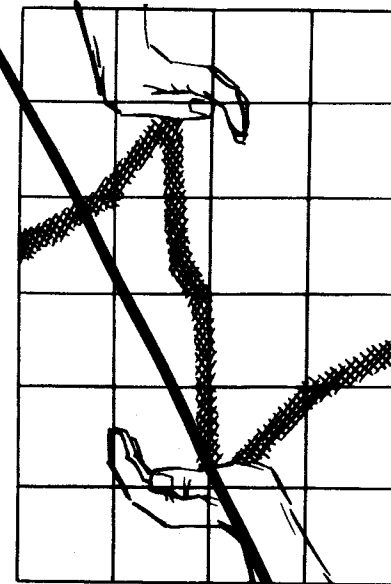
(2) Whether in any particular instance a decline in the leading indicators signals a retardation or a recession will eventually be determined by the movements of the coincident indicators, that is, by such measures of aggregate economic activity as total production, employment, income, consumption, trade and the flow of funds. In view of the fact that economic upswings and downswings have several relevant dimensions (length of swing, how deep it swings, and how pervasive the effect), and that the data themselves are fallible and subject to revision, several months may elapse before a current decline can be reliably appraised.

(3) The lagging indicators should not be neglected. They may provide evidence confirming a change in trend that has appeared earlier in the leading or coincident indicators. Their value in this role is all the greater because the factors that make them lag also make them relatively impervious to erratic movements. In addition, some of the lagging indicators have an important bearing on the subsequent behavior of the leading indicators. For example, when unit labor costs, a lagging indicator, rise rapidly, they may exert a downward pressure on profit margins, one of the leading indicators. In this connection, it is often the relation between the movements in lagging and coincident indicators (in this case costs and prices) rather than those of lagging indicators alone that is crucial.

(4) The ultimate objective of the work with indicators is the *prevention* of unfavorable developments, especially recession and inflation. The intent is not to compile good forecasting records; it is rather to develop warning signals which come sufficiently early to assure that effective preventive measures can be taken in time. Hence a successful record of forecasting recession and inflation would attest the failure of economic policy, while successful economic policy might well relegate many accurate forecasts to the limbo of apparent failure.

What can be said of the usefulness of business cycle indicators on balance? It seems clear from the record that the business indicators are helpful in judging the tone of current business and short-term prospects. But because of their limitations, the indicators must be used together with other data and with full awareness of the background of business and consumer confidence and expectations, governmental policies, and international events. We also must anticipate that the indicators will often be difficult to interpret, that interpretations will sometimes vary among analysts, and that the signals they give will not always be correctly interpreted.

Indicators provide a sensitive and revealing picture of the ebb and flow of economic tides that a skillful analyst of the economic, political, and international scene can use to improve his chances of making a valid forecast of short-run economic trends. If the analyst is aware of their limitations and alert to the world around him, he will find the indicators useful guideposts for taking stock of the economy and its needs.



STATISTICS FOR PUBLIC FINANCIAL POLICY

Leonall C. Andersen *Federal Reserve Bank, St. Louis*

ARTHUR BURNS,¹ Chairman of the Federal Reserve Board, sat back in his paneled office on Constitution Avenue, puffed his pipe pensively, and reflected on the forthcoming meeting of the Fed's Open Market Committee. What should they decide about purchase or sale of government securities in the open market, and about the many other instruments of policy available to the Committee?

Whatever the decisions might be, their consequences would affect wages paid to the steel worker in Gary, Ind., and the movie extra in Los Angeles; they would also affect the profits and the expansion plans of the largest steel company and the smallest corner grocer; and they would affect the prices paid for apples, automobiles, and xylophones by everyone.

¹The names, for concreteness, are those of February 1971, when this was written. They may change, but the issues will continue.