Signals and Confirmations of Economic Change

By Victor Zarnowitz
Victor Zarnowitz is Professor of Economics and Finance in the Graduate School of Business of The University of Chicago. His main research interests are in the areas of macroeconomic theory, business fluctuations, and time-series analysis and forecasting.

He received his Ph.D., summa cum laude, from the University of Heidelberg in 1951. A native of Poland, he acquired American citizenship in 1957. He has been a member of the research staff of the National Bureau of Economic Research since 1952 and of its senior research staff since 1963. He held a Social Science Research Council postdoctoral fellowship at Harvard University in 1953-54, lectured at Columbia University between 1956 and 1959, and was awarded a Ford Foundation faculty research fellowship in 1963-64, to pursue studies of the variability of investment demand. He joined the faculty of the Graduate School of Business in 1959.

He is a member of the American Economic Association, the American Statistical Association, and the Econometric Society. Since 1968 he has edited and analyzed the ASA-NBER Quarterly Survey of the Economic Outlook; since 1971 he has been coeditor and regular contributor to the quarterly reports Economic Prospects and Economic Outlook USA; and in 1972-75 he was director of research on evaluation of the indicator series for the Business Conditions Digest (monthly report of the Bureau of Economic Analysis, U.S. Department of Commerce).

ECONOMIC GROWTH is less generally acclaimed today than it was in the recent past, but concern about its adverse social aspects (pollution, disamenities of urbanization, etc.) tends to fade when growth is inadequate or negative and the bread-and-butter worries about unemployment and real income losses multiply. Ours is, of course, a growing economy, and growth is widely viewed as its “natural” state; rising trends prevail and are expected to persist over time. However, no business expansion has continued indefinitely. Downturns cause alarm when publicly recognized, but recognition usually comes late; timely forecasts of major slowdowns and declines are rare, and often they are isolated and disbelieved.

Yet each business contraction covered by the statistical record has been anticipated by downturns in specific time series from the group classified as leading cyclical indicators. These early signals of a rising threat to further expansion are partly self-validating in nature through their effects on economic expectations and behavior. (Consider, e.g., the influence on business production and investment decisions of declines in new orders, contracts, profit margins, and stock prices.) The analysis and forecasting of current and near-future business conditions can be measurably improved in such critical periods by proper monitoring, processing, combining, and reading of this and related information. This last statement applies also to signals of recovery, although there are some important differences between the situations prevailing at business upturns and at business downturns.
Business Fluctuations

Economic history tells us that growth of the modern industrialized market economies proceeded through a long series of “business cycles,” that is, recurrent sequences of expansions and contractions. These movements spread widely, if unevenly, over the diverse processes and sectors of the economy. Although varying considerably in intensity as well as duration, they are sufficiently long to cumulate and large enough in size and scope to show up as major fluctuations in total employment, output, income, and sales. No two business cycles are entirely alike, of course; indeed, each has some unique features. Yet they also have many common and apparently systematic characteristics and are clearly distinct from the much less synchronized and smaller movements of shorter duration (which are partly episodic-irregular, partly periodic-seasonal).

Statistical evidence of business cycles goes back at least to the early nineteenth century, but despite intensive studies their causes are still not well understood. It is clear, however, that well-developed economies with large private-enterprise sectors-complex interdependent systems-react to a variety of disturbances in such ways as to give rise to persistent and pronounced fluctuations in general business activity.

Theories of business cycles must therefore deal with the effects and interaction of two sets of factors: (1) the external “shocks” (e.g., variation in weather, inventions, wars, policy changes), which are numerous and in part randomly distributed over time, in part serially dependent and (2) the internal mechanism of the economy (demand and supply relations in the interconnected markets, etc.). Some theories stress (1), others (2) but many economists, including myself, find unconvincing any explanation that excludes either set. First, it is unlikely that cyclical fluctuations would go on
forever undiminished if no outside disturbances were to occur or that they would not be seriously affected by many of the shocks that the economy does in fact frequently experience. Second, and perhaps even more important, the external events by themselves explain little; what is crucial for the understanding of business cycles are those characteristics of the economy which shape the system’s responses, converting the shocks into the observed alternating phases of improving and good, worsening and poor business conditions.¹

Even if business cycles were at all times caused by some single factor—say, changes in investment due to “autonomous” shifts in profit expectations or changes in the growth of money supply due to shifts in discretionary policies—their outward manifestations could still differ considerably, posing the problem of which indicators to use for the purposes of current business analysis and forecasting, and how. But the weight of theory and evidence is that there is no single proven and accepted cause of cyclical fluctuations, let alone a single invariable chain of symptoms; instead, there are several plausible and not mutually exclusive hypotheses, and a number of frequently observed and relatively stable regularities. This being so, the range of potentially useful cyclical indicators is rather wide, and the twin tasks of their analysis and diagnostic-prognostic application are substantial.

Cyclical Indicators

While many economic variables participate in business cycles (as evidenced by the common cyclical movements in the time series representing these diverse factors and processes), important and persistent differences in timing and amplitude exist among them. Some series tend to lead, others to lag; some tend to have large and others small relative fluctuations.

Many of the sequential relationships which
link the individual indicators can be well demonstrated and explained. Thus, series that represent early stages of production and investment processes (new orders for durable goods, orders and contracts for plant and equipment) move in large swings which lead the smaller cyclical movements in series that represent late stages (output and shipments of durables, business capital outlays). Such leads are necessarily involved where goods are made to order rather than sold from stock, and production-smoothing through changes in unfilled orders and delivery periods are a regular feature here.

Other timing relations reflect sequences of business decisions under conditions of uncertainty. For example, cyclical changes in the average workweek in manufacturing precede those in employment, because it is less binding for employers to lengthen or shorten the hours worked than to hire or lay off workers.

Still other sequences reflect stock-flow relationships. As examples, investment in inventories leads total inventories, net accession rate leads employment, change in bank loans to business leads the total of such credit outstanding. This is so because the “stock” series (inventories, employment, loans) often undergo retardation before reversal of their cyclical movements.

Business cycles are defined as fluctuations in overall economic activity. Economists identify their turning points according to the dates of peaks and troughs in comprehensive series of national income, industrial production, employment, and their major sensitive components. The individual series in this group tends to be roughly coincident with the timing of general business expansions and contractions (the group as a whole would, of course, have a nearly perfect coincidence record). Since series such as new orders, building contracts, and the average workweek tend to lead industrial production, construction work, and em-
ployment, respectively, one can also expect them to lead at the dates of business cycle turns. By analogous reasoning, other series should lag at the same dates, and do. Thus, inventories lag because a decline (rise) in sales and output, when recognized as more than transient, creates pressures to reduce (increase) the stocks of materials and finished products. Short-term bank loans to business firms are used in large part for inventory financing, and they therefore tend to lag, too, as do the interest rates charged on them.

The leading indicators help to predict the more sluggish variables but are themselves difficult to predict. One reason for this is that they are, in general, highly sensitive to disturbances of all kinds and hence particularly volatile; another, that many of them reflect individual, more or less independent expectations and decisions, which in the world of uncertainty can be quite variable. However, major changes in some leading series are partly attributable to the prior behavior of the coinciders and laggers. Such lagging indicators as the interest rates on business loans, the volume of such loans, inventories carried in manufacturing and trade, and unit labor costs measure or reflect the costs of doing business; increases in the relative burden of such costs influence business activity adversely while decreases influence it positively. For example, a decline in inventories and interest rates during a business contraction paves the way for an upturn in new orders and then in the output of materials, etc., by making business operations less expensive and so potentially more profitable and also by depleting stocks relative to the current production and sales requirements. More generally, many lagging indicators, when inverted, lend other important series (not only coinciders but often also the leaders). Ratios of coincident to lagging indicators, e.g., sales-inventory
ratios, display early cyclical timing for very similar reasons.

The selection of cyclical indicators, supported by general economic considerations and logic as illustrated above, also has involved much empirical research in the form of statistical screening and testing applied to large collections of monthly and quarterly time series. Major changes in the economy and new and revised statistical data and analytical techniques require, from time to time, reappraisals of the indicators as well as other systems of economic intelligence. Research on indicators was initiated almost forty years ago by the National Bureau of Economic Research (NBER), an independent, nonprofit institution well known for major studies of business cycles, and it resulted in several evaluations and monographs.”

In the last three years, another comprehensive review of the indicators was carried out by the Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce with the cooperation of members of the NBER research staff. This paper draws in part on the recently published results of the BEA study.3

The Principal Leading Series

A new composite index of leading indicators was published in May 1975 by BEA, based on twelve monthly series selected for their superior performance as indicators which have consistently anticipated the turning points of the major economic fluctuations in the United States during the period 1947-70. To evaluate the leading, coincident, lagging, and other significant indicators so as to choose the most helpful ones, the team headed by this writer analyzed over 300 time series and scored most of them (all that looked sufficiently promising) according to six major characteristics: economic significance, statistical adequacy, consistency of timing at business cycle peaks and troughs, conformity to business expansions and con-
tractions, smoothness, and prompt availability (currency). A formal, detailed weighting scheme was developed and used to assess each series by all of the above criteria and their many relevant components.

This work resulted in new lists of indicators, classified by economic process (e.g., employment, production, consumption, fixed investment, money and credit) and timing (leading, roughly coincident, lagging, or undefined-at peaks, troughs, and both types of turn). This information, supported by a comprehensive system of measures of cyclical behavior, should be helpful to business analysts and forecasters; to us, it provided a guide for the selection of the series to be included in composite leading, coincident, and lagging indexes.

Such indexes outperform the individual indicators because they incorporate the best-scoring series from many different economic-process groups and combine those with similar timing behavior, using as weights their overall performance scores. Since the “mix” of factors which influence the course of the economy varies from one business-cycle episode to another, how individual indicators perform on a particular occasion is likely to depend on which factors are in operation, which are dominant, and how (through which process) they work. Accordingly, some of the (say) leading indicators would prove most useful in one set of conditions, others in a different set. To increase the chances of getting true signals and reduce those of getting false ones, it demonstrably helps to employ an index of all leading series of historically tested usefulness, subject to some additional requirements, such as diversified economic coverage and a minimum of duplication. Furthermore, much of the independent measurement error and other “noise” in the included series are smoothed out in the index as a whole.

Four components of the old index of lead-
ing indicators have survived the stringent tests applied in the present review and are retained in the new index: average workweek in manufacturing, net business formation, index of 500 common-stock prices, and new private residential building permits. There are eight new indicators: layoff rate in manufacturing (inverted), new orders for consumer goods and materials in 1967 dollars, contracts and orders for plant and equipment in 1967 dollars, net change in inventories on hand and on order in 1967 dollars, percent change in the wholesale price index of crude materials excluding foods and feeds, vendor performance-percent of companies reporting slower deliveries, money supply (currency and demand deposits held by the nonbank public-M1) in 1967 dollars (deflated by the Consumer Price Index), and percent change in liquid assets held by the private domestic nonfinancial sector.

A major difference between the old and the new index is that the former contained no deflated (constant-dollar) aggregates, while the new one includes four. In the 1970s, for the first time in recorded U.S. history, a number of important, comprehensive series in current dollars failed to show major declines during recessions that were as usual marked by contractions in the corresponding constant-dollar series. This, of course, reflects the strength and persistence of inflation. Hence the need to reduce strongly the dependence of the cyclical indexes on current-dollar aggregates—a need which was recognized and met in the new study.4

Other substantive changes were made which cannot be discussed here for lack of space, but let me point out a few of the innovations. Real money stock is an important variable in macroeconomic theory, and its empirical approximation, here selected, has a good record as a leading indicator. Sensitive prices are used in the form of percentage changes rather than
levels. Inventory investment is represented by the conceptually better, broader, and cyclically more sensitive series which includes the net change in stocks “on order”—goods ordered for further processing or resale but not yet received. This component is estimated by the change in manufacturers’ unfilled orders excluding orders for capital goods and defense products.

The components of the new leading index are all monthly (the quarterly and tardy profit series is no longer included), and they are generally available promptly in reasonably accurate form. The timing, smoothness, and currency scores are on the average considerably higher for these series than for the components of the old index, and the overall scores are somewhat higher. These ratings are based on measures for the sample period 1947-70, but it is after 1970 and particularly in 1973-74 that the new index shows the clearest advantage over the old series, as described below.

The Principal Coincident and Lagging Series

The new composite index of roughly coincident indicators is composed of the series on the number of employees on nonagricultural payrolls (demonstrably the best of the comprehensive employment indicators); the index of industrial production; personal income, less transfer payments, in 1967 dollars; and manufacturing and trade sales in 1967 dollars. These indicators summarize the state of total economic activity in real terms. They either confirm or invalidate expectations based on the behavior of the leading series; their behavior should firm up policy decisions that the leading indicators may suggest.

Nominal aggregates such as GNP and personal income are, of course, important and should be continually observed, but it would not be helpful to include them in the coincident index. They markedly failed to decline in
the recent recessions, and the recurrence of such recession-cum-inflation cannot, unfortunately, be ruled out.

The overall unemployment rate, a component of the old coincident index, is not included in the new index. This series is certainly one of the principal and most widely used measures of the economy’s performance, and rightly so, despite the fact that unemployment is inevitably difficult to define and estimate. However, the unemployment rate tends clearly to lead at peaks and lag at troughs of business cycles rather than to coincide at both types of turn. This is so because employment typically rises slowly in both the initial and the late stages of a business expansion, whereas the labor force grows at a fairly steady pace.  

The new composite index of lagging indicators retains, unchanged, two components of the old one: labor cost per unit of output in manufacturing, and business loans outstanding (reported weekly by large commercial banks). Manufacturing and trade inventories are retained but are now expressed in constant (1967) dollars rather than current dollars. Average duration of unemployment replaces a narrower measure of long-duration unemployment rate, and monthly data for the average prime rate replace the quarterly data for bank rates on short-term business loans. The ratio of consumer installment debt to personal income is added, and business expenditures for new plant and equipment, a quarterly series that tends to lag at troughs but to coincide at peaks, is dropped.

Our decisions regarding the make-up of the new indexes are supported not only by the scores and timing characteristics of the individual series, but also by the scores and timing of the indexes into which the series are combined; not only by the historical record used in evaluating the indicators but also by the evidence of subsequent events, which is of particular significance and interest.
Summing Up the Record

Chart 1 (pp. 12 and 13) shows the leading (L), coincident (C), and lagging (Lg) indexes monthly since January 1948, against the background of business cycle expansions and contractions (represented by shaded areas). The dates at the top of the chart give the NBER reference chronology of peaks and troughs (the beginning and end months of the demarcated contraction periods) for 1948-70. The last two dates, especially the trough in 1975, are tentative, i.e., subject to revisions in recent data, but they are well supported by the evidence currently available. The cyclical turns in the indexes are marked, and the numbers next to them show by how many months these specific peaks and troughs have led or lagged the corresponding reference (business-cycle) peaks and troughs.

The years 1948-75 include six general business downturns ("recessions") and six upturns ("recoveries"), and each of the three indexes has turning points to match each of these events. For the leading index, all twelve recorded observations are leads (-); for the lagging index, all twelve are lags (+). The coincident index shows nine exact coincidences (0) and three leads which represent technical but not very significant deviations from coincident timing.

Direct comparisons of the timing of L, C, and Lg confirm the regularity with which they follow each other in each successive business cycle. It is clear that, in these broad terms, the system of indicators worked quite well. No single turning point occurred out of sequence; i.e., the laggers never turned before the coinciders, nor the coinciders before the leaders, nor the leaders before the laggers of the previous episode. Thus, starting with the first observed peaks and troughs and continuing the chain arbitrarily at the beginning of the second cycle, we can express the sequence
CHART 1. NEW COMPOSITE INDEXES OF LEADING, COINCIDENT, AND LAGGING INDICATORS, January 1948—December 1975

NOTE: Circles entered on the chart indicate specific turning points; numbers indicate length of leads (−) and lags (+) in months from reference turning dates.

*This is not necessarily the peak but is the high for the available data.

aTentative

Source: Business Conditions Digest
symbolically as \( L_p, L_c, L_g, L_t, C_T, L_{CT}, L_{T1} \rightarrow L_{r1} \rightarrow L_{r2} \).

The lagging index functions well as a con-

firmer of the coinciders at both peaks and troughs, but it is apparent that its value as a forecaster of the opposite turn of the leaders is essentially confined to the \( L_g, L_t \) link, since the intervals \( L_g, L_t \) are mostly very long and variable (reflecting the variability in length of business expansions; see Chart 1).

The indicators selected on the strength of their record during the moderate cycles of 1947-70 performed equally well during the more turbulent years 1971-75. The new leading index, having made large gains in 1971-72, first flattened and then, after June 1973, turned down decisively, anticipating by 5 months the onset of the recession as identified by the de-
cline in the coincident index (as well as in real GNP). its contraction was almost con-
tinuous through February 1975 and particu-
larly sharp in the second half of 1974.

The coincident index rose rather steadily for three years after its upturn in November 1970, whereupon it declined, first mildly through October 1974 and later very sharply through March 1975.

The lagging index stayed low in 1971, then increased vigorously and reached peak levels only in 1974; it fell steeply in the first half of 1975, mildly thereafter, and may have touched the bottom most recently.

The 1975 expansion got to a good start with a sizable six-month rise of the leaders in March-August, which correctly predicted the substantial gains of the coinciders in the second and especially in the third quarter of the year. In September-December, the leading index re-
mained essentially unchanged, and there are some signs that the recovery has indeed slowed down.

Clearly, an essentially correct forecast that a recession was developing could have been
made at least early in 1974 on the basis of the combined evidence from the selected leading indicators: by January 1974 our index had declined continuously for seven months and had lost 7.2 percent, a change comparable to those which had occurred in connection with each of the five business contractions of the 1948-70 period. Yet only a minority of economists anticipated a recession early in 1974, though many recognized that a general business slowdown was under way. The failure of the prevailing forecast was caused by undue attention to the continued rise in the nominal aggregates—which reflected the momentum of inflation—and by the preoccupation with the unique aspects of the situation (notably the disturbing effects of the energy crisis) and relative neglect of the more general and recurrent aspects. Meanwhile, the sensitive security markets, which absorb with presumed efficiency the information contained in the indicators, registered early and unmistakably their concern about the deteriorating business conditions. The stock price series included in the leading index declined mildly through most of 1973 and sharply in 1974.

Cautions and Conclusions

Data for cyclical indicators provide useful information for current business analysis and forecasting—this positive but general assessment is surely supported by the surveyed record. But it is important to recognize more specifically both what can and what cannot be reasonably expected of this approach.

First, inasmuch as the indicators are generally available—and they are, in fact, much publicized and closely watched—no mechanical use of these data (chart-reading, fixed formula, or the like) should enable anyone to make any extraordinary gains, that is, to “beat the market” in the broadest sense. But
the same is true as well of similar applications of other systems of data and techniques in wide use, e.g., econometric models and anticipations surveys. And all this is entirely consistent with the actual treatment of these various techniques by economists with professional interest and expertise in the area, an approach which implies that indicators, models, and surveys are all potentially productive inputs into the process of improving our knowledge of how the economy “works” and our predictions of how the economy is likely to fare.

Next, there are the real limitations of forecasting with indicators, some of which relate to the limitations of all economic estimation and prediction. The reasons vary and can only be mentioned here, e.g., the role of random events and processes in the developments represented by economic time series; the fact that economic factors partly influence one another “simultaneously,” partly form sequential relationships; the disturbing influence of errors in observation or measurement; etc.

The major indicators incorporated in the composite indexes are all monthly and reasonably up-to-date; this is an advantage, since forecasters have learned that they need frequent and current data or else may fall hopelessly behind the times. (The regularly used econometric models and surveys of business and consumer expectations are at best quarterly, some are annual.) But some monthly series are subject to substantial revisions and a few important ones are not available promptly, which delays the validation of the latest readings of the indexes. Moreover, a single-month change in an individual indicator—particularly the leading series, which tend to be volatile—may represent a very short irregular movement rather than a cyclical movement. Although this is far less likely to happen in an index, which is computed each month from a weighted average of changes in a group of series, the indexes
are still affected by such aberrations in their components.

Probably the greatest difficulty in the use of leading indicators as predictors of business-cycle turns is the variability in the length of their cyclical leads. Some of this variation, however, is itself systematic, namely the leads at peaks tend to be long, the leads at troughs quite short; these timing differences can be largely explained and forecasters can take them into account.12

Another problem is that the leaders turn down not only in anticipation of business recessions but also in anticipation of the major slowdowns or “mini-recessions” such as occurred twice in the last thirty years, in 1951 and 1966-67 (Chart 1). At present, no distinction can be made on a current basis between the signals of contractions and those of major slowdowns in overall economic activity, and indeed the question has been raised whether such a distinction will be possible in practice. It can be argued that signals of slowdowns are valid and desirable if they alert policymakers to take measures that would reduce a threatening recession to a mere retardation of economic growth.13

In conclusion, no index of leading indicators (nor, for that matter, any other forecasting device) can perform well if used mechanically and in isolation. Good results can only be expected if the current behavior of the index is interpreted with experienced judgment drawing also on other relevant information. Even in the latter case, of course, various external factors that an economist cannot predict may temporarily distort the underlying relations between the leading, coincident, and lagging indicators. However, some relationships of this basic type evidently have persisted for a long time now, despite alterations caused by structural changes in the economy, by government interventions, by unanticipated rises in the
price level, and perhaps by yet other factors. The new indexes have several advantages, the major one being that they continue to perform well in times of strong and varying inflationary pressures.

NOTES


3 See Victor Zarnowitz and Charlotte Boschan, “Cyclical Indicators: An Evaluation and New Leading Indexes,” Business Conditions Digest (BCD), May 1975, and “New Composite Indexes of Coincident and Lagging Indicators,” BCD, November 1975. BCD is a monthly report of the Bureau of Economic Analysis, in which up-to-date charts and tabulations of the indicators have been regularly presented since 1961.

4 Thus the new index substitutes constant-dollar new orders and contracts for the current-dollar series included in the old index. However, adjustments for price changes were applied with caution to selected series rather than generally, for several reasons: Deflation procedures are often difficult and proved unneeded in some cases; they may worsen the cyclical conformity or change the timing of a series; most important, they can cause errors or distortions in the data that are serious yet hard to identify.

5 This and other change series are smoothed with weighted short-period moving averages so as to reduce their high noise contents and bring out
their cyclical elements without undue losses of desirable timing and currency characteristics.

6 All series are monthly; quarterly indicators such as real GNP are not included (experimental work shows that inclusion of real GNP would change the cyclical behavior of the index very little but would cause delays and frequent revisions).

7 Reasons for the relatively slow recovery of employment lie in the initial uncertainties about the prospects for an enduring expansion and the concurrent rises in the average workweek and labor productivity. Reasons for the lesser growth of employment in late than in mid-expansion stages lie in either demand slowdowns or supply constraints, or both.

Unemployment statistics, of course, measure economic inactivity and move countercyclically, so they are used as indicators in inverted form.

8 Two of these leads are very short and all involve very small differences between the values of the index in adjacent months; note, in particular, the minuscule decline before the business peak in August 1957, which causes the index to show a lead of 5 months.

9 Read $L_P \rightarrow C_P$ as “peak in the leading index for the first cycle covered precedes peak in the coincident index for the same cycle,” etc. The last link shown has the first-cycle trough in the $L_g$ index leading the second-cycle peak in the $L$ index. The sequence continues in the same way for the second and the following cycles: $L_{P2} \rightarrow C_{P2} \rightarrow \ldots \rightarrow L_{T2} \rightarrow L_{P3} \rightarrow C_{P3} \rightarrow \ldots$ and so on. Chart 1 covers five complete business cycles on the $P-T-P$ basis and ends with a recession-recovery ($P-T-P$) segment.

10 In contrast, the old index failed to signal the recession as it moved sharply upward through the first 7 months of 1974, mainly under the influence of inflation. For detail, see the papers cited in note 3 above.

11 There is evidence that forecasters recognize that no single technique or model is always dependable or self-sufficient or consistently superior to others; they favor using several approaches (models, indicators, surveys, extrapolations) in varying combinations and with large judgmental
ingredients over constant mechanical procedures with lower costs but still lower expected returns. For some further detail and references, see V. Zar-nowitz, “Promise and Performance in Economic Forecasting,” Selected Paper No. 41, Graduate School of Business, University of Chicago.

12 Some techniques that are designed to aid the forecaster in this respect are discussed in the paper on leading indexes cited in note 3; see also Julius Shiskin, “Reverse Trend Adjustment of Leading Indicators,” Review of Economics and Statistics, February 1967, pp. 45-49.