Evaluating the Leading Indicators

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Many people in the business community watch the composite index of leading indicators (CLI) with great interest. A combination of a dozen different economic time series, the CLI is designed to signal the direction of economic activity. While some economists believe that the index has tended reliably to forecast whether the economy is headed up or down in the near future, others point to "false signals" when downturns apparently projected by the leading indicators have failed to materialize. For some time, rapid inflation clouded interpretation of the CLI which, until recently, included many components expressed in current dollars. In response to this problem, the Commerce Department in May 1975 published a new series with fewer current-dollar components (see Table I and the chart). This article investigates the usefulness of the revised CLI as an indicator of future economic activity.

DESCRIPTION OF THE COMPOSITE INDEX OF LEADING INDICATORS

The index of leading indicators[1] is a composite of a dozen separate economic time series (listed in Table I), which were selected from over three hundred series on the basis of the following criteria: (1) how relevant the series was according to economic theory, (2) how well the series represented the economic process in question, (3) how consistently the series changed direction before a turning point in economic activity, (4) how well the series conformed to historical business cycles, (5) how smooth it was, and (6) the length of the reporting lag. Although some of these criteria are objectively quantifiable, others such as "theoretical relevance" clearly depend upon the judgment of those constructing the index. The selected series are combined into a composite index, with the weights of the various components based on scores reflecting the same criteria used originally to select them.[2]

The justification for a composite series made up of several leading indicators has been stated by the Commerce Department as follows. First, if the relative importance of different causal factors varies in different business cycles, then it is helpful to consider a variety of indicators. Second, measurement errors of individual series can be large. If such errors are independent, then looking at a number of series lessens the possibility of being misdirected by erratic movements of a particular component. Finally, the volatility of individual series, which arises from short-term random disturbances, may be "ironed out" in a smoother composite index.

This rationale for generating a composite of leading indicators reflects some of the reasoning behind recent studies of the predictive value of combining separate forecasts.[3] A primary conclusion of these analyses is that in most circumstances a combination of forecasts from different models is more accurate than any single model

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[1] Parts of the following section draw from the United States Department of Commerce [16]. The numbers in brackets refer to the works cited at the end of this article.

[2] Monthly changes for each component are first calculated and then standardized, so that all the series are expressed in comparable units. Next, for each month a weighted average of these changes is computed, with the weights determined by overall indicator scores. The monthly weighted average changes are again standardized so as to make the average monthly change without regard to sign equal to unity. Finally, the derived series of changes are cumulated into a monthly index with a base of 1967=100. For a more detailed description, see United States Department of Commerce [16].

[3] Bates and Granger [1] and Nelson [11].

Table I

RELATIONSHIP BETWEEN THE NEW AND THE OLD COMPOSITE INDEX OF LEADING INDICATORS

Series in new index	Series in old index
Average workweek of production workers, manufacturing	Same
Index of net business formation	Same
Index of stock prices, 500 common stocks	Same
Index of new building permits, private housing units	Same
Layoff rate, manufacturing (inverted)	Average weekly initial claims for unemployment insurance (inverted)
New orders, consumer goods and materials, 1967 dollars	New orders, durable goods
Contracts and orders for plant and equipment, 1967 dollars	Same, current dollars
Net change in inventories on hand and on order, 1967 dollars (smoothed)	Change in book value, manufacturing and trade inventories
Percentage change in sensitive prices, wholesale price index of crude materials excluding foods and feeds (smoothed)	Index of industrial materials prices
Vendor performance, percentage of companies reporting slower deliveries	Corporate profits after taxes
Money balance (M_1), 1967 dollars	Change in consumer instalment credit
Percentage change in total liquid assets (smoothed)	Ratio, price to unit labor cost, manufacturing

Source: Boschan and Zarnowitz [2].

forecast taken by itself. However, the weights used for combining the individual forecasts into a composite forecast are usually based upon relative forecast errors or some such objective method that has desirable statistical attributes. Weighting the various CLI components by their scores is in the spirit of the above procedure, although the scores reflect additional criteria, some of which are noticeably subjective.

In 1967, Shiskin [13] reported a correction of the old CLI, which substitutes the higher trend of the coincident indicators for the lower trend of the CLI. This so-called reverse trend adjustment (RTA) of the old CLI shortened its lead time before peaks in economic activity, somewhat lengthened its lead time at troughs, and reduced the overall variability of the CLI's lead time before turning points. Also, the RTA made for a somewhat smoother series and lessened the amplitude of some false signals such as the one in early 1962. Therefore, the reverse trend adjusted CLI was generally considered to be more accurate. As a result of the RTA, however, some peaks became less well-defined as the magnitude of the drops in post-peak months was lessened.

At times, economists have expressed concern that the development of the leading indicators has lacked explicit theoretical underpinnings.[4] To be sure, the theoretical framework provided by those who developed the CLI does not satisfy all economists. However, the series in the CLI (see Table I) usually reflect either direct or indirect measures of demand for various components of output or factors which, according to at least some theories, tend to have an impact on demand. Changes in these components of demand usually lead to changes in output in the near future.

Among the direct measures of demand are the series on building permits, orders for consumer and producer goods, and net change in inventories on hand and on order. By themselves, inventories on hand, a series included in the old CLI, would not be a very good leading indicator because of the difficulty in distinguishing between intended accumulation and undesired buildups resulting from an unexpected fall in sales. However, the sum of inventories on hand and on order should rise when desired accumulation is occurring but not when slack demand trims orders and raises undesired inventories.

Indirect readings on demand include the lag in obtaining deliveries, the layoff rate and average workweek in manufacturing, changes in crude materials prices, and the index of net business formation. The lag in obtaining deliveries is an indication of the magnitude of suppliers' backlog of orders or unfilled demand, as deliveries usually slow up when the backlog rises. The average workweek is a leading indicator because employers tend to shorten or lengthen hours more quickly than they can adjust the work force; similarly, the layoff rate can be altered faster than the rate of new hires. Crude materials prices are rather sensitive to small changes in demand, much more so than prices of goods at later stages of fabrication. The index of net business formation is both a direct and an indirect demand measure. It indicates, in part, future demand for investment goods by new businesses as well as the formation of enterprises in response to higher aggregate demand.

Stock market prices are an indication of expected demand and can also, according to some economists, play a role in altering the level of demand. As stock prices reflect expected profits, the market usually turns up when investors foresee strong aggregate demand. In addition,

[4] For example, see Koopmans [7].

because it is both an important component of individual wealth and a determinant of firms' cost of capital, the stock market can influence consumption and investment. Finally, the CLI includes two other financial variables—the money stock and total liquid assets. In many theories of aggregate demand, these liquid assets either directly or through influencing interest rates play important roles in determining spending.

USE OF THE CLI TO FORECAST TURNING POINTS IN ECONOMIC ACTIVITY

The CLI has been regarded primarily as an indicator of turning points in economic activity. One familiar method of judging the CLI's ability to forecast turning points has been to examine the length of time between a turn in the CLI and the subsequent turn in the level of economic activity and the variability of this lead time. If the lead time is only a few months, the index would not be very helpful because there is a one-month reporting lag for a composite based on preliminary readings of eleven of the twelve components. Moreover, it takes a few months of subsequent declines (increases) to identify a turning point. In view of lags in the impact of stabilization measures, short leads preclude fully effective countercyclical macroeconomic policy. The variability in the lead times influences one's confidence in using the indicator to date prospective turns and is particularly important for the effectiveness of countercyclical stabilization actions. For example, an unusually long lead time at the peak may result in monetary and fiscal stimulation before it is necessary and may therefore be inflationary. Similarly, an unusually long lead at the trough can make policies, designed for the "average" lead, act to prolong the recession.

Table II presents comparisons of lead times for the old and revised indexes with and without RTA. The behavior of the old and revised series is fairly similar up until the most recent recession. Both series tend to have longer leads at peaks than at troughs. With RTA, the behavior of the two series is again fairly similar at troughs but becomes somewhat more different at peaks. While RTA markedly lowered the length and variability of leads for the old CLI, it does not do so for the new CLI. The behavior of the two series became divergent in recent years, as inflation imparted an upward bias to the old CLI. For example, the old CLI did not peak until July 1974, well after the recent recession had begun.[5]

With respect to the characteristics of the new CLI's lead times, the four-month lead before the 1953-54 recession seems too short to have been of much use to policymakers. As indicated earlier, an unusually long lead like the one before the 1957-58 recession can complicate policies designed to fight inflation. Timely leads were recorded before the 1960-61 and 1969-70 downturns. The five-month lead before the industrial production peak of November 1973 was relatively short. However, the timing of the November peak was influenced by the Arab oil embargo; in the absence of the embargo the peak probably would have been somewhat later. While some of the short leads before troughs were not very

Table II

OFFICIAL LEADS AND LAGS OF THE COMPOSITE LEADING INDICATOR (CLI) AT CYCLICAL TURNING POINTS, 1948-75

Peak	Lead (—) or lag (+) (months)		Trough	Lead (—) or lag (+) (months)	
	Old CLI	Revised CLI		Old CLI	Revised CLI
Original trend					
November 1948	*	*	October 1949	—4	— 4
July 1953	— 6	— 4	May 1954	—6	— 6
August 1957	—20	—23	April 1958	0	— 2
April 1960	—12	—12	February 1961	—2	— 2
December 1969	—10	—11	November 1970	0	— 1
November 1973	+ 8	— 5	March 1975†	0	0
Reverse trend adjusted (RTA)					
November 1948	*	*	October 1949	—5	— 4
July 1953	— 6	— 4	May 1954	—6	— 6
August 1957	— 8	—21	April 1958	—2	— 3
April 1960	— 3	—11	February 1961	—2	—11
December 1969	— 8	— 7	November 1970	—6	— 8
November 1973	+ 8	— 5	March 1975†	0	0

* Available data do not extend back far enough to enable identification of a peak.
† Tentative.
Source: Boschan and Zarnowitz [2].

[5] Some economists might argue that the November 1973 peak in industrial output was brought on in large part by a special exogenous factor, the Arab oil embargo, and date the demand-related recession as starting several quarters later. For example, Bowsher [3] dates the demand-related recession as starting after September 1974. With this particular dating, the old CLI leads the demand-related peak by two months, a very short lead.

informative, the CLI (without RTA) did not exhibit any unusually long leads which could have prompted inadequately expansive countercyclical policies.

In addition to stable leads which are not too short, another important criterion is the frequency of false signals. False alarms can trigger countercyclical policies which in retrospect turn out to be inappropriate. A number of studies have attempted to gauge the frequency of false signals emitted by the old CLI series.[6] While their methodologies have differed, they have usually concluded that the old CLI series at times gave false and confusing signals, primarily during upturns.[7]

An important limitation of some past studies is that they did not use magnitude as a criterion in calling a signal. Most forecasters would probably not alter their near-term forecasts on the basis of small changes in direction. Also, some directional changes may be discounted on the basis of the preceding trend. For example, suppose the index rises after a larger and longer series of declines that had not been followed by a recession. As the CLI has a short lead at troughs, the upturn in the index suggests that economic activity will soon increase. On the other hand, the previous declines imply that a recession will occur within about twelve months after the CLI peak. How to reconcile these two conflicting pieces of information will depend upon the magnitude of the earlier downturn, compared with the current increase in the CLI. If the signal of an upturn is weak, it would probably be disregarded as it is outweighed by a stronger previous downward signal which has yet to exert its lagged impact.

A review of past studies points up the difficulty of specifying mechanical rules for determining incorrect signals.[8] Therefore, rather than develop any elaborate framework for designating false alarms emitted by the new CLI, a simple screening procedure was adopted to identify potential misleading signals. Two consecutive movements opposite to the previous trend of the CLI without the predicted turning point coming in the following year were labeled potential false alarms. Then, each episode was further studied to determine if the signal would have been misleading in view of the information likely available at the time of the signal. Some consecutive changes in direction were not considered to be false alarms, because they were smaller than any previous consecutive directional changes following correct turning-point signals. CLI movements reflecting strikes were also not counted as false alarms.

Evaluation of the new CLI brought to our attention some instances where possibly confusing signals were emitted (see the chart). The new index declined in the final months of 1950 and throughout most of 1951 without a recession following. Prior to the business-cycle peak in August 1957, the index behaved in a misleading manner. It peaked in late 1955, and a recession did not come until almost two years later. We identified four potential false signals in the 1960's. In the March-June 1962 period, the CLI declined for four straight months by an amount that exceeded the drops following CLI peaks before prior recessions. In 1963 the CLI registered two straight drops which were larger than declines after some past CLI peaks preceding downturns. In 1966, quite sizable declines were registered and again no recession followed. Later, in 1968, the index fell in three of the first four months of the year by amounts similar to those recorded after some past correct peak signals. And also, in 1974, the CLI gave temporarily confusing signals as it increased in February and particularly sharply in March. Contrary to what we found with the old CLI, the new index with RTA does not emit fewer false signals.[9]

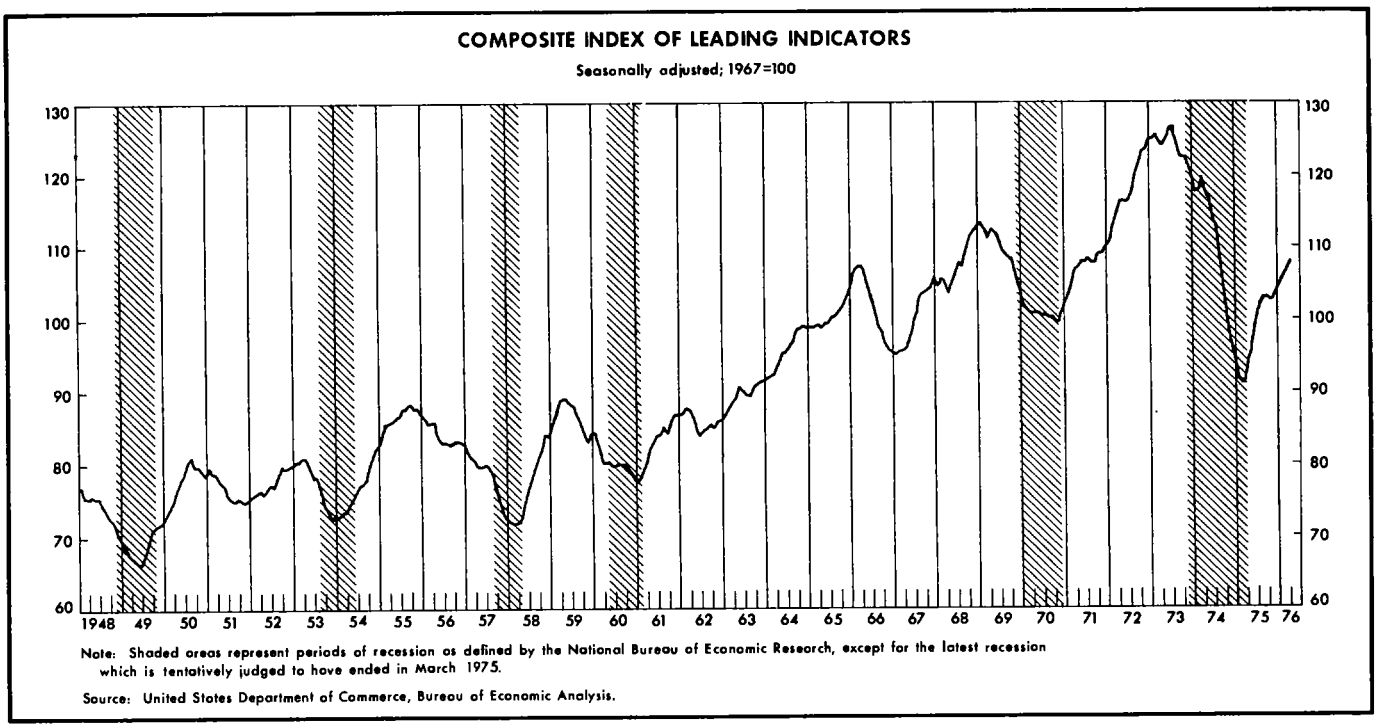
Focusing more closely on some of the above-cited episodes, several arguments can be made in defense of the index. After the fact, it may not be proper to label some CLI downturns as false signals without considering

[6] Okun [12], Evans [4], Stekler and Schepsman [15], and Hymans [6].

[7] Some past studies of the old CLI evaluated its signaling ability when based upon preliminary economic data, compared with historically revised data. Hymans [6] reports that the preliminary and the first-revision estimates of the leading indicators surprisingly outperformed the historically revised leading indicators. He argues that the anomaly can be partly explained by the nature of his test which depends on directions of change. On the other hand, in their analysis of leads between turning points in the leading indicators and industrial production, Stekler and Schepsman [15] concluded that the CLI based on contemporaneous data did have false turns which were later revised away. These two divergent findings may be reconciled, in part, by the somewhat different methodologies employed.

[8] For examples of the many problems of formulating a decision rule for labeling false turns, see the discussants' comments in Hymans [6].

[9] One false signal, in 1963, was eliminated because the series with RTA fell by what we judged to be an insignificant amount. However, the RTA series hovered erratically around its peak value for almost two years before the 1957-58 downturn. In the 1960-61 recession, it fell in the final three months of the year, after rising in five of the previous six months. The recession subsequently troughed in February 1961. After its peak in June 1973, it rose in the following October-November and February-March periods.



whether the policy response to the early warnings prevented the turn from actually occurring. Shiskin [14] makes an interesting case that declines in components of the old CLI during 1962 and 1966 prompted stabilization measures which helped to forestall recessionary tendencies in the economy. Also, the CLI downturns in 1951, 1962, and 1966 were followed by "growth" recessions, periods of below-average economic growth.[10] Nevertheless, it is difficult to distinguish clearly CLI behavior before growth recessions and most orthodox downturns, although the two may call for different public and private decisions. The CLI rise in February-March 1974 might have been discounted as a sign of recovery. A part of the drop in industrial production as of that date was undoubtedly related to the Arab oil embargo, so that some analysts might have questioned whether a "standard" recession had indeed begun. As the index had been falling since the previous June, the weight of evidence was for a standard recession to occur. Finally, the false signals in 1963, 1968, and early 1974 were subsequently reversed, and this emphasizes primarily the necessity of observing movements for at least a quarter of a year before predicting a business-cycle turn. Still, as the period required for confirmation increases, the CLI becomes less useful in guiding timely stabilization policies.

In evaluating the new CLI's worth to policymakers, values must be assigned to correct and false signals. The ability of the new CLI to signal true recessions is valuable in terms of suggesting the need for stabilization policies that can maintain high levels of output. This benefit must be weighed against the inflationary implications, however, if policymakers react to false recession signals by taking unnecessary stimulative measures.

IDENTIFYING FALSE TURNS. In view of the possible inflationary consequences if policymakers are misled by false recession signals, it would be very helpful if false signals could be readily identified. The review of past analyses, along with our evaluation of false signals, has suggested a few means of discerning false turns. As discussed earlier,

[10] Mintz [9] has identified growth recessions in the June 1951-June 1952, April 1962-March 1963, and June 1966-October 1967 periods.

potentially misleading signals can possibly be identified at the time they occur by consideration of magnitudes of change compared with past correct signals, strength of the preceding trend, strikes, and likely fiscal and monetary policy changes.

We also considered whether some of the confusing signals which we identified were associated with changes in a fewer number of components than was the case before other downturns. A comparison was made of the number of components of the new CLI falling over the first two months after peaks preceding conventional and growth recessions and also after false peaks. As expected, the average number of declining components was less both before growth recessions (7.33) and after false peaks (7.33) than before true recessions (8.25). However, as the number of observations are few and the differences are not large, no strong conclusions are warranted.

VALUE OF CLI AS A QUANTITATIVE PREDICTOR OF ECONOMIC ACTIVITY

So far, we have examined the CLI's ability to signal changes in the direction of the economy, which was the primary function envisaged by those constructing the CLI. How well does it do as a general forecaster of the level of economic activity? Some previous research had been directed toward using the old CLI as a quantitative predictor of either real gross national product (GNP) or industrial production.[11] We have attempted to assess the value of the new CLI as a forecaster of real GNP (see Table III). Over a sample period extending from 1953-I through 1970-II, the percentage change in the CLI in the previous quarter could explain around 37 percent of the variation in real GNP growth. (While this R^2—i.e., squared correlation coefficient—of 37 percent may appear low, it should be remembered that equations explaining percentage changes typically have substantially lower R^2's than when the dependent variable is defined in levels or changes in levels.) The correlation fell markedly (R^2=.17), however, when the CLI was lagged two quarters. Similar results were obtained using the CLI with RTA. Given the known lags in the impact of stabilization policies, the inability to forecast more than the upcoming quarter is certainly a weakness of the CLI.

How well does the lagged CLI predict real GNP growth relative to other forecasting devices? Out-of-sample forecasts, using the CLI lagged one quarter, were generated from 1970-III through 1976-I. The mean absolute error (MAE)—the summation of the absolute differences between actual percentage changes in constant-dollar GNP and predicted percentage changes from 1970-III through 1976-I divided by the twenty-three forecasted quarters—was then computed. The MAE associated with the CLI was lower than the MAE obtained from an often employed standard of comparison, a simple autoregressive model in which the percentage change in real GNP was regressed on the change in the previous period. On the other hand, the CLI's MAE is somewhat above that for published *ex ante* forecasts from large and elaborate econometric models.[12] However, these large models are more costly to use and their forecasts often reflect adjustment of the pure-model results with information not formally included in the model. Similarly, it would be wise for forecasters to use the new CLI in combination with other information. And our regression findings, along with the new CLI's ability to signal all postwar downturns, suggest that the index does perform well enough to qualify as a useful forecasting input.

Table III

ACCURACY IN FORECASTING REAL GROSS NATIONAL PRODUCT (GNP) GROWTH

Model	Sample period 1953-I through 1970-II	Post-sample period 1970-III through 1976-I
	Mean absolute error, in percent	
Forecast with CLI lagged one quarter*	2.61	3.31
Forecast with lagged GNP†	2.77	3.98

* $\%\Delta \text{ Real GNP} = \underset{(7.32)}{2.89} + \underset{(6.30)}{.21} (\%\Delta \text{ new CL1})_{-1}$,
where $R^2 = .37$, SEE = 3.24%, DW = 1.70

† $\%\Delta \text{ Real GNP} = \underset{(2.98)}{1.67} + \underset{(4.59)}{.48} (\%\Delta \text{ Real GNP})_{-1}$,
where $R^2 = .24$, SEE = 3.56%

Key: R^2 = Coefficient of determination
SEE = Standard error of estimate
DW = Durbin-Watson statistic
t-statistics appear in parentheses under regression coefficients

[11] Moore [10] and Greenwald [5] evaluated CLI projections of GNP growth, and Stekler and Schepsman [15] focused on CLI forecasts of monthly industrial production.

[12] Examining *ex ante* quarter-ahead real growth forecasts from six econometric models plus a composite of judgmental forecasts, McNees [8] reports an average MAE of 1.9 percent for the sixteen quarters ended in the first half of 1974. Over a similar period the MAE associated with the lagged CLI was 2.9 percent.

SUMMARY AND CONCLUSIONS

Judged in terms of its ability to forecast turning points, the revised CLI has never failed to signal any of the postwar downturns. On the other hand, it has occasionally dropped without a recession following. In a few cases, "growth" recessions followed, although it is usually not possible to distinguish CLI movements before conventional and growth recessions. While some other false signals of recession were later reversed, these episodes imply that it often takes at least a quarter of a year to confirm some signals. False alarms can sometimes be identified by examining magnitudes of change compared with past correct signals, the strength of the preceding trend, the diffusion of changes among components, and reactions of the monetary and fiscal authorities.

The new CLI does have some ability to forecast the magnitude of economic growth one quarter ahead but is somewhat inferior to the forecasts of the large econometric models for the 1970's. Moreover, the explanatory power of the new CLI lagged more than a single quarter is weak. Still, providing that users recognize its limitations, the new CLI can be a useful complement to other available forecasting methods.

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