six errors, respectively, with the two-month rule.

■ **Implications for the Current Outlook**
As of August 31, it appeared that the ILI had declined in February, March, May, and June 1989, thereby satisfying the criterion of falling in four of the last seven months. Thus, taken by itself, the ILI began forecasting a business peak when the ILI figure for June 1989 was released on August 4. But this forecast was confirmed by only one of the alternative indexes, so a peak was *not* being forecast by the more complete rule, which requires confirmation by *two* of the alternative indexes.

On September 1, the ILI for June was revised upward to no change, and the ILI for July was reported to have risen. This new information, in effect, canceled the ILI's forecast of recession, because the ILI then appeared to have fallen in only three of the last seven months.

This episode illustrates how the possibility of data revisions reduces the usefulness of the ILI as a tool for forecasting business peaks. It also illustrates the value of using the more complete rule, which had not signaled and still does not signal a peak.

■ **Conclusions**
The Composite Index of Leading Indicators is often used by analysts seeking to forecast business peaks and troughs. It can provide useful information, but its value as a forecasting tool is quite limited.

The ILI has a good record in turning down and up before business peaks and troughs. Forecasters, however, do not have the luxury of knowing the future path of the ILI—they only know where it has been, subject, of course, to revisions. Moreover, the ILI's value as a forecasting tool is limited by its tendency to give false signals.

For the purpose of forecasting peaks, the ILI can be used with a four-months-out-of-seven rule, supplemented by the requirement that two of the alternative indexes confirm the forecast. For forecasting troughs, the ILI should be discarded in favor of the Long-Leading Index, using a two-month rule.

Based on these rules, the ILI, which has not declined in four of the last seven months, is not signaling a recession.

■ **Footnotes**
1. For examples, see Hilary Stout, "Leading Indicators Fell Sharply During May, Darkening Outlook," *The Wall Street Journal*, June 29, 1989, page A2; and "Leading Indicators Down 0.1%," *The New York Times,* August 4, 1989, page 25.

2. Geoffrey H. Moore, *Business Cycles, Inflation, and Forecasting*, National Bureau of Economic Research Studies in Business Cycles, No. 24, Ballinger Publishing Company, Cambridge, Mass., 1983, page 370.

3. See Marie P. Hertzberg and Barry A. Beckman, "Business Cycle Indicators: Revised Composite Indexes," *Business Conditions Digest*, BEA, January 1989, pages 97-102.

4. The criterion of four declining months in a seven-month period was met 12 times in periods of expansion during the last 42 years. Four of these episodes were false signals, while the other eight correctly signaled impending business peaks. Thus, the rule was correct only two-thirds of the time.

5. Strictly speaking, the Ratio is not an index of leading indicators. The Long-Leading Index and the Short-Leading Index were developed by Columbia University's Center for International Business Cycle Research (CIBCR). Although they have been calculated back to January 1948, they were first published by CIBCR on October 6, 1987, and have been published in *Business Conditions Digest* only since April 1989.

Gerald H. Anderson is an economic advisor and John J. Erceg is an assistant vice president and economist at the Federal Reserve Bank of Cleveland. They wish to thank Susan Byrne for her research assistance.

ECONOMIC COMMENTARY

Forecasting Turning Points With Leading Indicators

by Gerald H. Anderson
and John J. Erceg

A major topic of current interest to economic forecasters is whether the U.S. economy is headed for recession in the near future. Some have concluded that recession is on the horizon, or has already begun. One piece of evidence offered to support that view is the Composite Index of Leading Indicators (ILI), which reached a peak in January 1989, and by mid-August was reported to have fallen in four of the last five months.

Generally speaking, a major task in economic forecasting is to anticipate turning points in economic activity — points when a business expansion will reach its zenith, or peak, or when a business contraction will reach its nadir, or trough. A reliable method for forecasting turning points has continued to elude forecasters, despite advances in mathematical and statistical techniques.

The financial news media frequently refer to "leading" indicators of economic activity as clues, if not predictors, of changes in activity. The media commonly report the magnitude of an increase or decline in the ILI, which, they conclude, implies continued growth or contraction in economic activity. Some reports also claim that the ILI is the government's "chief economic forecasting gauge."[1]

This *Economic Commentary* discusses the composition and ostensible purpose of the ILI and examines its record as a forecasting tool. We conclude that, while the ILI *can* provide useful information to forecasters, it is by no means a foolproof tool for forecasting peaks or troughs in business activity. We also conclude that the ILI does not yet appear to be signaling the approach of a business peak.

■ **The ILI: A Historical Perspective**
Economic data series that might be helpful in identifying changes in aggregate economic activity have been studied by researchers at the National Bureau of Economic Research (NBER), a private, nonprofit economic research organization, since the 1930s. Of the hundreds of economic series examined, some were found to precede or lead, others to coincide, and still others to follow or lag turning points in the direction of overall economic activity, as determined by the NBER.

The first notable use of leading indicators occurred in 1937, when Secretary of the Treasury Henry Morgenthau asked the NBER to compile a list of economic series that would best indicate when the 1937-38 recession would end.[2]

In October 1961, the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce began to publish leading, coincident, and lagging indicators in its then-new monthly publication, *Business Conditions Digest.*

The financial news media frequently point to the movement of the Composite Index of Leading Indicators (ILI) as proof of impending growth or contraction in economic activity. A closer look indicates, however, that while the ILI can provide a great deal of useful information, its value as a forecasting tool is limited. Its usefulness increases when it is used in combination with other indexes.

From among the leading indicators originally selected by the NBER, the BEA selected the 12 best on the basis of six criteria: economic significance; statistical adequacy; timing at troughs and peaks of aggregate economic activity; conformity to past business expansions and contractions; smoothness; and frequency and timeliness. The 12 individual series were combined into a composite index, which was first published in November 1968.

The BEA has revised the list of components of the composite index from time to time, as the usefulness of some series waned, and new or improved series became available. The composition of the ILI was last changed in January 1989 and now includes 11 series.[3]

The ILI as a Forecaster of Business Peaks

There have been eight business peaks since World War II. The ILI has peaked prior to each one by periods ranging from two to 20 months, making it a potentially good tool for forecasting business peaks. However, closer analysis reveals that the ILI has serious shortcomings as a forecasting tool.

The usefulness of the ILI as a forecaster of business peaks depends on avoiding false signals of peaks, avoiding the failure to forecast peaks, and providing ample but not excessive warning of peaks. The ILI exhibits some substantial failings when judged by these criteria.

First, the ILI has given from three to seven false signals of peaks, depending on the number of consecutive months of decline that is taken to be a signal of a peak. If a seven-month decline is taken as a signal, there were false signals in 1951, 1966, and 1984, when the ILI declined for seven, nine, and seven consecutive months, respectively. If a five-month decline is considered to be a signal, the ILI also gave a false signal at the start of 1988. The financial news media sometimes say that a three-month decline in the index usually indicates a recession. If so, there was also a false signal in 1962, and perhaps also at the beginning of 1979 and the beginning of 1981.

Second, it is stretching things to say that consecutive monthly declines in the ILI forecast the July 1981 peak, because the ILI had declined from its peak for only two months before the business peak, according to the BEA. A less restrictive statement of that episode is that the ILI declined in five of the eight months before the business peak, which could be taken as a reasonable signal.

Two of the leads reckoned by the BEA include periods when the decline in the ILI was interrupted by rises of two or more months. The 20-month lead before the August 1957 peak includes three gaps of two months each. Excluding those gaps, there was an uninter-rupted lead of nine months. The 15-month lead before the January 1980 peak includes a gap of two months, and three gaps of one month each. Excluding those gaps, there was no lead.

A forecasting rule using the ILI must specify how many months of decline constitutes a signal of a business peak, while also taking into account interruptions in the downward movement of the ILI. An example of such a rule is that the ILI is forecasting a recession if the index falls in four out of six months. That rule would have yielded false signals in 1951, 1966, 1984, and 1987, and would have failed to forecast the peak of July 1981.

Any forecasting rule based on the ILI must accept some trade-off between false signals and failures to forecast a business peak. We tested several rules based on the experience of the last 42 years. The least restrictive rule that would not have given any false signals is that the ILI must fall for 10 consecutive months. However, with that rule, the ILI would have failed to anticipate all of the peaks. The least lenient rule that would have forecast all of the peaks is that the ILI must fall in four out of seven months. With that rule, the ILI would have given four false signals.

Considering failure to forecast a peak, and a false signal of a peak, as equally egregious errors, two rules appear to minimize the total errors. One is that a recession is forecast if the ILI falls in any four of seven months. The other rule uses a test of falling in any four of eight months. Both rules would have made four errors, giving four false signals. However, neither would have failed to forecast any business peak. The first of the two rules seems preferable because it provides a longer average warning time and has a shorter average duration of false signals.

Another shortcoming of the ILI is the variability of its warnings of business peaks. As reckoned by the BEA, the ILI peaks from two to 20 months before a business peak. What is more relevant is the range in length of the periods between the time the ILI signals an impending business peak and the peak itself. The rule selected here on the basis of minimizing forecast errors provides leads ranging from one to 14 months.

This analysis indicates that any statement suggesting that the ILI always turns down before the economy turns down would be true, but misleading. It is misleading because it implies that the ILI can be used to *forecast* business peaks, when in fact the index is quite unreliable for that purpose. Any forecasting rule based on the ILI will give either some false signals of business peaks, or will fail to forecast peaks, or will do both. Moreover, the correct forecasts exhibit highly variable lead times.

The most accurate rule identified in this analysis can be said to offer the following guidance to an analyst using the ILI to help forecast the next business peak: If the ILI has declined in four of the last seven months, the chances are two out of three that a business peak will occur sometime within the next 14 months.[4]

The foregoing analysis uses a historical series for the latest composition of the ILI, calculated after all of the revisions of the basic data had been made. However, when actually using the ILI to forecast, an analyst first receives an un-revised figure for the ILI for a particular month. That figure could then be revised in each of the next five months, which adds to the uncertainty confronting the analyst. Consequently, the probability of false signals and failures to forecast might be even greater than is implied by this analysis.

Finally, this analysis assumes that the ILI is available during the month for which it is issued. In fact, it is published about four or five weeks following the end of the month. Therefore, the ILI gives forecasters that much less lead time.

The ILI as a Forecaster of Business Troughs

The ILI has turned upward prior to each of the last eight business troughs. By the reckoning of the BEA, the spans between the low points of the ILI and the troughs of the business cycles ranged from one month to 10 months. For six of the eight troughs, the span was from one month to six months.

Unfortunately, it is not uncommon for the ILI to give a false signal of the approach of a trough. In six of the eight contractions, the ILI gave a false signal by rising and then declining again. For example, in the 1960-1961 recession, the ILI rose in five consecutive months following the business peak but then flattened for three months, which at the time could have been interpreted as canceling the signal that a trough was at hand. Again, during the 1981-1982 recession, the ILI advanced in four months of a six-month period and then declined, before rising again to signal an impending end to the recession.

A rule that a one-month rise in the ILI forecasts a trough is clearly too lenient because it would have given false signals in six of the eight recessions. A rule with a three-consecutive-month criterion is probably too strict, because while it would have given no false signals, it would have failed to anticipate the troughs in 1958, 1970, 1975, and 1980.

The rule that seems to balance best the risks of the two types of error states that two consecutive rises in the ILI forecasts a business trough. That rule would have given two false signals and would have failed to forecast the troughs of 1970 and 1975. The forecasts of impending troughs given by the two-consecutive-month rule would have preceded the troughs by periods ranging from one month to nine months, and averaging 4.7 months.

Thus, the foregoing analysis can be said to offer the following guidance to an analyst using the ILI to help forecast the end of a recession: If the ILI has risen for two consecutive months, the experience of the last 42 years suggests that the chances are three to one that a trough will be reached in the next one to nine months. But if the ILI has *not* risen in both of the last two months, the analyst must nevertheless keep in mind that the rule has failed to forecast two of the last eight business troughs. If the ILI has risen for three consecutive months, the experience of the last 42 years suggests that a trough will be reached within the next six months or has already occurred within the last two months.

Forecasting Business Peaks Using Other Indexes in Combination With the ILI

In addition to the ILI, three other composite indexes of leading indicators are published in *Business Conditions Digest*. They are the ratio of the Composite Index of Coincident Indicators to the Composite Index of Lagging Indicators (the Ratio), the Long-Leading Index, and the Short-Leading Index.[5]

Rules based on these measures have the same shortcomings as the ILI: a rule lenient enough to predict all business peaks will also give false signals, and a rule strict enough to avoid false signals will fail to forecast most of the peaks. If four declines in the last seven consecutive months is considered a forecast of a business peak, the three alternative indexes would have forecast all of the last eight peaks, with one exception: the Short-Leading Index would have failed to forecast the July 1953 peak. However, the Ratio, the Long-Leading Index, and the Short-Leading Index would have given false signals nine, five, and eight times, respectively.

Despite the shortcomings of the alternative indexes, analysts can improve their forecasts to some extent by using the alternative indexes in conjunction with the ILI. A rule for doing so is to say that the ILI is forecasting a peak only when two conditions are met: (1) the ILI has declined in four of the last seven months, and (2) at least two of the alternative indexes are also signaling a peak by the same four-out-of-seven test.

Using that rule, the ILI would have forecast all eight peaks. The average lead time falls slightly to 4.4 months from the 5.6 months obtained by using the ILI alone. However, the range of lead times is narrowed to one to nine months from one to 14 months, thereby reducing the uncertainty about when the peak will arrive.

The rule also would be somewhat better in that it would have given three false signals instead of the four that are given by forecasting with the ILI alone. The false signal of a business peak following the stock market collapse in October 1987 would have been avoided. The rule does not reduce the nine-month average duration of the false signals.

Forecasting Business Troughs Using Other Indexes

We used two rules to examine the forecasting accuracy for business troughs of both the ILI and the alternative indexes. Because recessions have been much shorter than expansions, the forecasting rules can be much simpler than those used to forecast peaks. The two rules tested are (1) a one-month rise in a measure forecasts a trough, and (2) rises in two consecutive months forecast a trough.

The Long-Leading Index with the two-month rule would have given the best performance during the last eight recessions in terms of minimizing forecast errors. It forecast all eight troughs and gave only one false signal. Its range of lead times, one to nine months, is wider than some of the other choices, but that greater variability seems a small price to pay for its much greater forecasting reliability.

Thus, the Long-Leading Index appears to be superior to the ILI, which gave two false signals and failed to forecast two troughs with the two-month rule, and gave seven false signals with the one-month rule. The Ratio and the Short-Leading Index are much less reliable measures for forecasting troughs, making 10 and nine errors, respectively, with the one-month rule, and five and