Business Cycle Indicators

Contents

The Conference Board's Business Cycle Indicators Project

As part of a long-term strategic plan to redeploy its resources to respond to a changing economy, and in particular, to improve the U.S. national accounts, the Bureau of Economic Analysis of the Department of Commerce selected The Conference Board to be the new custodian of the official composite leading, coincident, and lagging indexes. The Board also agreed to maintain the *Business Cycle Indicators* database, which includes the composite indexes and a set of economic series known as the "leading indicators" as well as more than 200 other economic series, and to start a related publication, also called Business Cycle Indicators.

The first independent release of the composite leading index by The Conference Board was on January 17, 1996. The first issue of *Business Cycle Indicators* was published in February 1996. In December 1996, The Conference Board unveiled revisions to the composite indexes, which are explained in the articles included in this package. (These articles were first published in the December 1996, January 1997, and February 1997 issues of *Business Cycle Indicators*.)

Business Cycle Indicators puts economic information into the hands of users in a timely manner so that it can serve as an important tool for monitoring the business cycle. In addition, this report will be the primary vehicle for introducing new economic indicators that The Conference Board is developing, including any future revisions to the leading index. Annual subscriptions are $125 for first-class mail and $95 for publication-class mail. The news release for "Leading Economic Indicators and Related Composite Indexes" is available by fax, at $40 per year, or mail, at $24 per year. Call (212) 339-0345 to order these services. Further information on the Business Cycle Indicators project, including the entire database in electronic spreadsheet form, is on the Internet at www.tcb-indicators.org.

Overview of the Cyclical Indicator Approach

Careful analysis of cyclical indicators has proven to be useful for monitoring and predicting alternating waves of economic expansion and contraction known as the business cycle. Cyclical indicators are economic series that are classified into three categories—leading, coincident, and lagging—based on the timing of their movements. The leaders are those series that tend to shift direction in advance of the business cycle, and for this reason they get the lion's share of the attention. The coincident indicators, such as employment and production, are broad series that measure aggregate economic activity; thus they define the business cycle. Lagging indicators tend to change direction after the coincident series. These series are used to confirm turning points and to warn of structural imbalances that are developing within the economy.

The series that are published in *Business Cycle Indicators* have been subjected to various tests, including conformity to the general business cycle and consistent timing as leading, lagging, or coincident series. No single time series fully qualifies as an ideal cyclical indicator, however, and it is important to analyze groups of indicators and look for common patterns.

The leading, coincident, and lagging composite indexes are constructed as averages of the most reliable cyclical indicators; these indexes smooth out a good part of the volatility of the individual series. Diffusion indexes, which measure the proportion of a set of indicators that are rising, are useful because they tell how widespread a particular business cycle movement has become.

It is often reported that a three-month decline in the leading index signals a recession. But few economists actually use such a simple and inflexible rule. Historical analysis shows that a decline of between 1 to 2 percent for the leading index and declines in at least half of the components over a six-month period is a reasonable, but not perfect criterion for a recession warning. The U.S. economy is continually evolving and is far too complex to be summarized by one or two economic series.

About The Conference Board

Founded in 1916, The Conference Board is a private, not-for-profit, nonadvocacy organization. We are a worldwide research and business membership group, with more than 2,700 corporate and other members in more than 60 nations. We produce a wide range of reports and periodicals, conduct numerous conferences and seminars, and organize peer group councils for senior executives that cover every aspect of business planning and management. Assuming the responsibility for computing the composite indexes and maintaining the BCI database supports our mission to improve the business enterprise system and to enhance the contribution of business to society.

Details on the Revisions in the Composite Indexes

On December 30, 1996, when November data are first reported, The Conference Board will make important changes to the leading, coincident, and lagging composite indexes. Most noteworthy are the changes in the composition of the leading index. Two of the eleven current component series will be deleted: **change in sensitive materials prices** and **change in unfilled orders for durable goods.** One series will be added: **interest rate spread, 10-year Treasury bonds less federal funds**. These changes, which were first described in last month's issue, are expected to improve the performance of the **composite leading index.** The following is a fuller discussion of the revisions and their effect on the historical cyclical patterns for the composite leading, coincident, and lagging indexes.

Components of the Leading, Coincident, and Lagging Indexes

Table 1 lists the components of the leading, coincident, and lagging indexes and notes all significant revisions. This table also shows the new standardization factors that are associated with each component.

The two deletions from the leading index are being made because these indicators tend to give "false signals" and because reliable replacements could not be found. Moreover, dropping these two series improves the cyclical performance of the leading index in recent years. The added series, the interest rate spread, has become a widely used forecasting variable and, starting with next month's issue, it will be regularly reported as a leading indicator in the tables and charts of this publication. (Last month's issue includes a chart of this series.)

Other revisions to the leading indicators are being made to reflect changes in data availability and improved statistical practice. These changes will, however, have little effect on the cyclical performance of the composite leading index:

(a) **Initial claims for unemployment insurance** (BCI series 5) will be based on the seasonally adjusted,

Table 1 Components of the Leading, Coincident, and Lagging Indexes

		Changes	Standardization Factors**
Leading indicators			
BCI-1	Average weekly hours, manufacturing	none	.222
BCI-5	Average weekly initial claims for unemployment insurance	total U.S., 4-week average	.025
BCI-8	Manufacturers' new orders, consumer goods and materials	92$*	.047
BCI-32	Vendor performance, slower deliveries diffusion index	none	.026
BCI-27	Manufacturers' new orders, nondefense capital goods	replaces BCI-20, 92$*	.012
BCI-29	Building permits, new private housing units	in millions	.017
BCI-92	Change in manufacturers' unfilled orders, durable goods	deleted	--
BCI-99	Change in sensitive materials prices	deleted	--
BCI-19	Stock prices, 500 common stocks	none	.031
BCI-106	Money supply, M2	92$*	.293
BCI-129	Interest rate spread, 10-year Treasury bonds less federal funds	added	.310
BCI-83	Index of consumer expectations	none	.017
	Index standardization factor		.654
Coincident indicators			
BCI-41	Employees on nonagricultural payrolls	none	.487
BCI-51	Personal income less transfer payments	adjusted for accruals	.267
BCI-47	Industrial production	none	.134
BCI-57	Manufacturing and trade sales	none	.112
	Index standardization factor		1.000
Lagging indicators			
BCI-91	Average duration of unemployment	none	.040
BCI-77	Inventories to sales ratio, manufacturing and trade	none	.120
BCI-62	Change in labor cost per unit of output, manufacturing	6-month percent change	.067
BCI-109	Average prime rate	none	.250
BCI-101	Commercial and industrial loans	92$*	.118
BCI-95	Consumer installment credit to personal income ratio	none	.211
BCI-120	Change in consumer price index for services	6-month percent change	.194
	Index standardization factor		.825

* All deflators are based on the chain-weighted concept

** See the technical appendix for an explanation of all standardization factors

the middle of each month) for the total United States and its territories, as reported by the Department of Labor. Previously, the initial-claims series excluded Puerto Rico, monthly averages were computed by prorating the weekly data series, and a separate set of seasonal adjustment factors were developed specifically for this series. The changes greatly simplify the calculations, but make little practical difference in the behavior of this component and its contribution to the leading index.

(b) **Building permits** (BCI series 29) will be in millions of new private housing units, which is the same form reported by the U.S. Census Bureau. Presently, the permits are converted to an index series. The change removes a minor degree of imprecision due to rounding effects.

(c) **Manufacturers' new orders, nondefense capital goods industries** (BCI series 27) will replace contracts and orders for plant and equipment (BCI series 20). The new-orders component constitutes about 90 percent of the contracts-and-orders series. Analysis of the excluded portion—contracts for commercial and industrial building (plant) from a nongovernment source (F.W. Dodge)— showed that it is considerably more volatile than the BCI series 27 and it is not a reliable leading indicator on its own. Nonetheless, as cyclical indicators the difference between the two series is relatively small.

(d) Both **manufacturers' new orders, consumer goods and materials** (BCI series 8) and **manufacturers' new orders, nondefense capital goods industries** (BCI series 27) will be put into constant-dollar terms using chain-weighted deflators from manufacturing shipments data (with a base year of 1992) and reported in millions. Presently, the deflators are constructed from producer price indexes, and these two series are reported in billions with some additional rounding.

(e) **Money supply** (BCI series 106) will continue to be based on the Federal Reserve's M2 definition, but will be put into constant-dollar terms using the chain-weighted deflator for personal consumption expenditures (PCE) with a base year of 1992. The M2 deflator is presently constructed from a consumer price index and has a base year of 1987.

Table 2 Timing of the Revised Composite Indexes at Cyclical Turning Points

	Composite Leading Index		Composite Coincident Index		Composite Lagging Index	
Leads (-) or lags (+) at business cycle peaks (months)						
Apr 1960	-11		0	-3*	+3	
Dec 1969	-8	-11*	-2		+3	
Nov 1973	-9		0		+13	
Jan 1980	-15		0		+3	
Jul 1981	-3	-8*	+1		+2	+3*
Jul 1990	-6**	-18*	-1		-9	-8*
Leads (-) or lags (+) at business cycle troughs (months)						
Feb 1961	-3	-2*	0		+9	+6*
Nov 1970	-7	-1*	0		+15	
Mar 1975	-1		0		+18	+21*
Jul 1980	-3	-2*	0		+3	
Nov 1982	-8	-10*	+1		+6	+7*
Mar 1991	-2		0		+21	+36*

* Timing of current version when different from the Department of Commerce peak/trough designations
** -25 for absolute peak in cycle

Four components of the leading index: **average weekly hours, vendor performance, stock prices,** and **index of consumer expectations,** are not being changed.

The components of the coincident index remain the same with one minor change: **personal income less transfers** (BCI series 51) will include an additional adjustment that adds the difference between wage accruals and disbursements, using a series that has only recently been computed and reported by the Bureau of Economic Analysis. The new adjustment removes bonus payments that do not follow a regular pattern and thus cannot be directly captured by seasonal adjustment factors. This change smoothes some large spikes in the personal income data that first appeared in 1992. In essence, this revision makes the series more closely reflect national income and GDP because it associates wage payments closer to the period in which they are earned, instead of when they are received.

In the lagging index, **commercial and industrial loans** (BCI series 101) will use the same chain-weighted PCE deflator as does money supply in the leading index. Also, **labor costs per unit of output** (BCI series 62) and **consumer price index for services** (BCI series 120) will be used in the form of annualized percent changes during a six-month span instead of monthly percent changes that are smoothed using the Canadian filter adjustment. These changes have little effect on the cyclical performance of the two series and the lagging index.

Standardization factors in Table 1 determine how monthly changes in each component contribute to the monthly change in the associated index. These factors are designed to give each component a similar opportunity to contribute to the change in the index in any given month and to equalize the volatility across the composite indexes. The component standardization factors are inversely related to the relative variance of the individual components, and the index standardization factors adjust the leading and lagging indexes to have the same variance in month-to-month percent changes as the coincident index. (See the technical appendix for further detail on how these factors were derived and how they are used in constructing the indexes.)

Turning Points in the New Indexes

Table 2 compares turning points for the new and current versions of the three composite indexes. The revised leading index has a shorter lead time for three of the five cyclical peaks since 1959, but a longer lead at three business cycle troughs. For example, the cyclical peak at 6 months is closer to the economic downturn in 1990 than the 18-month lead from the old version (and a 25-month lead for the new version if the absolute highpoint in the 1983-96 period were chosen). There are no noteworthy changes in the peak and trough dates for the coincident and lagging indexes.

Effects of Revisions in the Leading Index, 1984-96

Chart 1 compares the new leading index with the current version since 1984 because it is important to look at the entire record of the revised leading index, not just lead time before recessions. (Also see the charts on page 5 that illustrate the full history of the current versions of the three composite indexes and the charts on page A3 that illustrate the full history of the revised versions.)

Chart 1 shows that the new leading index has similar cyclical properties to the old series. However, a few differences are noticeable:

(1) The "false signal" given by the decline in the index during 1984 is muted in the revised index.

(2) The revised index provides a more realistic signal of the 1990–91 recession.

(3) The "false signal" given by the decline in the composite index in 1995 is less pronounced in the revised index.

Analysis of the individual effects of the different types of revisions shows that the change in the components is primarily responsible for the lessening of the "false signal" problems in 1984 and 1995. The more realistic and sharper turning point in early 1990 are the result of both the changes in the composition of the index and the revised factors.

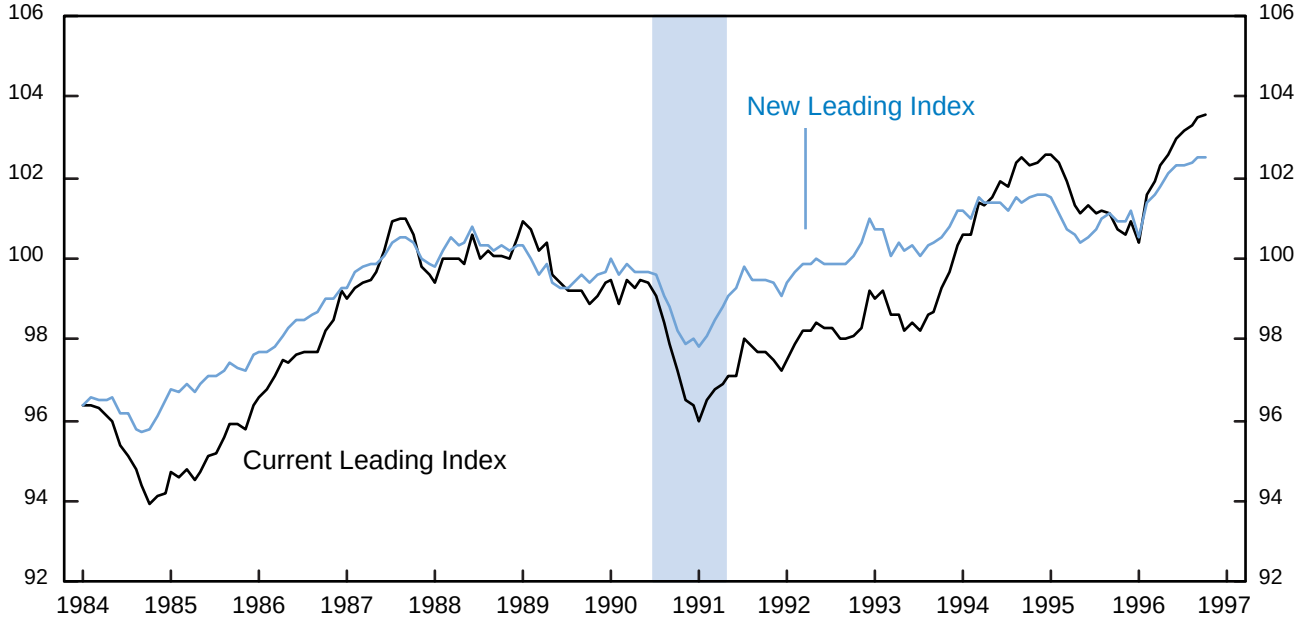
Still, the chart shows that the leading index was relatively flat in the late 1980s and that there is some ambiguity over the peak date before the 1990–91 recession. Therefore, next month's issue of *Business Cycle Indicators* will discuss criteria for determining recession warnings. This will help clarify the relevant issues in interpreting declines in the leading index. In particular, a guide will be provided for using the new leading index to signal turning points in the economy.

Conclusion

Charts of the three composite indexes on pages 5 and 6 and the tables on page 26 use the data series that were reported on December 3 based on the procedures used since The Conference Board assumed their responsibility from the U.S. Department of Commerce in late 1995. In next month's issue, the revised composite indexes will completely replace the current versions.

The preceding explanation of the revisions to the composite indexes is aimed at helping readers make the most efficient use of these economic series. As suggested by a comparison of the historical patterns for the current and revised leading index, the new version should yield more useful warnings of turning points in the business cycle. Caution is still needed, however, because the improvements are relatively modest and no single indicator or index is infallible.

Chart 1 Revisions in the Leading Index



Technical Appendix: Calculating the Composite Indexes

The procedure for calculating the composite indexes has five distinct steps. In the notation below, the "t" and "t-1" subscripts refer to the current and prior month, respectively, and the "x" and "m" subscripts refer to a particular component of the index.

(1) **Month-to-month changes are computed for each component.** If the component X is in percent change form or an interest rate, simple arithmetic differences are calculated: $x_t=X_t-X_{t-1}$. If the component is not in percent change form, a symmetric alternative to the conventional percent change formula is used: $x_t= 200*(X_t-X_{t-1})/(X_t+X_{t-1})$. (See below for details on this formula.)

(2) **The month-to-month changes are adjusted to equalize the volatility of each component.** Standard deviations (v_x) of the changes in each component are computed. These statistical measures of volatility are inverted ($w_x=1/v_x$), their sum is calculated ($k=\sum_x w_x$), and they are restated so the index's component standardization factors ($r_x=1/k*v_x$) sum to one. The adjusted change in each component is the month-to-month change multiplied by the corresponding component standardization factor ($m_t=r_x*x_t$).

(3) **The sum of the adjusted month-to-month changes is computed and an additional adjustment is made to equalize the volatility of composite indexes.** For the coincident index, no further adjustment is made and the monthly (symmetric formula) percent change in the index is the simple sum of the adjusted changes for each component ($i_t=\sum_m m_t$). For the other two indexes, each monthly sum (i_t) is multiplied by an index standardization factor (f) that equalizes the volatility across the indexes. This factor is the ratio of the standard deviation of the percent changes for the coincident index (v_{coin}) to the standard deviation of the unadjusted percent changes for the particular composite index ($f_{lead}=v_{coin}/v_{lead}$, $f_{lag}= v_{coin}/v_{lag}$).

(4) **The level of the index is computed using the symmetric percent change formula.** The first month's value is $I_1 = (200+i_1)/(200-i_t)$. The second month's value $I_2 = I_1 * (200+i_2)/(200-i_2)$ and this formula is used recursively to compute the index levels for each month that data are available.

(5) **The index is rebased to average 100 in 1992.** The history of the index is multiplied by 100 and divided by the average for the 12 months of 1992.

Updating the indexes. Steps 1 through 5 are used to compute the composite indexes for long (historical) periods. The indexes are updated for the latest and previous six months of data using the predetermined factors from the sample period. Revisions in the components that fall outside of the moving six-month window are not incorporated in the index until the entire index is recomputed. (The Conference Board plans to update the sample period and recompute the entire history of the indexes once a year.) Also, when data for a particular indicator are not available, the standardization factors (r_x) for the other components are recomputed that month so that they continue to sum to one. No change is made to the index factor (f).

Computing the component contributions. Steps 2 and 3 can be combined to compute the contributions of each component as $m_t=f*r_x*x_t$.

Changes in procedures. Prior to this revision, average absolute changes were used, instead of standard deviations, to measure the volatility of each component. The remaining procedures follow those developed by the Department of Commerce before the composite index program was transferred to the Board. (For an alternative description, see the *Survey of Current Business*, October 1993.)

Additional technical details

Sample periods. The revised indexes start in 1959, which is the first year that data for all component series are available. Data that were available as of December 5, 1996, were used to compute all of the standardization factors that are reported in Table 1. For the coincident index, the standard deviations that are used to compute the standardization factors are estimated using the sample period: 1959–1995, excluding two unusual months in 1992 when personal income, industrial production, and sales temporarily fell because of a hurricane that hit Florida. For the leading index, two separate sample periods were used: 1959–83 and 1984–1995. For the lagging index, the 1959–95 period was used to compute standard deviations with two adjustments that reflect the fact that BCI series 109 was unchanged between 1959–65 and the two unusual months in 1992 that affected the personal income data used to compute BCI series 95.

Symmetric percent changes. The formula, $200*(X_t-X_{t-1})/(X_t+X_{t-1})$, treats positive and negative changes symmetrically. When it shows a one percent increase followed by a one percent decrease, the level of X has returned to its original value. This is not true with the more conventional formula, $100*(X_t-X_{t-1})/X_{t-1}$ where the same percent increase and decrease would leave X at slightly lower value. The symmetric percent change formula has been used since the public debut of the composite indexes in the late 1960s. Both formulas, as well as a third, increasingly popular alternative based on logarithmic differences, produce very similar cyclical patterns.

Rounding is avoided whenever possible until the final step, when the index is reported at one decimal place. (One exception is the standardization factors, which are calculated to three decimal places.) The final rounding, together with the symmetric percent change formula in step 4, is the reason the rounded sum of the reported contributions from each component does not always equal the simple percent change in the rounded index.

The Newly Revised Leading Index

The Conference Board unveiled revised leading, coincident, and lagging composite indexes in December 1996. The most noteworthy feature of the revisions is the change in the composition of the leading index. One series was added: **interest rate spread, 10-year Treasury bonds less federal funds**. Two series were deleted: **change in sensitive materials prices** and **change in unfilled orders for durable goods**. In addition, minor changes were made to the methods used to calculate certain other component series (primarily, changing the deflators used to calculate constant dollar series). Also, the standardization factors that translate movements in the components into movements in the indexes were adjusted to be consistent with the other changes.

The December 1996 issue of this publication provided details on the changes, including a comparison of cyclical turning points for the new and old leading indexes. This issue discusses how the new leading index might be used to anticipate recessions, and examines the recent historical performance of the new leading index in more detail. The analysis also tries to explain why the change in the composition of the leading index is expected to improve its performance as an indicator of future economic activity.

Forecasting Recessions With the New Leading Index

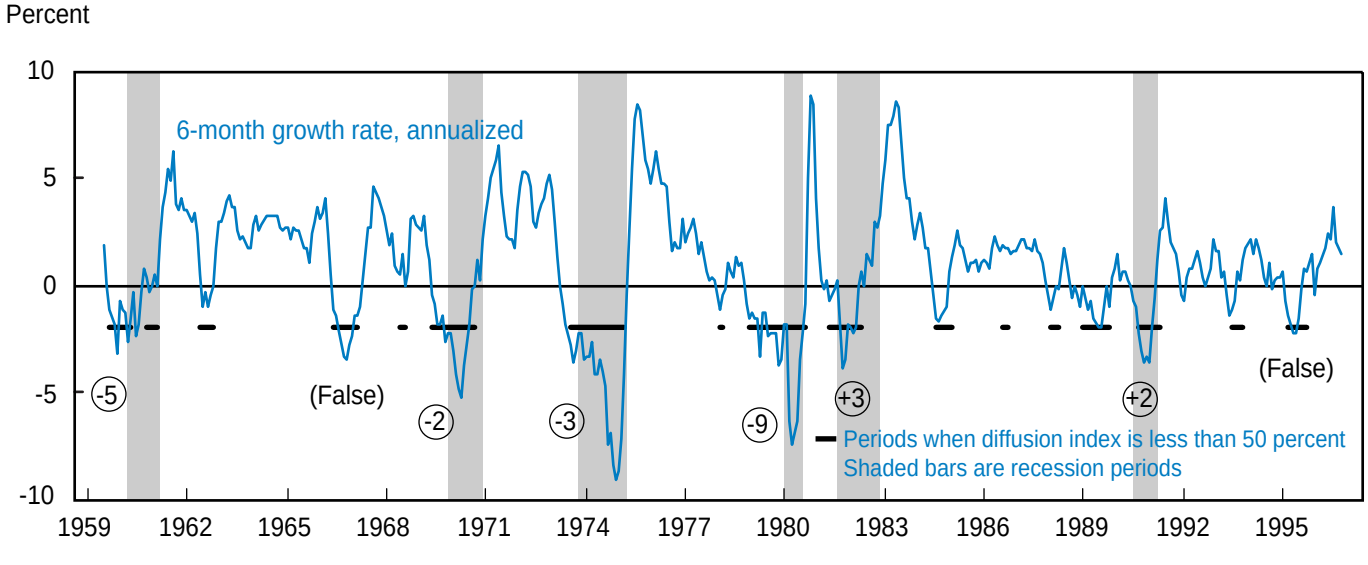
Followers of cyclical indicators are keenly aware of the difficulty of differentiating between a "false signal" and a "real" or accurate prediction of recession. The long-standing rule of thumb that three consecutive monthly declines in the composite leading index forewarns a recession has not proven dependable. It has given at least one false signal during six of the past eight expansions. This simple rule misfires too often because it overreacts to short-run movements in the leading index. Experienced users of leading indicators understand the importance of analyzing the index and its components in a more pragmatic manner, and especially of analyzing movements across a span of more than three months.

A downward movement in the **composite index of leading indicators** of 2 percent (annual rate) or more over six months, coupled with declines in the majority of the component series, is needed before a recession warning can be considered reliable. To illustrate the historical performance of a recession-warning rule consistent with these principles, Chart 1 shows six-month percent changes (in blue, annualized) in the new leading index along with a disjointed line (in black) that denotes periods when more than half of its component series were falling (i.e., the diffusion index was below 50 percent). The chart shows that a recession has usually just begun or is about to begin when the following two criteria are met (simultaneously, across a six-month span): (1) the annualized rate of change in the leading index falls below -2 percent, and (2) the diffusion index is below 50 percent.

The circled numbers in the chart denote the lead time of the warning before each of the past six recessions. The average is a lead of 2 months, compared with an average lead time of more than eight months for peaks in the leading index (see Table 2 in last month's issue). However, it usually takes more than six months, and sometimes years, to determine that a peak has occurred in both the leading index and the general business cycle. Also, peaks—defined as the high point in a particular time span—are sometimes greatly affected by revisions in data (an example is discussed below). In day-to-day use, a more systematic approach like the kind used in Chart 1 is needed when trying to anticipate the onset of a recession.

During the 1959–95 period, using the double criteria mentioned above yields two false signals of recession—one in 1966,

Chart 1 Leading Indicators—Composite Index, Diffusion, and Recession Signals



Source: The Conference Board

The historical performance of the new leading index suggests that future false signals will be minimized. Its true test, however—whether it can predict a recession in real time—will have to wait: The recent upward movement of the new leading index and a rise in a majority of its components signals economic expansion well into 1997.

and then briefly in mid-1995. In contrast, similar analysis using the old leading index showed false signals in 1963, 1966, 1984, 1988, and 1995. (See the May 1996 issue of *Business Cycle Indicators* for the old version of Chart 1.)

In two cases—the 1981–82 and 1990–91 recessions—both criteria were met after the economic downturn had begun, demonstrating that the leading index, and the cyclical indicator approach in general, sometimes tells you where you're going only about the time you get there. In fact, this is true for all analytic approaches, as was again demonstrated by both the 1981–82 and 1990–91 recessions, which surprised virtually all forecasters.

A pragmatic cyclical indicator approach would use the leading index and the double criteria discussed above, but would not rely entirely upon it. Most important, this type of analysis can provide an earlier signal of a turn in the economy than other approaches. (A word of caution: Future issues of this publication will discuss how in some historical analyses, like the kind in Chart 1, the performance of the leading index and other indicators might be overstated because they are based not upon data available at the time, but upon revised, and presumably more accurate, data.)

Comparing the New and Old Leading Index, 1984–1995

Although declines in the leading index in 1984 and 1995 were not followed by recessions, the declines seen in the new index are muted when compared with the old version (see the top chart on page 5). The old index showed a 2.5 percent decline from its high point in 1984 and a 2.6 percent decline from its high point in 1995; in the new version, these declines were 0.9 and 1.2 percent, respectively. Therefore, the new leading index offers an improvement over the old version because it seems to differentiate slowdowns in the economy from full-fledged recessions—a development that can be traced directly to the change in its composition.

Except for the most recent cycle, there is little difference between how far in advance the old and new leading index turned down before each of the past six recessions (see last month's issue for details). During 1988–1990, the specific month that should be designated as the cyclical peak is ambiguous, mostly due to the general flatness in the leading indicators, and therefore the leading index, in those years. (See the top panel on page 5 and charts of the individual series on pages 7 and 8.)

For the newly revised leading index, the absolute high point during the cyclical expansion, which occurred in June 1988, is an obvious candidate. Historically, however, the leading index has a very slow long-term uptrend—only about one-third as fast as the overall economy—because many of the components show either little or no long-run trend.

If the leading index were adjusted so that its trend was the same as either GDP or the coincident index, the absolute peak would occur much later than the middle of 1988. Specifically, a trend-adjusted leading index would peak close to January 1990, which is the month that The Conference Board has designated as the new leading-index peak associated with the 1990–91 recession.

The Leading Index in 1996

The old and new leading indexes both show clear upward trends in the first 10 months of 1996. The old leading index advanced more steadily than the new index, perhaps as a correction to its sharp decline in 1995. In any event, the recent upward movement of the new leading index, coupled with a rise in a majority of its components during the past six months, justifies a belief that the current economic expansion will continue at least into the first half of 1997.

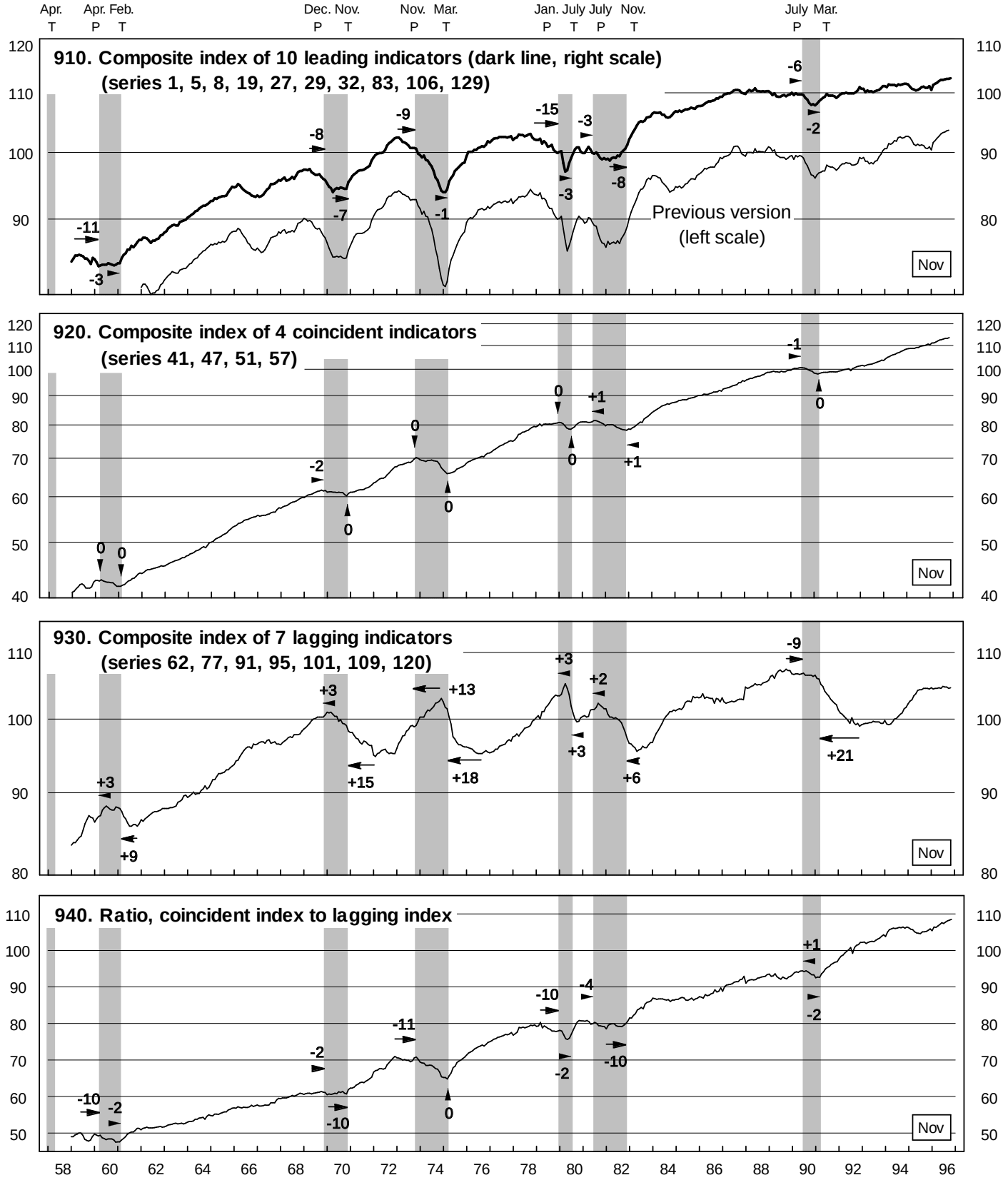
Conclusion

This issue reports on the historical performance of the new leading index, which seems to differentiate slowdowns in the economy from true recessions better than the old leading index. Hopefully, this tendency will persist and false signals from the new leading index will henceforth be minimized.

The true test of the new leading index—whether in day-to-day use it can anticipate an economic downturn—will have to await the next recession. The current economic expansion seems healthy enough to continue well into 1997, and The Conference Board will be happy to wait as long as possible for this test.

CYCLICAL INDICATORS

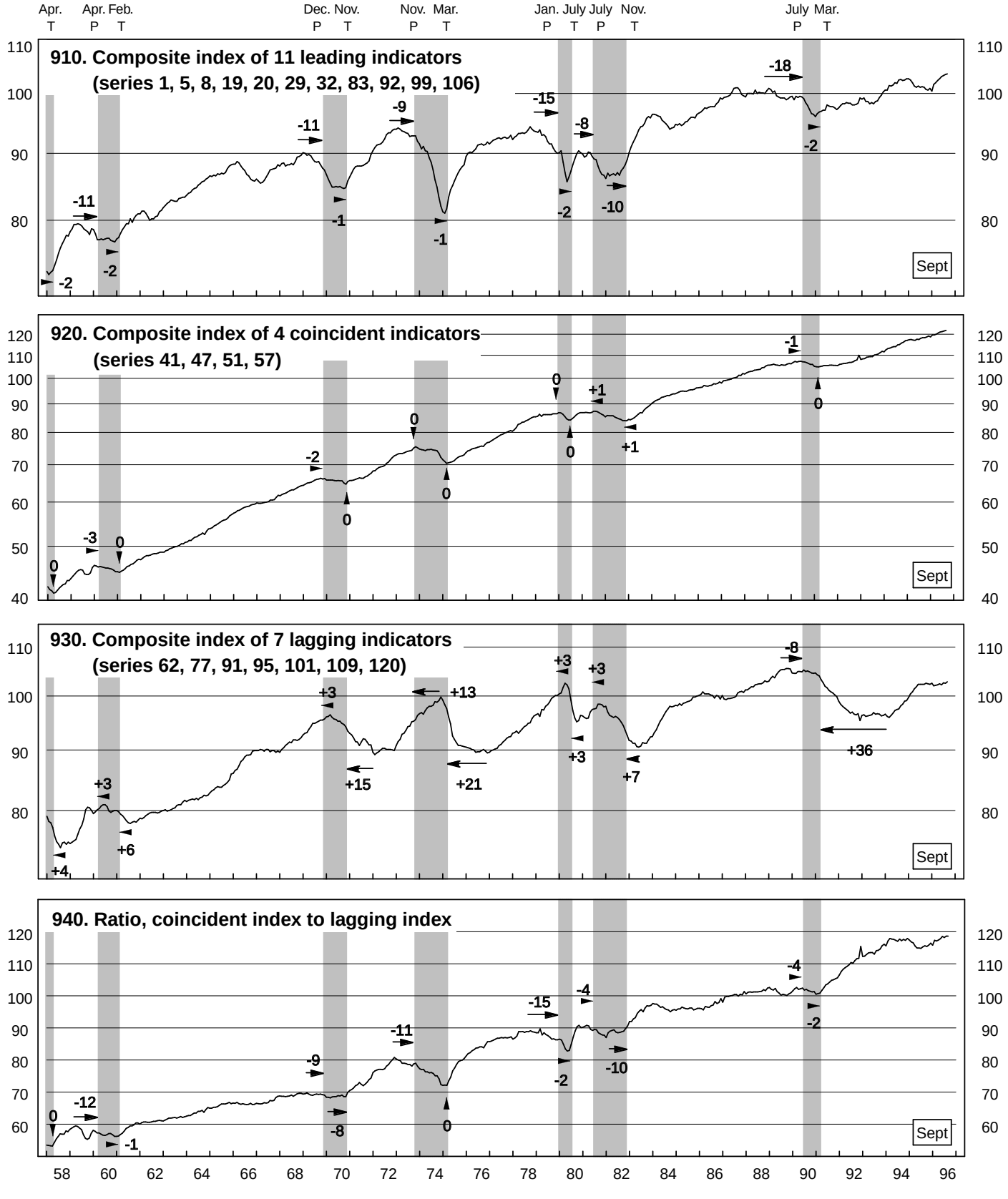
COMPOSITE INDEXES



Note — Series 910, 920, 930, and 940 are plotted on a ratio scale.

CYCLICAL INDICATORS

COMPOSITE INDEXES



Note — Series 910, 920, 930, and 940 are plotted on a ratio scale.

Predicting Growth With the Leading Indicators: The Composite Versus the Diffusion Index

The composite leading index summarizes movements in 10 economic series that have historically led turning points in the general economy. As an average of individual leading indicators, the composite smoothes much of the idiosyncratic volatility of its components, while retaining common movements. Thus, it presents a clearer and more convincing picture of the likely direction of the economy than any individual series. Still, the **composite leading index** can be overly influenced by large movements in individual series. The **diffusion index of 10 leading indicator components,** which measures the proportion of the indicators that are rising, provide a complementary source of useful information about the business cycle.

Last month's issue of *Business Cycle Indicators* discussed the performance of a recession-warning system that uses both the composite leading index and the corresponding six-month diffusion index for the leading indicators. This issue explores the value of this diffusion index, relative to the composite index, for predicting growth in the general economy.

Diffusion Indexes Versus Composites

By construction, diffusion indexes show how widespread a particular movement among a group of indicators has become. The BCI database includes diffusion indexes for two different time spans—one month and six months—for the components of the leading, coincident, and lagging indexes and for employment in 356 industries. (The first three diffusion indexes are constructed by The Conference Board as part of the *Leading Economic Indicators* news release, while the employment-based diffusion indexes are reported by the Bureau of Labor Statistics.) Six-month diffusion indexes provide much more reliable signals of turning points than one-month indexes, which tend to be very erratic.

Composite indexes are constructed from the month-to-month changes in their individual components (see the December 1996 *BCI* for details on the methodology). Even when composite and diffusion indexes are based on the same components, they can provide independent information. Indeed, they sometimes move in opposite directions. Also, diffusion indexes, unlike composite indexes, do not differentiate between small and large increases (or decreases) in the underlying data. Thus, composite indexes are much more sensitive to the size of the movements in the individual components.

Last month's *BCI* offered a turning-point rule, in which a 2 percent annualized decline in the composite leading index coupled with a fall in the six-month diffusion index to less than 50 percent sounds a recession warning. Although this rule is not foolproof, it is much more reliable than the oft-quoted rule that a recession is signaled by three consecutive monthly declines in the leading index. The latter criterion has given numerous false signals over the years.

Predicting Growth With Both Types of Indexes

The charts on the top of page 6 show that movements in the leading index tend to foretell movements in the coincident index. A graphical comparison of the six-month rates of change suggests that the lead is strongest in the 2–4 month range. (The September 1996 *BCI*, which used old versions of the indexes, demonstrated that a short lead time matches the general cyclical patterns of the two series. The results for the newly revised versions show a similar pattern.)

The charts on page 6 also show that the six-month diffusion index for the 10 leading indicator components leads changes in the coincident index. However, a full objective comparison of the predictive ability of the diffusion index, especially relative to the leading index, is difficult to perform with charts alone. Therefore, Table 1 explores the predictive power of both the composite leading index and the corresponding diffusion series using a statistical measure of fit called R-square. R-square measures the percent of the variance of the forecasted variable (monthly percent changes in the coincident index, in this case) that can be "explained" by movements in the leading series. It is analogous to measures of correlation between two variables, but more useful when applied to forecasting equations that have distinct explanatory variables and a predicted variable. R-square would equal one if the equation was perfect in its fit, less than one and more than zero in intervals where there is a useful but less-than-perfect fit, and is close to or equal to zero in the intervals where the equation is relatively useless.

Table 1 tabulates R-squares for leads of one to twelve months and different explanatory variables constructed from the two types of leading indexes (see the table notes for details). Although this exercise is based on simple correlations and is not a substitute for more complex forecasting equations and tests, it is helpful in determining the best lead times for the two series and comparing their relative performance as predictors of the pace of economic expansion.

Table 1 shows that R-square is considerably higher when either percent changes in the composite index or the level of the diffusion index is measured for a six-month time span. For example, R-squares for the forecasting equations that use one-month percent changes in the leading index are in the .06–.12 range for lead times of 1–4 months. R-squares rise to the .16–.20 percent range when percent changes in the leading index are measured over a six-month span. This finding confirms the view held by many economists that one-month movements in the leading index need to seen in the context of movements over the past few months before reliable conclusions can be drawn.

The table also shows that the composite index is a better predictor than the diffusion index for almost all lead times when a six-month span is used. On the other hand, when a one-month span is used, the diffusion index fits better than the composite index in the 5–9 month range. The differences in R-squares for forecasting equations that use either the diffusion or the composite index are not great, however. This is not surprising because the contemporaneous correlation between the percent changes in the leading index and the level of the diffusion index is high—around 85

Table 1 Fit of Forecasting Equations Using the Composite and Diffusion Leading Indexes

	One-Month span			Six-Month span		
Lead	Diffusion Level	Composite Pct. Change	Both	Diffusion Level	Composite Pct. Change	Both
1	0.041	0.060	0.060	0.149	0.199	0.199
2	0.099	0.116	0.119	0.151	0.201	0.201
3	0.071	0.098	0.098	0.139	0.178	0.178
4	0.111	0.117	0.124	0.143	0.160	0.164
5	0.034	0.032	0.036	0.139	0.143	0.150
6	0.061	0.045	0.062	0.151	0.148	0.160
7	0.062	0.044	0.062	0.126	0.139	0.143
8	0.067	0.055	0.068	0.115	0.125	0.129
9	0.068	0.054	0.068	0.090	0.094	0.098
10	0.073	0.075	0.080	0.067	0.075	0.076
11	0.049	0.048	0.053	0.045	0.044	0.048
12	0.022	0.040	0.041	0.031	0.032	0.034

Table entries are R-square (R^2) statistics for forecasting equations in the form

$y_t = a + b\ x_{t-k}$

y_t is the predicted or dependent variable

x_{t-k} is the explanatory or independent variable, with k being the lead time

R^2 measures the percent of the variance in the y_t variable that is explained by the forecasting equation with the a and b coefficients fit by regression methods that maximize the R^2 value (for a given x_t series). For the columns labeled "Both," there are two x variables with separate b coeffecients. The sample period was 1959–1996.

percent—regardless of whether a one-month or six-month span is used.

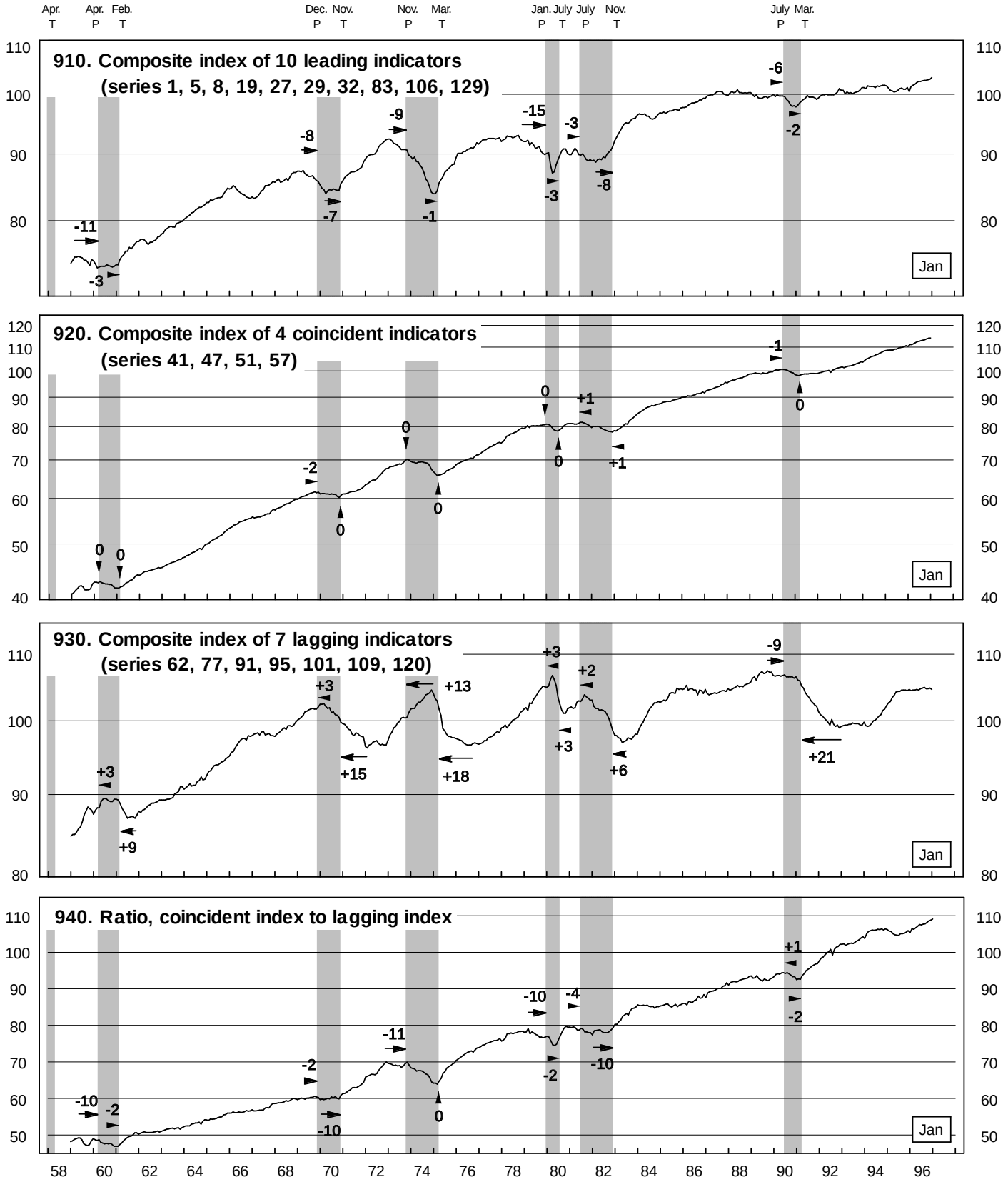
The other major finding—that there is little additional value in using both series to predict growth—may surprise some. The table shows quite clearly that correlations constructed from a forecasting equation that uses both the composite and diffusion indexes are barely higher than the correlation from using only one series to predict growth in the coincident index.

Conclusion

Changes in the leading indicators—as measured by the composite leading index, which is sensitive to the size of the movements in the individual components, or by a diffusion index, which simply counts the proportion of components that are rising—are correlated with future rates of growth. Users of the leading indicators and the associated indexes should be aware, however, that the out-of-sample performance of a particular model or approach is often much worse than the in-sample performance. More sophisticated forecasting models that make use of the individual components of the leading index as well as alternative leading indicators are likely to perform much better than a model that relies solely on composite and diffusion indexes.

There are some conclusions from Table 1 that are likely to hold up in more sophisticated analysis. First, the forecasting performance of the leading index is best at a lead interval of less than six months. This contrasts with the oft-heard statement that the leading index forecasts the economy 6 to 12 months in the future; its performance is strongest at much shorter leads. Second, percent changes over a six-month span are much more informative than percent changes in a single month. Although analysis over a longer time frame confounds the desire to quickly identify changes in the pace of economic activity, it is needed for the sake of reliability. Third, when predicting economic growth, the diffusion index does not provide much additional information beyond that obtained from the composite leading index. Even though the diffusion index for the leading indicators is useful in a recession-signaling rule, it does not reflect the more subtle movements in the pace of economic activity that would be required for it to add much to a forecasting equation that already includes the composite index.

COMPOSITE INDEXES

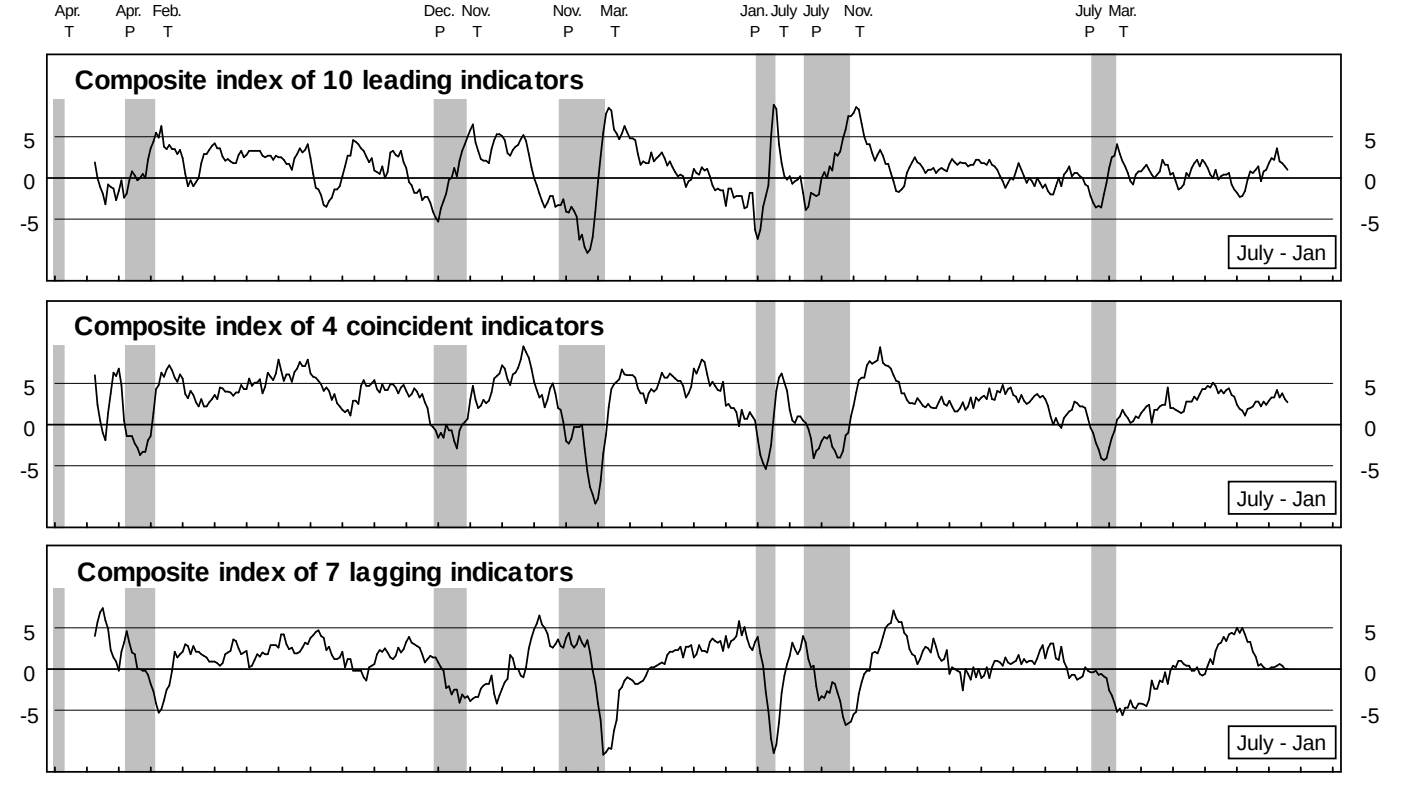


Note — Series 910, 920, 930, and 940 are plotted on a ratio scale.

CYCLICAL INDICATORS

COMPOSITE INDEXES: Rates of Change

Percent change over 6-month span, annual rate



COMPOSITE INDEXES: Diffusion

Percent of components rising over 6-month span