The information content of composite indicators of the euro area business cycle

A number of public and private institutions have constructed composite indicators of the euro area business cycle. Composite indicators combine a variety of individual economic variables into a single indicator. The institutions use such indicators to summarise information on general developments in economic activity that stem from different sources, to identify turning points in the business cycle and, sometimes, to make short-term forecasts of growth in economic activity. This article briefly illustrates the techniques commonly used for constructing composite indicators and, in particular, assesses the information content of such indicators with regard to the euro area business cycle. The article concludes that, although composite indicators might be used as an additional tool for conjunctural analysis, they cannot replace a thorough assessment of individual indicators of cyclical developments. In particular, composite indicators, by construction, hide the pattern of individual variables which provide essential information as regards the driving factors behind developments in activity. A detailed analysis of individual indicators is therefore necessary for an in-depth assessment of current developments in, and short-term prospects of, economic activity.

1 Introduction

Under its monetary policy strategy, the ECB analyses a broad range of indicators to assess the outlook for future price developments. Analysis of conjunctural developments plays an important role in this assessment. In this context, it might also be useful to consider composite indicators of the euro area business cycle as one additional input to the analysis. A number of public and private institutions have developed such indicators. These institutions use composite indicators for three different purposes: first, as a summary indicator of the general development in economic activity; second, as a tool for identifying turning points in the business cycle; and, third, as a device for making short-term forecasts of economic growth.

However, by construction, composite indicators are not a substitute for a more thorough analysis of individual indicators of developments in economic activity. In contrast to macro-econometric models, they do not appeal strongly to theoretical relationships and are therefore not suitable for scenario analysis and the assessment of medium to long-term prospects. Moreover, being summary indicators, composite indicators conceal the specific pattern of individual variables which must be analysed in order to obtain a more complete insight into the driving factors behind current and short-term changes in economic activity and thereby into likely developments in a more medium-term perspective.

In the light of these considerations, this article first describes the methods commonly used by public and private institutions for constructing composite indicators. Thereafter, the potential information content of composite indicators with regard to the euro area business cycle is examined.

2 Defining the business cycle

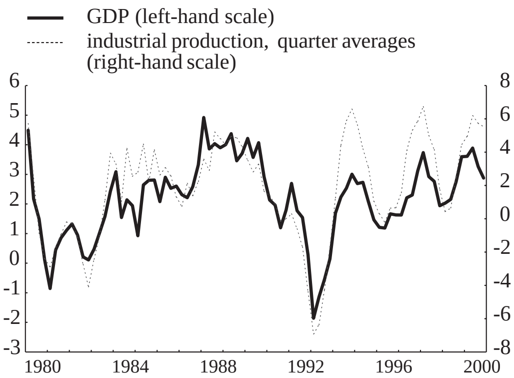
Composite indicators refer to developments in the business cycle. Commonly, a reference business cycle is used to assess the properties of a particular composite indicator. However, no general agreement exists with respect to which series should be chosen as representative of the business cycle. The first question to be addressed is thus: what could be defined as the reference business cycle?

Business cycles may be defined as broad-based recurrent medium-term fluctuations in economic activity. In principle, a range of indicators can be taken into account when identifying the business cycle, including variables such as employment, income and trade as well as output. However, within the framework of composite indicator analysis, attention is usually limited to the volume of industrial production or to real GDP as reference series. Industrial production data have the advantage of being available on a monthly rather than a quarterly basis. Industrial production, however, accounts for only about a quarter of the total economy in the euro area. GDP, on the other hand, is a more comprehensive variable and therefore ultimately more relevant for analysing economy-wide fluctuations. As is shown below, the choice between euro area industrial production and GDP may not be decisive, as the cyclical patterns of the two series have been very similar. For the purpose of this article, data on both GDP and industrial production excluding construction (henceforth referred to as "industrial production") for the euro area as a whole have been used. The sample is limited to the period from 1980 to 2000, as statistics are not generally available for earlier years.

Chart 1

Euro area GDP and industrial production

(year-on-year growth)



Sources: Eurostat and ECB calculations.

In practice, in the context of composite indicators, actual year-on-year growth rates in the reference series rather than estimates of the business cycle derived from statistical or econometric methods are most often used for making inferences about recent cyclical developments. Quarter-on-quarter growth rates normally signal cyclical changes in a more timely manner than year-on-year growth rates. However, the larger volatility of quarter-on-quarter growth rates makes them more difficult to track by composite indicators, which might explain the focus on year-on-year growth rates. This implies that a more detailed analysis is warranted for assessing cyclical changes in a more timely manner. For the dating of (historical) turning points, more rigorous methods are normally applied to determine the cycle (see also Box 1 "Determination of the reference business cycle"). Chart 1 shows that developments in the growth of GDP and industrial production in the euro area appear highly synchronised. However, the relative sizes of peaks and troughs in GDP and those in industrial production have varied in the past, depending in particular on the nature of the shock at the origin of the cyclical developments.

Box 1

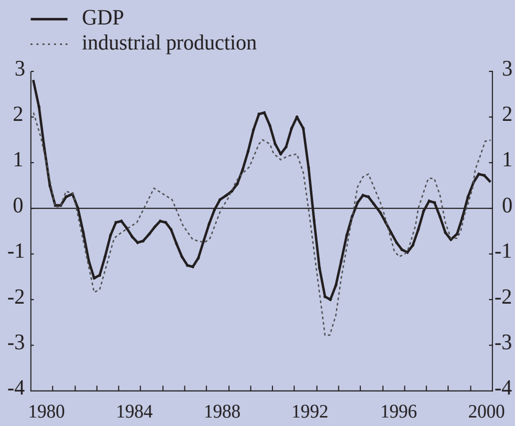
Determination of the reference business cycle

'The' business cycle is a theoretical concept, with no commonly agreed upon empirical identification method. Time series of aggregate economic activity may be decomposed into four components: a trend, a cycle, seasonal fluctuations, and an irregular term. The cycle is found by elimination of the seasonal component, the trend, and the irregular term. As these different components are not directly observable, they will vary with the method of decomposition used. Often, however, it is found that the results of composite indicator analysis do not depend decisively on the method chosen to determine the cycle in the reference series.

Among the different possible decomposition methods, the “band-pass filter”, as proposed by Baxter and King[1], has been applied in this box. The band-pass filter eliminates a very slow-moving trend component and very high-frequency (irregular and seasonal) components, i.e. only fluctuations within a specific frequency band are retained and are considered as corresponding to the cyclical developments. Following the standard approach, the band is defined as follows: the minimum duration of the business cycle is imposed as 18 months (6 quarters), so as to eliminate irregular and seasonal components, while fluctuations longer than 96 months (32 quarters) are attributed to long-term trend changes. The turning points in the cyclical pattern of the reference index are determined with the commonly applied method developed by Bry and Boschan.[2] This method was initially devised for monthly data and has been adapted for the quarterly series on GDP. It essentially smoothes the cyclical component of a series and discards spurious cycles on the basis of rules regarding the minimum duration of the cycle. The chart and table below show the business fluctuations and the associated turning points determined using the above-mentioned methods.

Euro area business cycle fluctuations

(de-trended series, normalised data)



Sources: Eurostat and ECB calculations.

Turning points

(determined by Bry and Boschan algorithm)

	Industrial production	GDP
Trough:	December 1982	1982 Q4
Peak:	-	1984 Q1
Trough:	-	1984 Q4
Peak:	August 1985	1985 Q4
Trough:	October 1987	1987 Q2
Peak:	August 1990	1990 Q3
Trough:	-	1991 Q2
Peak:	-	1992 Q1
Trough:	June 1993	1993 Q3
Peak:	April 1995	1995 Q1
Trough:	November 1996	1997 Q1
Peak:	February 1998	1998 Q1
Trough:	November 1999	1999 Q1
Peak:	August 2000	2000 Q2

There is, however, one major drawback to using de-trended series as reference series. Whatever the technical method chosen, the estimation of the cyclical component is less reliable towards the end of the sample period. Data both before and after a given date are needed to estimate the components at this particular date. This poses problems at the beginning and at the end of a series. One possible solution is to discard estimates of the business cycles at the beginning and the end of the sample. However, analysts are usually interested in the most recent developments. The common way of dealing with this problem is to extend the original series backwards and forwards by way of estimation and forecasting. This, however, implies that the estimated cycle at the end of the series is subject to revisions as new information becomes available which may differ from the forecast values, a major drawback for practical purposes. Therefore, de-trending methods are best suited for analysis of historical cyclical developments. For composite indicators, where the focus is on the most recent developments, actual growth rates are often used to remove the upward trend movement and extract cyclical variations. The implicit underlying assumption is then that the trend component grows at a constant pace.

1 *Baxter, M. and R. G. King (1999), “Measuring business cycles: approximate band-pass filters for economic time series”, The Review of Economics and Statistics, 81(4), pp. 575-93.*

2 *Bry, G. and C. Boschan (1971), “Cyclical analysis of time series: selected procedures and computer programs”, NBER, Technical Paper No. 20.*

3 Constructing composite indicators

Composite indicators are constructed by combining a number of series into a single indicator. Composite indicators are said to be "leading" when they provide information about future cyclical developments. When indicators reflect the current situation, they are labelled "coincident" indicators. Several arguments are commonly put forward to defend the use of composite indicators in addition to the analysis of the individual constituents. First, different economic variables sometimes provide different signals as regards current or future growth developments. Different kinds of shocks may cause these divergent patterns as they affect the various sectors of the economy to differing degrees and at different moments in time. Several individual series covering different aspects of the economy might therefore be combined into a composite indicator to provide a summary indicator. A second argument relates to the fact that, statistical effects, such as measurement errors, calendar effects or base effects, may account for the latest readings of various series pointing towards different developments, thereby making an overall assessment more difficult. To the extent that these variations and errors are independent, they would cancel one another out in a composite index, the pattern of which would thus be less erratic and easier to read. Composite indicators might therefore appear a convenient tool at first sight. However, it should be borne in mind that composite indicators, once constructed, aggregate information in a predefined manner. This impairs their usefulness in practice and may be misleading, as specific developments of different economic variables at different moments in time drive overall economic developments. Therefore, summary indicators cannot replace a thorough examination of underlying developments and the analysis of individual indicators remains essential for a reliable assessment of the current and near-future developments.

To compile their composite indicators, public and private institutions generally select a small number of constituent series on the basis of criteria of both a statistical and an economic nature.[3] As regards statistical criteria, first, in order to be confident about the relationship between a particular variable and the business cycle, sufficiently long time series are needed. Second, time series should be subject to as small revisions as possible. Large revisions are detrimental to indicators, as early estimates cannot be relied upon. Third, limited volatility is important, so as to avoid false signals from the latest readings. Fourth, timeliness is essential in view of the provision of early information. Candidate indicators must "lead" the reference series, taking into account both econometric lead times and publication schedules. Some series are published well in advance of the reference series, and therefore gain in terms of timeliness.

As regards criteria of an economic nature, it should be noted that constituent series of composite indicators are chosen mainly on empirical grounds, i.e. on the basis of their observed behaviour vis-à-vis the reference series, rather than on the basis of economic theory. However, usually it is required that the leading properties of variables are economically plausible, i.e. only those variables whose observed relationship with the business cycle is in line with economic theory are selected. Constituent series might have leading properties for several reasons. First, candidate series may report developments in factors which have caused

3 *In two recent contributions to academic literature on composite indicators, Forni et al. (2000, 2001) propose a new way of computing coincident and leading indicators of economic activity, using a large number of constituent series. However, this method has thus far not been applied by public and private institutions for their published indicators. Forni, M., M. Hallin, M. Lippi and L. Reichlin (2000), "The generalised factor model: identification and estimation", The Review of Economics and Statistics 82(4), pp. 540-554, and (2001), "The generalised factor model: one-sided estimation and forecast", mimeo.*

or influenced upturns and downturns in the past. For instance, large and protracted movements in oil prices have tended, in the past, to have a significant impact on economic activity. In that sense, the indicator approach reflects some of the relationships between economic series which are embedded in macro-economic models. Second, some economic series, such as production orders, refer to the situation at an early stage of the production process of the relevant sector of activity. Third, other variables may reflect expectations about developments in activity. For instance, stock prices are thought to reflect expectations about future profits and to some extent about future economic activity.

When constructing composite indicators, public and private sector institutions typically draw from data sets including survey data of business and consumer confidence, indicators of domestic and foreign economic activity, and monetary and financial variables.

Usually, the selected constituent series are normalised and synchronised. Normalisation adjusts for the fact that not all the basic indicators exhibit cyclical fluctuations of the same amplitude. It thus prevents the selected constituents with stronger fluctuations from unduly dominating the composite indicator. Synchronisation then adjusts for the different leads of the constituents. This causes the indicators to coincide on average, making the cyclical pattern of the composite indicator clearer than it would be without synchronisation. The lead of the composite indicator is restricted to the lead of the constituent series with the shortest lead. Different possibilities may be envisaged to measure the relative leads of the constituent series, and none is invariably superior to the others. Moreover, measured lead times may not be stable over time. Therefore, the choice made on how to synchronise the constituent series is to some extent arbitrary.

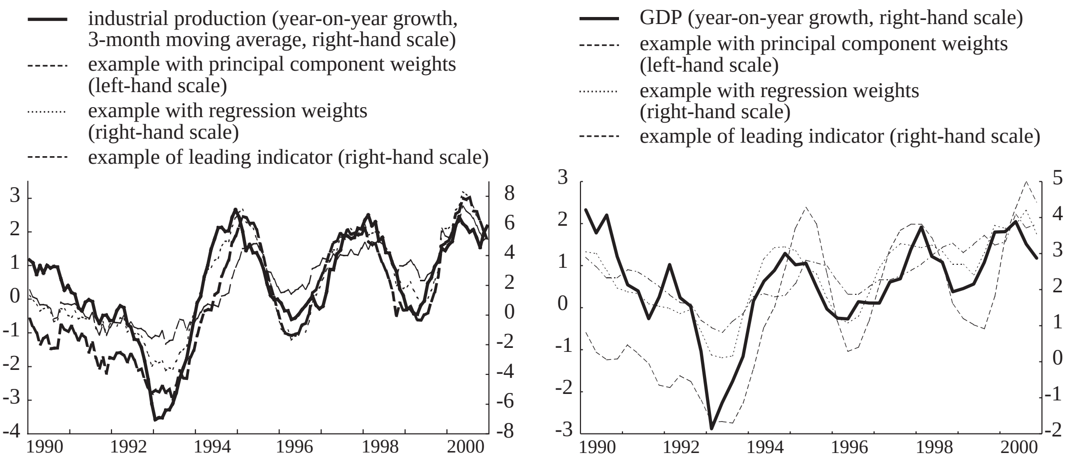
The determination of the weights attributed to constituent series in composite indicators does not appeal to economic theory. The weights can be defined either arbitrarily or on a statistical basis. Two frequently used statistical methods are illustrated here. One method named "principal component analysis" relies on the idea that the fluctuations of each series reflect two elements, namely fluctuations common to the group of variables, on the one hand, and variable-specific developments, on the other. The first part, the so-called first "principal component" can be deemed to represent developments in the business cycle. The smaller the variable-specific component, the higher the weight attributed to one constituent. In this method, weights are attributed on the basis of the behaviour of each individual variable vis-à-vis the group of constituent series, independently of the chosen reference series. By contrast, a second method, "regression analysis", exploits the behaviour of a single variable vis-à-vis both the group of constituent series and the chosen reference series. With this method, an individual series is given a higher weight if its development more closely reflects those of the reference business cycle. In that sense, regression analysis may be seen as appealing to economic relationships between the reference business cycles and the constituent series, reflecting these to the extent that they are borne out by the data, while principal component analysis is a purely statistical method.

In order to shed some light on the contribution available composite indicators might be able to make to analysing the euro area business cycle, examples of various composite indicators are constructed here, using the standard methodologies described above. The composite indicators draw from a set of constituent series such as those frequently used by public and private institutions. Although data for individual euro area countries are often used as well, since they cover a wider range of variables, the data used here relate to the euro area as a whole. Here, the constituent series comprise: euro area industrial confidence as published in the EC Business Surveys, industrial production in the non-euro area

Chart 2

Illustrative composite indicators

Vis-à-vis year-on-year growth in industrial production *Vis-à-vis year-on-year growth in GDP*



Sources: Eurostat, OECD and ECB calculations.

OECD countries, the leading indicator published by the OECD for OECD countries outside the euro area, a euro area monetary aggregate in real terms, and a measure of the euro area yield curve. Industrial confidence has a shorter lead than the other series and is thus restricting the lead of any indicator using it. Therefore, some composite indicators which do not include industrial confidence are also constructed. These combinations are labelled leading indicators, while the composite indicators which include industrial confidence are referred to as examples of coincident indicators. Some examples, after synchronisation with the respective reference series, are shown in Chart 2.

4 Usefulness as a summary indicator

Commonly, the first purpose of a composite indicator is to summarise the information of individual indicators so as to reflect the general development in economic activity. The extent to which a variable reflects the cyclical pattern of the reference series is examined in two ways here, using so-called maximum correlations and Granger causality tests. The results are shown in Table 1.

The maximum correlation coefficient refers to the correlation between the reference series and the composite indicator over the whole sample period, with the composite indicator lagged by a number of months or quarters so as to maximise the correlation coefficient. The magnitude of the correlation coefficient indicates how closely the composite indicator concerned follows the cyclical pattern of the reference index. The indicators constructed with regression weights perform better than the indicators with principal component weights in this test, especially in the case of GDP as a reference cycle. The lead refers to the "effective lead", i.e. taking into account publication schedules as well as results of correlation analysis. Indeed, constituent series are generally released in a more timely manner than industrial production and GDP data. The value of composite indicators in a given month or quarter can therefore be computed before industrial production and GDP data for this period become available. The examples illustrated here are at least coincident. The results show that the coincident indicators dominate the leading indicators in terms of maximum correlation

Table 1

Correlations and Granger causality

	Maximum correlation over the whole sample	Effective lead	Granger causality
Vis-à-vis year-on-year growth in industrial production			
Coincident	0.8	1-3 months	One way
Leading	0.7	8 months	One way
Vis-à-vis year-on-year growth in GDP			
Coincident	0.6 -0.8	0-1 quarter	One way or not significant
Leading	0.7	5 quarters	One way

Source: ECB calculations.

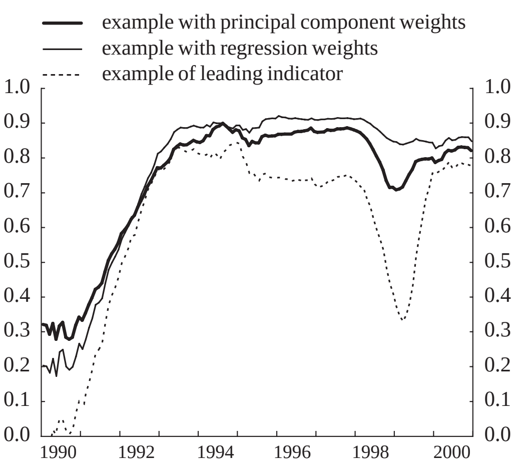
coefficients. This points to the importance of looking at coincident indicators to receive confirmation (or not) of signals given by leading indicators.

Not only is the performance over the entire sample period important, but also the stability of the relationship. In order to test for stability, a rolling correlation may be performed, i.e. a correlation is calculated over a window of specific length (here, a five-year period), rather than over the whole sample, and with the starting date of the window moved by one month or one quarter at a time. The stability in the correlation computed over these five-year time spans is an indication of the stability of the relationship between the composite indicator and the reference series. The results for the example composite indicators used here are shown in Chart 3. There is a clear dip in the moving correlations around 1990. However, during the 1990s as a whole, most indicators appeared to be relatively well behaved, although more so for industrial production than for GDP. Moreover, moving correlations of the coincident indicators are dominating those of the leading indicators, thus

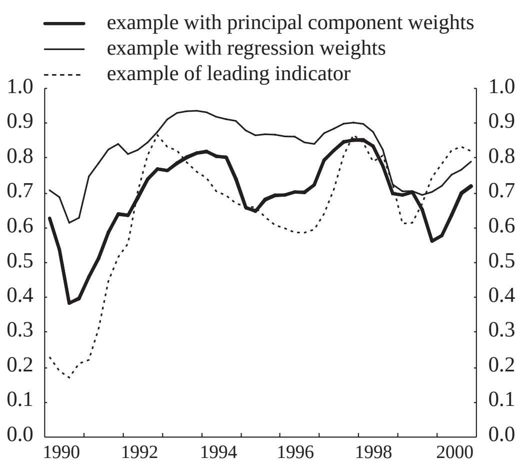
Chart 3

Moving correlation of the composite indicators over five-year windows

Vis-à-vis year-on-year growth in industrial production



Vis-à-vis year-on-year growth in GDP



reinforcing the point made above about the importance of looking at coincident indicators.

A large number of economic variables generally move relatively slowly. This implies that the current and short-term developments in a series can be at least partially inferred from recent developments in the series itself. The Granger causality test assesses whether, in addition to the past values of a reference series, the past values of a composite indicator help to improve predicting the current value of the reference series. This test is performed in two directions, i.e. it is also calculated whether the reference series would help to explain the behaviour of the composite indicators. Ideally, a composite indicator would have predictive power for the reference series and not vice versa. If this is the case, it can be said that changes in a composite indicator precede the changes in the reference series. Two-way relationships are frequent, however. It should be noted that Granger causality is no real proof of causality. Co-movements are often accounted for by common factors affecting both the reference and the indicator series. It appears that most composite indicators used here help to explain the behaviour of the reference series, whereas the reference series cannot help to explain current developments in the composite indicators.

Overall, it appears that composite indicators may reflect the past general developments in the business cycle. However, the stability of the relationship of the example indicators with the reference cycles has fluctuated strongly over time, casting some doubt on the usefulness of such indicators in actual practice.

5 Detection of turning points

The second objective generally aimed at by composite indicators is the (advance) signalling of turning points in business cycle developments. In order to assess the information value of composite indicators in this respect, it should therefore be examined, first, whether, in the past, turning points were detected in advance of their actual occurrence in the reference series, and, second, whether composite indicators reflected all the turning points in the reference series and did not show extra cycles. In the example composite indicators illustrated here, turning points were determined by the same method as applied to the reference series. It should be noted that, although this method is useful for identifying historical turning points, there is some uncertainty towards the end of the sample. This implies that, in real-time analysis, the technique cannot be primarily relied upon to infer whether the latest data indicate that a turning point has just been reached. For this purpose, while composite indicators potentially provide a first indicative piece of information, thorough further economic analysis and judgement remain essential. This caveat implies that turning points in economic activity can generally be identified confidently only quite some time after they have actually occurred.

As regards the determination of the leads at turning points, one approach could be to look at the average lead at peaks and troughs. However, given the limited number of turning points and the generally large variance of the lead at different turning points, the observed average lead is not normally a reliable estimate. Alternatively, therefore, a lead profile test[4] may be used. This test computes the probability that an indicator leads the business cycle at turning points by at least a given number of months or quarters. The method can be applied separately to peaks and troughs, to determine any differences in leads at these points. The leads of the example indicators shown in Table 2 are all

4 *Banerji, A., "The lead profile and other non-parametric tools to evaluate survey series as leading indicators", 1999 CIRET Conference.*

Table 2

Signalling of turning points

	Effective lead at turning points (*in months/quarters*)		Extra/missed turning points
	Troughs	Peaks	
Vis-à-vis industrial production			
Coincident	0-4	2-5	Generally none
Leading	10	8	None
Vis-à-vis GDP			
Coincident	0-1	0-1	Some missed and some false signals
Leading	5	5	in the mid-1980s and early 1990s

Source: ECB calculations.

at the 10% significance level, i.e. based on past observations, there is a 90% chance that the indicator signals turning points with a lead at least as large as the number of months or quarters indicated.

The composite indicators presented here for illustrative purposes have signalled quite a number of historical turning points ahead of those of the reference series. The composite indicators based on principal component weights appeared to perform somewhat better in this respect. However, there are also missed and extra signals of turning points of the indicators of GDP in the mid-1980s and early 1990s. This illustrates that composite indicators may also give misleading signals, underpinning the need for additional and more detailed analysis.

For both industrial production and GDP, the examples of leading indicators have turned earlier than the other indicators. However, the point made in Section 4 about the risk of false signals from leading indicators is also illustrated by the fact that the example of a leading indicator of GDP has given more false signals. Also, the indicators of industrial production show significantly longer leads in the 1980s than in the 1990s.

Although composite indicators might thus provide a tool for examining the emergence of turning points, their usefulness is limited in actual practice. First, the lead times of the composite indicators have varied largely in the past so that they cannot be relied upon to infer the exact timing of turning points. Moreover, as explained above, the determination of turning points becomes less reliable at the end of the sample, which impairs the practical use of indicators in this regard. Rather than substituting other means of analysis, composite indicators may therefore be seen as providing, at best, complementary information with regard to turning points.

6 Performance in short-term forecasting

Composite indicators are also often interpreted with regard to the magnitude of business cycle fluctuations, i.e. the strength of upturns and the depth of downturns. In this respect, a number of tests can be carried out to examine their information content. First, the change in the indicator in the periods preceding the turning points was calculated and compared with the change in the reference series. It appears that the intensity of a turning point in the reference series is only broadly reflected in the amount of change in the composite indicators, so that no reliable quantitative assessments can be made. A second test is similar, except that the speed of change, rather than the change in the level of the indicators, and the reference series are measured. However, again, the patterns described by the indicators do not faithfully reflect those of the reference series. Therefore, it cannot be concluded, for instance, that if a composite indicator accelerates sharply upwards, the forthcoming peak in activity will be particularly high. Finally, the "turning point significance" of the composite indicators can be computed. This measure assesses the speed of change in the indicator and is therefore similar to the previous test. The change is computed over a given horizon (e.g. six months and two or three quarters), rather than from the previous turning point. The results are consistent with those of the second test in that the turning point significance of the composite indicators does not seem to be strongly related to that of the reference series. These tests appear to suggest that composite indicators cannot be used to derive precise measures of the magnitude of a forthcoming peak or trough.

More generally, composite indicators are sometimes used to derive forecasts of growth in economic activity in the short term. The usefulness of composite indicators for this purpose can be examined by using the estimated relation between GDP or industrial production growth and the composite indicator over a given sample period to make forecasts beyond this period, i.e. to make "out-of-sample forecasts". As only data from before the forecasting period are used, taking into account publication delays, this approach can be regarded as a simulation of "real-time" forecasts. There is one important difference between this experiment and actual practice, however, in that only final estimates of the constituent series are used in this simulation whereas in "real time" the forecaster has to work with data which can subsequently be revised. The models used for forecasting have been estimated recursively. For instance, GDP growth is regressed on the composite indicator and lagged values of GDP growth over the period from 1980 to 1996 and this estimated relationship is used to derive forecasts of GDP growth in the first three quarters of 1997. The model is then re-estimated including data up to the first quarter of 1997 to derive forecasts over the second to the fourth quarter, and so on until the end of the sample period. The forecasts made in the simulation are compared with the actual outcomes and the average error (the root mean square error) is computed. The root mean square error (RMSE) is a measure of the quality of the forecasts. The lower the error, the better the forecast. The quality of the forecasts is further assessed in comparison with the forecasts of a benchmark model, usually taken as a "naïve" model. Here, as is commonly done in literature, forecasts of industrial production and GDP with a model based solely on their respective own lagged values are used as a benchmark.

Table 3 shows the results obtained for forecasts of industrial production and GDP growth in the current month/quarter (before official data are released), and for one and two periods ahead. The RMSE is compared with the average growth rate of the reference series in the out-of-sample test period. For example, in the case of the benchmark model for industrial production, it appears that the error is 1.1 percentage points, which compares to the observed average rate of growth of industrial production of 2.9%. This error is then reported in Table 3 in relative terms as a forecast error of 28%. Comparing the relative errors is, however, not sufficient to assess whether composite indicators bring valuable additional information. Given the limited number of forecasts performed, differences in the forecast error may not be representative and their actual significance should be assessed by statistical tests.[5] Table 3

5 The test performed here is one proposed in Diebold, F. X. and R. S. Mariano (1995), Journal of Business and Economic Statistics, vol. 13, pp. 253-265. This test is commonly used for this purpose.

Table 3

Out-of-sample forecast performance of composite indicators

Average root mean square errors as a percentage of the average growth rate of the reference series.

	Current period	Forecast horizon One period ahead	Two periods ahead
Vis-à-vis year-on-year growth in industrial production			
Benchmark model: forecasts based on past values of industrial production	28	31	36
Forecasts using composite indicators			
Coincident	26*	26-28**	26-28***
Leading	28	28	31
Vis-à-vis year-on-year growth in GDP			
Benchmark model: forecasts based on past values of GDP	13	20	27
Forecasts using composite indicators			
Coincident	10-15	15	20
Leading	12	17	20

, **, * significant at the 10%, 5%, and 1% confidence level respectively.*
Source: ECB calculations.

indicates whether the differences with the naïve benchmark model are significant. Significance at the 5% confidence level means that there is a 95% chance that errors from forecasts using composite indicators are smaller than those from forecasts based on the benchmark model, i.e. inferred from past values of industrial production or GDP only.

In the case of industrial production, the example composite indicators improve the forecasting qualities of the benchmark model, by reducing the out-of-sample forecast errors – in most cases significantly. However, this notwithstanding, the errors remain relatively large when compared with the mean rate of growth in industrial production. In the case of GDP, including one of the example composite indicators also generally reduces the out-of-sample average forecast error, but not significantly so. Nonetheless, the forecast errors for GDP growth, at between 10% and 20% of the observed average growth rate of GDP, are smaller than the forecast errors for industrial production growth. This is due to the relatively low volatility in GDP growth, which makes it easier to forecast than industrial production growth. This is also reflected in the fact that the naïve benchmark model already performs relatively well in the case of GDP growth.

Overall, it can be concluded that the addition of composite indicators to a naïve benchmark model does not seem particularly useful for making reliable estimates of the rate of growth of either industrial production or GDP.

7 Concluding remarks

Composite indicators are typically constructed with the aim of obtaining a summary indicator of the information stemming from different sources and aspects of the economy as regards current developments in, and the short-term outlook for, economic activity. They also frequently aim at capturing turning points in the business cycle, as well as, in some instances, at deriving short-term forecasts of growth in economic activity. Against the background of these three potential uses, some example composite indicators, constructed in line with common practices, were examined with regard to their information content on the euro area business cycle. The analysis suggested that composite indicators may, with hindsight, appear to have followed developments broadly similar to those of the business cycle. However, as also illustrated by the example indicators, the relationship between composite indicators and the business cycle may be not very stable over time, which obviously hampers the interpretation of the latest readings of such indicators. As regards turning points, the example composite indicators have shown similar peaks and troughs in advance of the historical ones observed in the reference business cycle. However, this does not imply that the exact timing and intensity of a forthcoming turning point in activity can be inferred from the latest readings of such indicators. Rather, the lead times have largely varied in the past and, generally, in real time, turning points in indicators can only be identified confidently quite some time after they have occurred. Moreover, the information content of composite indicators in terms of accurate short-term growth forecasts appears limited. Furthermore, and most importantly in the context of policy-making, composite indicators, by construction, hide the driving factors behind current and short-term changes in economic activity. In order to determine the nature of the shocks affecting the economy, individual economic indicators, rather than composite indicators, are necessary for thorough economic analysis, assessment and judgement. All in all, while careful monitoring of ongoing work in the construction of composite indicators by public and private institutions is warranted, such indicators cannot replace comprehensive coverage in economic analysis.