The Contribution of Economic Indicator Analysis to Understanding and Forecasting Business Cycles*

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Abstract

This paper reviews major features of the development of economic indicator analysis (EIA), notably its contribution to identifying, understanding, explaining and forecasting business cycles. The paper highlights the substantial pioneering role of Dr Geoffrey H. Moore in this development. The paper reviews some key issues regarding the selection and classification of economic indicators; and the methodologies developed to use these indicators to identify and measure business cycles on national, regional and sectoral bases. After making an overall assessment of EIA, acknowledgement is given to the widespread development and applications of EIA around the world to study the co-movements of key economic variables and to forshadow changes in them.

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1. Introduction and the pioneering contribution of Dr Geoffrey H. Moore

Governments and private businesses rely on a large volume of economic (and other) information in the strategies that they follow and in their policy decisions. One major objective of this paper is to describe how economic indicator analysis (EIA) has been playing an increasingly important role in contributing to this information, initially for the United States and then for an increasing number of market-oriented countries in North America, Europe and Asia-Pacific. Another objective is to recognise the major role of Moore in this development. This began when he was invited in 1939 to join Wesley C. Mitchell and Arthur F. Burns to participate in their formal business cycle analysis at the National Bureau of Economic Research (NBER), New York. It will be seen that in recognising the contribution of EIA to understanding business cycles and thereby adding to the knowledge of an increasing number of economists, policy makers and others in an increasing number of countries, we shall also be recognising Moore's life-long contribution to this subject and the close attention paid to his work: witness, for instance, the following statement in the obituary (by Robert D. Hershey Jr.) in the *New York Times* of March 11, 2000:

> One of his [Moore's] Statistics 1 students at New York University in 1946 was Alan Greenspan, now chairman of the Federal Reserve, who yesterday called his former teacher "a major force in economic statistics and business-cycle research for more than a half-century." Mr. Greenspan told Congress in 1994 that he closely followed all of Dr. Moore's work, which focused mainly on economic fluctuations and ways of measuring them.

Moore's substantial contribution to the on-going development and application of EIA will also be observed in the references in this paper to a selection of his publications. Some of these were co-authored with colleagues working under his expert guidance and supervision. These papers contributed to: first, a fuller and, in turn, a more accurate understanding of the empirical regularities of business cycles; secondly, the

increasingly widespread dissemination of this knowledge, both nationally and globally, with comparable research being inspired in an increasing number of countries; thirdly, the forecasting of business cycles; and finally, and not least, the on-going search for theoretical explanations of business cycles, a challenging and interesting subject that is being reviewed in some detail elsewhere by the author.

EIA initially involved the construction of leading (referred to below as short-leading), roughly coincident and lagging indexes. Additional indexes have been added in recent years, largely a result of Moore's initiatives and with the aid of his colleagues. The new indexes include the development of: long-leading (as well as the former short-leading) indexes; leading and coincident indexes for major sectors (including services, metals, manufacturing and construction) and regions of an economy; and leading indexes of inflation and employment. These indexes furnish comprehensive summaries about a number of key aspects of an economy, particularly: how the economy has performed in the past in respect to its output, inflation, and employment experiences, and so on; its current economic performance; and its prospects in the coming months. The indexes are usually updated monthly, reporting the latest information, and thus provide broad overall assessments of important aspects of an economy at an earlier date than generally available otherwise. It is appropriate to note here that the *American Economic Review* (June 1996), in recording Moore's election as the 'Distinguished Fellow' of the American Economic Association for 1995, states: 'In the 1950's, in collaboration with Julius Shisken, he [Moore] developed a methodology for constructing leading, coinciding, and lagging composite indexes which have become important forecasting tools.' (See: Moore (ed.) 1961, esp. vol. 1, Part Three; Shiskin 1961; and Shiskin and Moore 1968.)

Our acknowledgement of the contribution of EIA can be highlighted through the following seven aspects: first, recognising the need for a monthly measure of aggregate economic activity; secondly, discussing the selection and classification of economic indicators to permit the construction of the indexes mentioned above, especially the leading, coincident and lagging; thirdly, defining what we mean by business cycles; fourthly, describing how the relevant coincident index and its components can be used to date business cycles on national, regional and sectoral bases; fifthly, noting the development of EIA *around the world;* sixthly, making an overall assessment of the contribution of EIA; and finally, and importantly, illustrating how EIA may be used to study the co-movements of key economic variables and to forecast the course of economic activity (and of the business cycle) for a particular country, region and or sector in the months ahead.

2. The selection of economic indicators to satisfy the need for a monthly measure of aggregate business activity

2.1 Problems entailed in using estimates of real gross domestic prooduct (GDP)

In order to monitor and forecast the fluctuations in business activity, ideally what is required (as discussed in more detail in Boehm 1987, pp.3-5; Boehm 1998, pp. 9-12; and Boehm and Summers 1999, pp. 253-55,) is a precise and accurate measure of the 'aggregate economic activity' of a nation, region, or sector as soon as possible after the event. In this vein, an increasing number of economists in the 1980s and 1990s, in seeking a theoretical and empirical explanation of the stylised facts of business cycles, have hypothesised in terms of a single measure of real activity to represent the business cycle. The measure chosen has generally been real GDP or industrial production. In Boehm (1998) and Boehm and Summers (1999), this methodology and

the problems that it may encounter are discussed, in particular, whether it is theoretically appropriate or realistic and empirically justified to represent the business cycle by a single measure such as real GDP or industrial production.

It would certainly be very helpful if we could simply define the *ideal* measure of the current level of aggregate economic activity as *monthly* real GDP; or, in addition, for a country like Australia real GNFP (gross non-farm product) in order to allow for irregular weather influences on the harvest. As noted in the sources mentioned in the previous paragraph, though no such ideal series is available, it is nevertheless worth pondering what it would mean to have a series that accurately and consistently, and without requiring later revisions, measures total economic activity. This series would therefore clearly reflect business fluctuations. An important reason for looking to GDP (and or GNFP) possibly providing the required ideal measure is because it could be the most comprehensive of the official statistical series that reports the level of aggregate economic activity. It would seem appropriate to see the ideal measure as a monthly series since this tends **to** be the period for which a number of important variables are measured and from which forecasts for the next year or so are made. But it could be even more helpful for policy purposes if earlier signals of business cycle peaks and troughs were anticipated than furnished by monthly series. Indeed, Moore's recognition of this led to a weekly leading index for the United States being produced by the Center for International Business Cycle Research (CIBCR, New York) for its subscribers; and now the Economic Cycle Research Institute (ECRI, New York) does so. (As noted more fully below, CIBCR and ECRI were both founded and directed by Moore.) An interesting exercise for the future will be to assess the respective performances and advantages in forecasting with the aid of the weekly leading index compared with those gained from the monthly indexes.

2.2 Merits in using the coincident composite index developed in EIA

If we had at least an ideal monthly measure of the current level of aggregate economic activity, it could perform the role of the concept that is widely known in EIA as the coincident composite index. We discuss this index more fully below. We could also base our theoretical and empirical study of the stylised facts of the business cycle, and forecasts of the level of economic activity and particularly changes in it in the months ahead, on the evidence that for some aspects of activity we have statistical series that anticipate actual changes in the aggregate economic activity. These series in EIA are, of course, called leading indicators. Other series, known as lagging indicators, follow paths that habitually lag the general course of the aggregate economic activity as portrayed by the coincident index; and, when inverted, the lagging composite index computed from the lagging indicators provides a long-leading compsite index (see Moore 1983, Ch. 23).

Thus, in theoretical and applied analyses of the business cycle, our ideal substitute measure for monthly real GDP (or GNFP) would furnish the basis for identifying reference cycle chronologies of the peaks and troughs of business cycles, both classical and growth cycles (as defined in section 4 below). But, in reality, as the U.S. Department of Commerce (1984, p. 65) acknowledged in discussing the definition and measurement of aggregate economic activity, '… no single time series measures it adequately; however, a variety of statistical series measure some of its major aspects'. This still applies and will almost certainly continue so, and more or less equally to all countries. Thus, in the absence of an ideal single monthly measure of real GDP, we select roughly coincident indicators that, when combined in a composite index, will, as far as possible, truthfully reflect aggregate economic

activity. Roughly coincident timing means that an indicator generally experiences a lead/lag relation of between plus or minus three months at coincident index turning points. The ideal, of course, would be a lead/lag of zero months; and this does occur to some extent. For the selection of the coincident indicators, criteria are used (as discussed in section 3 below,) to identify the statistical series that historically appear to have accurately represented the current economic activity. (See also Stock and Watson's (1991) consideration of the question of 'What do the leading indicators lead?' and their support for the development of the 'coincident indicator model', an idea also approved by Oppenländer (1994, p. 718).

Nevertheless, as mentioned briefly above, there has been a strong tendency in recent economic research on business cycles for theories and associated empirical analyses to be developed with the business cycle being defined in terms of a single series such as GDP. But, unfortunately, the real GDP and GNFP series that are available do not satisfy as far as possible our ideal requirements. This is not only because the estimates of GDP and GNFP are not available monthly. The available quarterly series are subject to significant revisions (for varying reasons), as illustrated in: Boehm 1998, esp. pp. 12-26 and 48-55; and Boehm and Summers 1999, esp. pp. 255-63. Nor does any other statistical series individually satisfy our requirements for analysis of the current state of economic activity. To meet these requirements, a reference cycle chronology, as implied by Burns and Mitchell's definition of business cycles (quoted in section 4 below), can best be determined on the basis of the consensus of the economic fluctuations experienced in selected key roughly coincident indicators, the subject to which we now turn our attention.

3. The selection and classification of economic indicators

3.1 To aid monitoring the course of business activity

This subject was largely pioneered at the NBER through the work of, in particular, Mitchell, then Burns, and later Moore. The widespread development of economic indicator analyses in recent years has aided the analysis, including, in particular, the monitoring of the course of business activity and the identification of the peaks and troughs of business cycles (both classical and growth) on regional and sectoral as well as initially on national bases in an increasing number of industrial market economies. It will be seen how a slowdown or downturn in the economy being foreshadowed by the leading composite index can be monitored to see whether it is only a growth recession (or slowdown) or whether it leads to a classical (real) recession. As noted above, we discuss the meaning of growth and classical recessions in section 4 below. We shall also see that the monitoring essentially involves identifying if the declines (or, alternatively, expansions) in the leading index and the following corresponding declines (expansions) in the coincident index are pronounced, pervasive and persistent (the three P's as Geoffrey Moore and Anirvan Banerji have appropriately dubbed this aspect of EIA in connection with business-cycle experiences; see, for instance: ECRI 1996, and subsequent issues of this monthly publication; and Banerji 1999, pp. 72-6.)

The effectiveness of EIA in business-cycle studies and in economic forecasting depends much on the care and attention paid to the selection and the on-going monitoring of the indicators themselves. This entails testing whether the indicators perform consistently in the course of the business cycle: in particular, whether they display a consistent relationship in respect to being leaders, roughly coincident, or laggers during each phase of a cycle and at the turning points of

economic activity. In brief, it is important to ensure that the selected indicators continue to perform for the reasons they were initially chosen.

3.2 To make international comparisons of business cycle experiences

The rationale for the EIA is that market-oriented countries display through the selected economic indicators repetitive alternating sequences (or empirical regularities) that underlie their ever-changing business-cycle experiences. The objective of the indicator analysis is to identify these sequences and to monitor their on-going occurrence in order to identify through the coincident indicators the current state of business activity and to aid through the leading and lagging indicators the forecasting of the course of activity in the months ahead. A detailed cross-classification of the indicators in the leading, roughly coincident and lagging indexes by economic process chosen for the United States is available in Moore 1980, pp. 78-9 and Moore 1983, pp. 70-1. A cross-classification of the indicators in the three indexes for Australia is provided in Boehm and Moore 1984, p. 39. The economic processes embraced by the indicators include: employment and unemployment; production, income, consumption and trade; fixed capital investment; inventories and inventory investment; prices, costs and profits; and money and credit. Thus the rationale and scope of EIA cover a wide range of business activities. It is from these aspects that the tested veracity of EIA will continue to furnish its strength and longevity.

Moore's (and his colleagues', in particular, Philip A. Klein's) 'International Economic Indicator' (IEI) projects initially at the NBER (see especially: Moore and Klein 1977; and Klein and Moore 1985) during the mid-1970s and then at the CIBCR during the years 1978 to 1997 and at ECRI since its foundation in 1997 allow

international comparisons of the state of the business cycles in different countries or groups of countries. This is an important facility since business cycles may be transmitted internationally. International comparisons are especially instructive because of the high degree of the real and financial linkages between industrial countries; for instance, for Australia, notably with the United States and Japan. An international comparison of business-cycle experiences is discussed further in section 6 below.

In recognition of the international manifestations of business cycles, a research strategy of the IEI projects, especially at both CIBCR and ECRI, has been to check to what extent the long-leading, short-leading, coincident, and lagging indicators that have a recognised success in monitoring the United States economy for more than sixty years (see, for instance, Auerbach, 1982) perform equally efficiently as indicators in other market-oriented countries (see: Moore 1983, Ch. 6; Boehm and Moore 1984, p. 34; and Moore and Moore 1985). However, no series has been included for other countries simply because it appeared to parallel by description a series in the CIBCR's or ECRI's indexes of economic activity for the United States. Where better long-leading, short-leading, coincident, and lagging indicators have been found for other countries, or it may be expected will be found in the on-going research, they have or will be included. Furthermore, a large number of apparently comparable series have been examined for each country. Some were rejected as unsuitable in the process of selection; and others are being examined further. In short, the indicators included are generally the best that have so far been found. 'Best' here is based on a selection of indicators from an *a priori* knowledge (including a theoretical understanding) of the working of the economy and their evaluation individually in terms of the criteria discussed below. Fortunately, and not

surprisingly, a number of the indicators chosen, for instance: for Canada, France, United Kingdom, West Germany, Italy and Japan (see: Moore 1980, pp.80-1 and Moore 1983, pp. 72-5); and for Australia (see Boehm and Moore 1984), parallel quite closely those also found suitable to monitor the economies of the United States and other industrial countries in the IEI projects, thereby enhancing the comparisons that we can make of the business cycles in each country. Furthermore, revisions have been made from time to time in the composition of the indexes as a result of particular series no longer being available, or ceasing to portray an aspect of business activity as well as does an alternative series, or when new series become available. (For reviews of changes in the components of the NBER's indicator system for the United States, see Moore 1983, Ch. 24; for revisions to the components of the U.S. Commerce Department indexes, see: Hertzberg and Beckman 1989; and Green and Beckman 1993. See also Zarnowitz 1992, Ch. 11).)

3.3 Criteria employed in selecting economic indicators

In applying theoretical knowledge of the working of the economy and in evaluating selected indicators to determine whether they qualify for inclusion, the development of EIA has led to the application of several criteria. These are discussed in detail in Zarnowitz and Boschan (1977, pp. 171-3; see also U.S. Department of Commerce, 1984, p. 70, n. 1). The criteria, in particular, (as also summarised in Boehm 1987, pp. 8-10) are that the indicators should:

(1) represent significant economic processes or variables found to be important sources or measures of business cycle movements;

(2) be statistically adequate by accurately measuring what is claimed of the series;

(3) not be subject to revisions that would change (significantly) earlier conclusions (regarding the business cycles) based on them;

(4) reveal or reflect a consistent relationship over time with business cycle peaks and troughs; in particular, for the leading indicators that they should turn ahead of the peaks and troughs in aggregate business activity, and for the lagging to display later turns to those in aggregate business activity (with ideally no series displaying extra turns to those of the business cycle);

(5) (associated with the fourth) conform to general cyclical movements between peaks and troughs, so that they are good cyclical performers not only at peaks and troughs but also in portraying the path of economic activity from peak to trough and trough to peak, and hence aid economic forecasting;

(6) (also related to the fourth and fifth criteria), not be dominated by non-cyclical and erratic changes but should display fairly smooth upswings and downswings from one business cycle to the next; and

(7) be promptly, frequently and regularly available, preferably monthly but at least quarterly, thus being known soon after the period to enable early assessment. This is again especially important for the leading indicators in foreshadowing changes in the direction of business activity.

3.4 Weights applied to the selected indicators in constructing composite indexes

A detailed weighting scheme to score each indicator (in the construction of the composite index) according to its characteristics in terms of the above criteria was developed for the United States (see Zarnowitz and Boschan 1977, pp. 171-3 and U.S. Department of Commerce 1984, pp. 65-70). ‘However, [as Auerbach (1982, p. 594) concluded:] the extensive effort devoted to assigning and updating weights for

the series included has essentially no effect on the resulting index; it is indistinguishable from one with equal weights.' Hence in Moore's IEI project and in the Melbourne Institute's indexes of economic activity (reported initially in Boehm and Moore (1984) and discussed further below), there is empirical justification for each indicator carrying, on grounds of performance, the weight of unity in its inclusion in a composite index. But this is a matter that needs to be kept under review.

It is also appropriate to note here that the standardisation process in the construction of the composite index is, itself, a form of weighting. The standardisation procedure involves computing for each individual series the month-to-month percentage changes, or the month-to-month differences where series are already in percentage or ratio form. These percentage changes, or differences, in the component series are then standardised by dividing them by the average percentage, or difference, change in that series without regard to sign for a selected long-run period. The purpose of standardisation is to ensure that volatile series, which typically exhibit large percentage changes, do not have a bigger influence on the average of all the series in each composite index than those that have a smaller amplitude of variation.

4. The definition of business cycles

4.1 To apply to either or both classical and or growth cycles

Defining business cycles is not a simple matter, partly because cyclical experiences, notably in respect to 'the 3 P's' mentioned in section 3 above, may vary, sometimes significantly, from one country to another during a given period and from time to time in the same country. These divergent experiences also largely explain why there is, as yet, and seems unlikely ever to be an accepted *general* theory of business

cycles. However, there are several key elements that are commonly believed to be central to a theoretical explanation.

The term 'business cycle' in this paper, as noted above, is used to refer to either or both classical and growth cycles. Classical cycles are defined as recurring, alternating expansions and contractions in the *absolute level* of aggregate economic activity (with the expansion including here the recovery stage of the growth cycle). Growth cycles, on the other hand, are defined as recurring fluctuations in the *rate of growth* of total activity relative to the long-term trend rate of growth. So growth cycles refer to the deviations of the series from trend. (See Boehm and Liew (1994, p. 5) for a stylised illustration of business cycles in terms of classical and growth cycles.).

A descriptive definition of business cycles that has been widely acknowledged, at least as a starting point, was first formulated by Mitchell (1927, see esp. pp. 468-9) at the NBER, and then adapted by Burns and Mitchell (1946, p. 3), namely:

> Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own.

This definition applies to classical cycles that were initially the centre of business cycle studies at the NBER. However, the relatively long classical expansion in the United States of 106 months from February 1961 to December 1969 (see Table 1) increasingly raised questions as to whether the business cycle had become obsolete (see esp. Bronfenbrenner 1969; see also: Boehm 1990, esp. pp. 27-8; Boehm 1998, p.

2; and Boehm and Summers 1999, p. 247.), Furthermore, Table 2 exhibits an even longer classical upswing in Australia from September 1961 to July 1974, an expansion of 154 months. There were also long classical upswings at this time in other industrialised market economies. These experiences, particularly in the United States, stimulated a revival of interest in growth cycles, especially manifested in research at the NBER by Mintz (1969, 1972, 1974). Mintz's work on growth cycles as well as classical cycles led to the Burns-Mitchell definition of business cycles, as quoted above, being revised to the extent, as Mintz (1974, pp. 6-7) states of '... inserting the words "adjusted for their long-run trends" after "economic activities". This version brings out the identity between classical cycles and growth cycles when long-run trends are horizontal'.

4.2 Advantages for theoretical studies and policy-making from distinction between classical and growth cycles

Tables 1 and 2 illustrate several important aspects that would need to be taken into account in both theoretical studies and policy-making. One concerns the purpose and usefulness for theoretical and policy objectives of distinguishing between classical and growth cycles and identifying the turning points themselves of both kinds of cycles. Another aspect, (as noted in Boehm and Summers 1999, p. 251,) '... is that, while there was a long classical upswing in the 1960s in both the United States and Australia, nevertheless there were during that time two growth cycles in each country that did not lead on to classical cycles.' In the past three to four years or so, questions about the continued existence of the business cycle have again been revived by the long classical expansions being experienced in the United States, Australia and other market-oriented countries. These relatively long expansions and the fairly optimistic

expectation held by some commentators, at least until late in 2000 and early in 2001, that the expansions seem likely to continue have again raised questions regarding the obsolescence of the business cycle. This subject is discussed further in Boehm (1998, see esp. pp. 2-3); and Boehm and Summers (1999, esp. pp. 4-5 and 8). However, the recent monthly reports of ECRI (see esp. ECRI 2001b, 2001c and 2001d) have led ECRI to conclude that a classical recession in the United States seems 'no longer avoidable' (ECRI 2001b, p.1). This would mean that the record longest classical peace-time expansion in the United States , which would have concluded its tenth year since March 1991, is coming to an end, indeed may already recently have done so on the evidence available to early May 2001. But it is likely to be some time before this can be settled. (On 'the dating of [classical] business cycles' in the United States by the NBER for statistical and historical purposes, see Council of Economic Advisors 1999, p. 21.) Similarly for Australia, the latest evidence suggests that the long classical expansion since December 1992 (see Table 2, column 8) may also recently have ended. We discuss the recent cyclical experiences in the United States and Australia further in section 8 below. It is also interesting to note from Tables 1 and 2 that, as in the 1960s so again during the recent long classical upswings in the United States and Australia, a growth cycle was experienced in both countries in the mid-1990s.

The evidence in Tables 1 and 2 suggest that the main (typical) business cycle in the United States and Australia has been a short cycle with a total duration, on average, between about 3 to 5 years in respect to growth cycles and around 1 to 2 years longer for classical cycles. These cycles entail a study of, on the one hand, the impulses occurring on both the demand and the supply sides and, on the other, the associated mechanisms propagating the impulses. This process makes for the more or

less severe recurring, cumulative expansions and contractions in business activity. (These interesting aspects are being discussed more fully elsewhere by the author.)

5. Identifying business cycle chronologies on national, regional and sectoral bases

5.1 Methodology to identify the turning points

Table 1 presents the identified dates of the peaks and troughs of business cycles in the United States since 1948; and Table 2 does so for Australia since 1951. As explained above, the term 'business cycle' is used in this paper to refer to either or both growth and or classical cycles. The methodology followed to identify the respective growth- and classical-cycle chronologies in both countries involved the basic procedures developed initially at the NBER. The procedures for selecting business-cycle chronologies, as described in more detail in Boehm and Moore (1984, pp. 38 and 40-42), essentially involve identifying (with the aid of computer programs) the classical and growth cycle turning points in three parts: first, the turns in the coincident composite index constructed from the widely recognised coincident indicators representing income, production, retail turnover, employment and unemployment; secondly, the turns in the coincident series themselves; and thirdly, identifying the medians of the clusters in which the turning points of the coincident indicators have occurred. The clusters are usually readily identifiable (as illustrated in Boehm and Moore 1984, Tables 3 and 4), since the individual coincident indicators are in important respects interrelated.

The computer programs used to select the turning points are based on the rules for turning-point selection developed at the NBER over many years and discussed in Bry and Boschan (1971). The method used in constructing the composite index

corresponds with that developed by the U.S. Department of Commerce in conjunction with the NBER. (On the construction of composite indexes, see: U.S. Department of Commerce: 1977, pp.73-6 and 1984, pp. 65-70; and CIBCR 1993, Appendix D.)

5.2 Development of regional business cycle chronologies

The success of the economic indicator approach in monitoring the empirical regularities of business cycles in national economies such as the United States, Australia and other market-oriented countries (as shown further below) created an increasing desire (particularly among business and government economists and policy-makers) for comparable leading and coincident indexes on a regional basis. (See, for instance, Orr, Rich and Rosen 2001, and their references to earlier studies for several other States of the United States.) Preliminary leading and coincident indexes have been constructed for the six Australian States (see Boehm 1996). The results fully affirm the growing interest in regional leading and coincident indexes. One important finding justifying the continuation of this development is that the business-cycle experiences have varied between each Australian State and between individual States and the national results. Furthermore, it is believed that Australia's experience illustrates well, and is typical of how regional and national chronologies compare. Thus the regional indexes should provide a major addition to the information otherwise available and should help to ensure that policy decisions of governments and private and public businesses would be more closely consistent with and would assist the economic situation of the particular region concerned.

The development of the regional indexes for Australia followed closely the methodology that was used for the construction of the national indexes, as described briefly above. So the initial tasks were to obtain coincident indicators for each State

(comparable as far as possible with those being used nationally) and to establish reliable business cycle chronologies for each State. The chronologies could then be used to test the performance and reliability of the potential leading indicators. This was especially in order to be confident that the leading indicators chosen do, in fact, generally lead the current course of business activity in the region concerned.

It is interesting to note that while the use of regional leading indexes is widespread across the United States and several have been constructed in Australia, it appears that very few have been prepared in comparison with regional coincident indexes and business cycle chronologies, as has been done for Australia (and reported in Boehm 1996). As Phillips (1994, p. 352) observed:

> The first step in the construction of a regional leading index is deciding what the leading index should lead. The BEA's [the U.S. Bureau of Economic Analysis's] leading index was constructed to lead business cycle peaks and troughs as designated by the National Bureau of Economic Research (NBER). Unfortunately, most regions do not have officially designated business cycle turning points.

One notable exception in the United States was the development of coincident and leading employment indexes for the Connecticut economy, with the coincident employment index helping to to date the State's classical business cycle (see Dua and Miller 1996).

The roughly coincident indicators available for the Australian States and used in Boehm (1996, see esp. Table 1) as matching coincident indicators for Australia: are real wages, salaries and supplements (a reasonably reliable proxy for real household income that is not at present available for the States), real gross state product (GSP), real retail turnover, total employed labour force, and unemployment rate (inverted). There were thus available for the States five key series covering the four major economic areas of income, production, trade and the labour market. However, the

Australian Bureau of Statistics (ABS) discontinued publication of quarterly real GSP in 1997 because of the problems being encountered in its measurement on a quarterly basis. The ABS's estimates of quarterly domestic final demand for each State would be worth testing as a proxy for GSP.

The limitations on space do not permit the inclusion here of the matching classical and growth cycle chronologies for each Australian State for the period 1968-94 and an examination of them with the classical and growth cycle chronologies for Australia as a whole. But these are available in Boehm (1996) where some interesting differences as well as similarities between Australia and the States are shown.

The comparison of Australia's regional and national cyclical experiences illustrates well the importance and assistance to forecasters and policy-makers of having available the regional leading and coincident indexes as well as the national. This is especially to take more accurately into account the specific cyclical experience of a particular region in comparison with the national scene. The differences and similarities in the regional business cycle experiences justify continuing attention being paid to the cyclical experiences in each region, and raise important questions about the qualifications and care with which the results for Australia as a whole need to be treated. Reasons for the similarities and differences in cyclical experiences between the Australian States and nationally on the one hand and between the States themselves on the other warrant continuing further research. Dua and Miller (1996, p. 510) also observed that 'the performance of state and regional economies … became much more diffuse in the United States during the 1980s, with different states and regions having significantly different experiences with economic performance'. Attention could also justifiably be given to the development of comparable indexes

for major cities, as is being done for a number of cities in the United States (see: Moore, Banerji and Chen 1992; Phillips 1994, esp. p. 350). It should also be noted that alternative techniques for identifying and assessing economic indicators have been developed and would be of interest to use as a further check on what has been decided, for instance, by Boehm (1996). These techniques include recent advances in statistical and econometric analysis to examine the performance of the NBER and ECRI systems of EIA (see, for instance: Boehm and Martin 1987; and Lahiri and Moore (eds) 1991, esp. Part 1). It is confidently believed, however, that the alternative tests would generally confirm and support the results and decisions made by Boehm (1996).

There is a strong case for regional analyses of countries like Australia and the United States. This applies equally to the development of econometric models as well as EIA used to aid economic forecasting. An advantage of regional leading indexes is, as Phillips (1994, p. 347) observed, that they furnish a relatively low cost method of short-term economic forecasting This is also for many more easy to understand and follow month by month than are econometric models. Furthermore, the regional leading and coincident indexes could be used to supplement and complement alternative econometric techniques to monitor and forecast the course of business activity.

5.3 Exploiting EIA to understand cyclical experiences of major sectors of an economy

In addition to the construction of leading and coincident composite indexes on regional and national bases, attention has also been successfully given to the development of leading and coincident indexes for major sectors of an economy. The

CIBCR did so for the U.S. service sector and metals industries (on services: see Moore 1987; Layton and Moore 1989; on metals, see Moore and Cullity 1990). ECRI has developed, and publishes in its monthly reports, leading and coincident indexes for the United States for employment, services, financial services, manufacturing and construction; and a leading imports index, a leading exports index and a leading trade balance index (see, for instance, ECRI 2001c, p.5). In addition, ECRI reports for the United States a weekly leading index and a monthly and a weekly future inflation gauge (see ECRI 2001e), and it publishes daily the JOC [Journal of Commerce]-ECRI industrial price index. Other indexes that ECRI constructs largely for its own use in order to monitor and achieve a better understanding of the U.S. economy include an unemployment severity index, a leading diffusion index, and a leading credit index. Each additional index and the cycle it exhibits may, of course, usefully be monitored in relation to the corresponding cycles in related variables and in the national and regional indexes. ECRI also reports future inflation gauges for France, Germany, Japan, and United Kingdom (see ECRI 2001d and 2001e).

Leading and coincident indexes have been constructed for Australia's service sector and metals industries. (On services, see Boehm 1991a, 1991b; on metals, see Boehm 1994). The service sector now accounts for more than half and in some cases about two-thirds of GDP in most relatively developed countries like the United States and Australia; and the metals industries in both countries as well as the manufacturing and construction sectors generally constitute a sufficiently large enough area of productive activity to justify being monitored in their own right in terms of EIA. (See, for instance, Layton and Moore 1989; Moore and Cullity 1990; and Boehm: 1993 (esp. pp. 8-11) and 1994.) However, it should be noted that the leading and coincident indexes so far constructed for Australia's service sector and metals were seen as

'experimental', but it is believed that they exhibit pictures for both sectors that are instructive and justify further attention being given to them. This is despite the fact that there was a more limited number of suitable series available to construct Australia's leading and coincident indexes for the service sector and metals industries than for the United States. Australia's series are available also for a shorter period, from 1961 for services and 1977 for metals compared with 1948 for the United States for both sectors. The availability of suitable - preferably monthly and or at least quarterly - data for sectoral analyses in countries like Australia should improve over time.

The objective of micro studies involving major sectors of the economy has been to identify indicators that describe, first, the current state of economic activity in the sector along with the cyclical changes in it; and secondly, to aid forecasts of likely changes in the sector's activity. This information should, in turn, aid policy-making in respect to the sector in particular and the economy in general. In the process of the sectoral studies it has also been instructive to discover how indicators that are recognised as leading and coincident indicators in a macroeconomic context perform in the microeconomic scene. The greater extent to which this can be done means greater comparability between the national, regional and sectoral indexes. A fairly detailed comparison of Australia's leading and coincident indexes for both the total economy and the service industries over the period 1971-91 is made by Boehm (1991a); for a similar analysis for the United States over the longer period of 1949-87, see Layton and Moore (1989). The methodologies used in constructing the leading and coincident indexes for the sectors noted above for both the United States and Australia followed the well- established procedures for the analysis of economic indicators for the macro-economy.

One of the interesting and important but generally not surprising aspects highlighted by the micro-analysis for Australia is that there appears to be a stronger case for having the indexes for the service sector than for the metals industries since the indexes for the latter (reported in Boehm 1994) have highlighted the greater degree of similarity between the metals industries and the total economy than applies in respect to the service industries. This is consistent with the findings for the United States by Layton and Moore (1989) and for metals by Moore and Cullity (1990). In the absence of indexes for the metals industries, one could reasonably say that those interested in what is likely to happen in this sector would be assisted in any case by noting what is occurring in the total economy. There are, however, sufficient differences between the metals industries on the one hand and the total economy on the other to make it worth while to have separate indexes portraying the prospects and current economic performance for the metals industries themselves.

One major reason for the greater interest in the service sector would clearly be its relative importance, as noted briefly above. The share of this sector's output in GDP in Australia grew from about two-fifths in the late 1940s to two-thirds in the early 1990s (see Boehm 1993, p. 9). In the United States, the service sector accounts for just over half of GDP and a little more in employment (see Layton and Moore 1989, p. 379). This growth and relative importance mean that in both countries (and likewise for other relatively developed market-oriented countries) business cycle experiences are no longer as heavily dependent as they were earlier on the fluctuations in the goods-producing industries. Moreover, the growth and the size of the service sector have manifested an increasingly modifying influence on the severity of cycles arising from the goods-producing sector. The non-storability of

most services helps to explain the milder fluctuations in service employment and output. (On employment, see Boehm 1991a, esp. pp. 395-8.)

To summarise, the growth of the service-dominated relative to the goods-producing economy has not meant that the business cycle may or has become obsolete, as some have suggested. Nevertheless, classical recessions are much less frequent or severe in the service sector. This, together with the growth in general importance of the service sector should mean a reduction in future in the general severity and duration of recessions compared with what they may otherwise have been. It means that business cycles may henceforth be more in evidence in terms of fluctuations in growth rates. But here also the fluctuations in the growth rates are likely to be less severe for the service sector than for the total economy. (For similar experiences in the United States as described above for Australia, see Layton and Moore 1989, esp. Figures 3 and 7.) Furthermore, ECRI (2001a, p.1) reported that 'the manufacturing sector [in the United States] is in a contraction, which is set to get even worse. Were it not for the resilience of the service sector, the economy would already be in a recessiion.'

5.4 Cyclical experience of the farm sector

Another important and interesting sectoral aspect worth noting briefly here is that there have tended to be a greater number of classical and growth cycles in the farm sector than in the overall economy. It is noted in Boehm 1998 (pp. 19-21 and 52) that this was so in both the United States and Australia during the 1960s to the 1990s, though to a slightly greater extent in Australia. Boehm (1998, p. 19) states that Australia's farm sector over the period 1960 to early 1997 '… experienced eleven classical cycles compared with only five in the total economy. There were about the

same number of growth cycles in Australia's farm sector as classical cycles, with some differences in the timing of turning points.' (See also Boehm and Summers 1999, pp. 257 and 259.) The greater cyclical instability of Australia's farm sector justifies the preference for the use of the GNFP series in studies of Australia's cyclical experiences. It also needs to be allowed that the farm sector has declined significantly in relative importance in industrialised market economies. Real farm product as a share of real GDP has declined in Australia from about 6 per cent in the early 1960s to just under 4 per cent in 1997. (See also: Boehm 1993, pp. 8-9; and Boehm and Summers 1999, p. 259). Similarly, the share of farm product in real GDP in the United States has declined from nearly 4 per cent in 1960 to about 2.5 per cent in 1990. As Boehm (1998, p. 20) observed, the fairly rapid decline in relative importance of the farm sector in industrialised market economies has also progressively reduced the effect of the farm sector's greater instability and has thus contributed to the decline in the volatility of GDP, as observed in respect to the farm sector for the United States by DeLong and Summers (1986, p. 685). (See also Boehm and Summers 1999, p. 259.) This decline in volatility is also apparent in coincident composite indexes for the 1990s (see, for instance, Charts 1 and 2).

6. The development of EIA around the world

6.1 Aiding the continuing monitoring and identification of business cycle experiencs for an increasing number of countries

There are three interesting and important aspects to acknowledge here. First, the extent to which EIA has spread around the world with especially long-leading, short-leading and roughly coincident indicators being identified for an increasing number of countries. This, in turn, has enabled the construction of long-leading,

short-leading, and coincident indexes that together with the respective carefully identified ‘select’ indicators included in these indexes have aided the second and third aspects warranting acknowledgment. The second is the identification of business cycle chronologies for these countries from the coincident indexes and their components, thus manifesting further evidence of the nature of business cycles in respect to how pronounced, pervasive and persistent they have been (the 3 P’s as noted in the opening paragraph of section 3 above); and the third is the evidence thus provided for international comparisons of business cycle experiences in each country.

Table 3 presents the average duration of growth cycles in twelve market-oriented countries and for three groups of countries; and Table 4 does so for classical cycles also for twelve countries but only one group of countries. The quality of the results used to construct Tables 3 and 4 is relatively high and equally as good for both growth and classical cycles for most countries, but particularly for growth cycles. It needs to be allowed that classical cycles were much less frequent, or did not occur at all in some countries in the 1950s and 1960s, notably Japan and West Germany. This contributed to the increasing interest in growth cycles in the 1960s, as noted above. Thus the main business cycle for most countries has been a relatively short growth cycle with an average duration of generally just over three to under five years (from peak to peak or trough to trough). Classical cycles have averaged about one to two or three years longer than their growth cycles for Australia, France, Italy, New Zealand, Taiwan, and United States. But the average durations of the classical cycles in other countries listed in both Tables 3 and 4, notably Japan and Malaysia, gvf fchave been significantly longer than their growth cycles; though allowance should be made for the fact that both countries have experienced only two classical cycles in the periods available of their cyclical record. It also needs to be allowed that

there was considerable variability of the duration of individual growth and classical cycles around the average durations for some countries. This is revealed by the relatively high standard deviations shown in parenthesis in Tables 3 and 4 for most country's average duration. The standard deviations are especially high for their classical cycles, and also generally for the expansion phases, notably again for the classical cycle.

6.2 International comparisons of business cycle experiences and the leadership role generally of the United States

Another by-product of the international spread of EIA and the identification of corresponding business cycle chronologies for individual countries is the opportunity thus provided for a study of the apparent economic linkages between countries. For instance, it is particularly instructive to acknowledge the extent to which it appears that growth cycle peaks and troughs in most European and most Asia-Pacific countries (for which data are available) have generally lagged corresponding turns in the United States. Table 5 reveals that the lags in terms of both median and mean measures have tended to be longer at peaks than troughs, probably reflecting partly the fact that in most countries the expansion phases of growth cycles have, on average, been longer than the contraction phases, whereas both phases have, on average, been approximately the same in the United States (see Table 3). The major exception to the conclusion among the European and Asia-Pacific countries of the leadership role of the United States has been Taiwan. Taiwan has generally led turns in the United States at both peaks and troughs, a subject worthy of more examination. Nevertheless, the median and mean lags of growth cycles at both peaks and troughs have for most countries been consistently between 6 to 12 months, notably at peaks,

particular exceptions (apart from Taiwan, as already noted) being Canada and the United Kingdom. Moreover, where data are available for the 1950s as well as for the 1960s, there appears to have been a slight increase in the median and mean lags in more recent years of the turning points of most countries vis-à-vis the corresponding turns for the United States, notably at peaks in Australia, Japan and West Germany. Among the European countries the median and mean lags in the turning points for the United Kingdom in comparison with those in the United States have generally been quite a bit shorter than for France, Italy and West Germany, notably again peaks.

Another notable exception to the experience in most European and most Asia-Pacific countries (for which growth cycle chronologies are available for comparison with the experience of the United States) has been Canada where the growth cycle turning points have generally been roughly coincident with those of the United States; and more so in terms of the median whereas the mean has slightly lagged at peaks and been roughly coincident at troughs.

One of the objectives of the international economic indicator (IEI) project (pioneered and directed by Moore) at the NBER and then at CIBCR and now ECRI, in attempting to produce business cycle chronologies that are comparable in concept and method of construction for the countries reported in Tables 3 and 4, is to permit a comparison of cyclical experiences for each country (as is also done in Table 5). Boehm and Moore (1984, pp. 47-48) reported:

> In earlier studies in the IEI project, the hypothesis that the United States tends to lead the rest of the industrial world in their cyclical experiences has been examined; in particular, that downturns occur first in the United States and pull other countries along with it. Initially, the comparisons of growth cycle turns in the United States, Canada, Japan, United Kingdom and West Germany provided little support for this hypothesis (see: Klein 1976, pp. 31-40; Moore and Klein 1977, pp. 1-8 and vii-5; and Kaish 1982, pp. 365 and 367). However, it was then found that in both Italy and France, growth cycle turning points typically occur after comparable turns in the United States, with lags in

> the vicinity of eight to ten months (Klein and Moore 1979, pp. 37-9). It has also been found that United States growth cycle peaks and troughs lead the Swedish turns (Klein 1981, pp. 20-1). A comprehensive study using composite indexes for thirteen countries also showed that cyclical conditions in the United States play a dominant role (Beguelin 1980).

One reason why the median and mean lags for the turning points of growth cycles in Japan and West Germany vis-à-vis the United States are now longer than found in the studies referred to in the quote above, appears to be the general increase in the lags of the turning points since the early 1970s and especially in the 1980s and early 1990s. The general tendency for a big country like the United States to lead the cyclical experiences of other individual countries gives added importance to the continued prosperity of the big country, especially for a relatively small country like Australia. There are also important implications for forecasting and policy-making.

However, some aspects about the evidence used for Table 5 warrant more detailed research and explanation than offered here. One is to allow that the duration of the lags (mostly, but occasional leads) of the turning points for each country used to compute the medians and means reported in Table 5 tend to vary and to be greater for some countries than others. The variability is reflected in the relatively higher standard deviations of the means for some countries reported in Table 5 (columns 5 and 6) than for other countries. It might therefore be felt that insufficient allowance is made for the strength of the respective expansion and contraction phases of each cycle. There is some implicit allowance for this in Table 5 since the comparison is between cycles displaying conformity with the corresponding growth cycle for the United States, as noted above. Layton (1987, p. 31) tested '... the hypothesis that the U.S. growth cycle is "causal" to the Australian growth cycle ... within the Granger-causality context'. Layton's causality test was between the coincident indexes of Australia and the United States during 1967-83. Other tests Layton

reported did not indicate a systematic linkage between Australian and United States cyclical experiences. This is not surprising in view of the general complexity and variability of business cycles from one cycle to another and the varying comparability of cycles (for structural and domestic reasons) between cycles at the same time and over time. Nevertheless, Layton concluded (pp. 41-2):

> The estimated model indicates U.S. cyclical activity had a statistically significant influence (by the usual *t* tests) on Australian cyclical activity during the historical period under study [namely, 1967-1983]. Moreover, U.S. cyclical activity is found to lead on average by about eight months. These within-sample findings complement and support the recent work of Boehm and Moore (1984). Using a turning-point analytical approach, they found the U.S. growth cycle to be a consistent leader of the Australian cycle. The present analysis reinforces the finding in that the strength and consistency of the association is examined at all points, not just turning points.

Another factor that would need to be taken into account in a more detailed study is the effect of the occasiional extra cycles in the United States in relation to some countries as well as also occasional extra cycles in other countries that do not match those in the United States. However, in view of the relatively high degree of conformity between the growth cycles in each country reported in Table 3 and used for Table 5, the percentage of corresponding turns since 1960 with the turns in the United States is relatively, indeed remarkably high for each country. This adds to the importance and significance of the results reported in Table 5, including not least for forecasting and other cyclical analyses. The data used in the preparation of Table 5 cover the period from 1960, except for Malaysia for which the data are available only from 1970 and for New Zealand and South Korea from 1966. The conformity in terms of matching cycles for corresponding periods with the United States was 100 per cent for Canada, Malaysia, New Zealand, South Korea, and Taiwan. Conformity was 87.5 per cent for Australia, France, United Kingdom and West Germany; while for Italy for both peak to peak and trough to trough and Japan for trough to trough it

was 71.4 per cent, but 75 per cent for Japan for peak to peak. However, there was one extra cycle in comparison with the United States in Australia, South Korea, Taiwan and West Germany. There were two extra cycles in Canada, Italy and Japan; three extra in Malaysia and New Zealand, but no extra in France and the United Kingdom.

7. Overall assessment of EIA

The general contribution of EIA has been discussed above through the fixing of business cycle chronologies on national, regional and sectoral bases, thereby manifesting (as noted more fully below in the quotation from Romer) very helpful points of reference regarding the states of the economy, region or sector. These chronologies are largely comparable in concept and method of construction through following the techniques developed over a number of years at the NBER in conjunction with the U.S. Department of Commerce. The techniques and quality of the indexes have been further developed and improved from 1978 at the CIBCR and now also at ECRI since 1997, the Melbourne Institute since 1985 and other institutes in an increasing number of countries. These developments largely followed the establishment of the IEI project by Moore and his colleagues, initially at the NBER from 1973 to 1978. The IEI project was at first concentrated on the G7 countries. Australia was the next country to join in 1984 (see Boehm and Moore 1984); and has been followed by an increasing number of other countries. This is partly reflected in the results thereby available for the analyses in Tables 3 to 5. These results testify to the contribution that it is now increasingly widely recognised an EIA can provide. Further fruits of this development and contribution should result by facilitating, at least potentially if not yet in fact, more comprehensive theoretical and empirical studies of the stylised facts of business cycles.

Though the road on which EIA has traveled since Burns and Mitchell's (1946) monumental study presented in *Measuring Business Cycles* has been at times very rocky, (as is being discussed more fully elsewhere by the author), it seems fair and accurate to say that it has never gone 'off course' or posed any serious doubts regarding the merits of it being developed further, as indeed it has; and hence the justification of the following assessment by Romer (1994, pp. 573-4):

> One reason that the NBER reference dates have been so influential is simply that they are very convenient. They provide a quick shorthand that economists can use to summarize a very complex phenomenon. More fundamentally, the NBER dates have been influential because they are thought to be reliable. The amount of work that went into their development is extremely impressive. Arthur Burns and Wesley Mitchell's seminal study *Measuring Business Cycles,* in which the NBER methodology is described and developed, is surely one of the most respected books in American macroeconomics.

Nevertheless, in their theoretical and empirical studies of business cycles, some economists have been silent on the longevity and usefulness of EIA, as recognised, for instance, by Auerbach (1982). So next it will be worth noting briefly the contributions that EIA can make to combined theoretical and empirical studies of the business cycle, particularly in terms of a more complete and accurate understanding not only of the past and current states of economic activity but also the prospects in the coming months.

8. The use of EIA for studying co-movements of key economic variables and for forecasting classical and growth cycles

8.1 Advantages of using the coincident composite index as a proxy for the business cycle and to compare cyclical movements in other key economic variables

Since especially the late 1980s (but to some extent earlier as well) a key feature of much combined theoretical and empirical research on business cycles (as noted briefly in section 2 above) has been to use a single series such as real GDP (or output) or industrial production as a proxy for the business cycle. As discussed in Boehm (1998, pp. 7-9) and Boehm and Summers (1999, pp. 252-3), influential papers by Lucas (1977) and Kydland and Prescott (1990) led to the methodology of using a single series for the cyclical analysis of the empirical regularities and irregularities in studying persistence and co-movements in key macroeconomic variables during business cycles. Papers that have followed the methodology of using a single series as a proxy for the business cycle in examining the cyclical evidence for a particular country and or for an international comparison include: Hodrick and Prescott (1980) and their revised version of this paper in Hodrick and Prescott (1997); Kydland and Prescott (1982); Long and Plosser (1983); Plosser (1989); Danthine and Girardin (1989); Wolf (1991); Brandner and Neusser (1992); Backus and Kehoe (1992); Blackburn and Ravn (1992); Kim, Buckle and Hall (1994); Crosby and Otto (1995); Serletis and Krause (1996); Fischer, Otto and Voss (1996), and Andreou, Osborn and Sensier (2000).

Reliance on a single series as a proxy for the business cycle has contributed to contrasting and or conflicting findings regarding the pro-, counter-, or acyclical changes in key economic variables. Evidence for this is examined in some detail in

Boehm (1998, pp. 9-21 and 48-51) and Boehm and Summers (1999, pp. 255-263). These findings may reflect the relatively poor and or varying quality of the data, or possibly and more likely, revisions in the data that may shift turning points. Boehm (1998) and Boehm and Summers (1999) identify the timing of these changes in real GDP and real GNFP for Australia. They also show that GDP and GNFP are subject to 'extra cycles' in comparison with the cycles manifested in a comprehensive coincident composite index. Furthermore, the coincident indexes are generally available monthly whereas the GDP and GNFP series are available only quarterly. Boehm (1998) and Boehm and Summers (1999) concluded that a more appropriate and helpful methodology than using a single series for the reference cycle would be to use, where available, a country's coincident composite index. This series is not only less subject to revisions but also represents or indicates more closely and accurately the general course and level of economic activity. Moreover, internationally comparable coincident composite indexes - a major product of economic indicator analyses - are now available monthly for most major market-oriented countries, as exhibited by the data used to construct Tables 3 to 5.

As observed by Boehm and Summers (1999, p. 266), an important strength of the coincident composite index itself is that it is much less subject to revisions or changes than is a single series (such as, notably GDP or GNFP in the national accounts). This is partly because the combination of the several components in the coincident indexes - for instance, seven for the United States and six for Australia - reduces the effects of measurement difficulties relating to errors or later revisions of a series, especially where the early estimates of a series are based on preliminary or inadequate information. It particularly means that the coincident index generally exhibits a more accurate, stable and up-to-date reading of the course of each phase of

the business cycle and of the turning points than would a single series. In brief, the combination in the coincident index of key measures of economic activity involving income, production, retail trade and the labour market (through the level of employment and the unemployment rate) comprehensively captures the underlying empirical regularities manifested in the course of and changes in the business cycle, as seen in terms of its cumulative expansions and contractions and the associated peaks and troughs.

8.2 Using EIA to forecast business cycles

The coincident index can also be used progressively in conjunction with the long-leading and the short-leading indexes both to aid reliable short-term forecasts of the likely course of business activity in the months ahead and to furnish an early identification of the timing of business-cycle turning points, both classical and growth. This is illustrated in Charts 1 and 2 where we exploit a methodology largely pioneered by Moore and used by him and his colleagues at CIBCR and continuing so at ECRI (see Banerji 1999, p. 72; see also Zarnowitz and Moore 1982). Boehm (1998, pp. 37-52) and Boehm and Summers (1999, pp. 268-71) show how the growth rates in the leading and coincident indexes (as explained below) may be used to forecast the course of economic activity in the months ahead for Australia. Here the analysis is extended not only to demonstrate this application of EIA to the business-cycle experiences in the United States but also to take advantage of the development of long-leading indexes for the United States and Australia. The traditional leading indexes for both countries are (as noted in section 1 above) here called short-leading indexes that have generally been seen to anticipate likely changes in the coincident index (and reflecting the business cycle) with leads, on average, of about six to nine

months at peaks and generally about three to six months at troughs. The CIBCR's long-leading index for the United States '... was required to have an average lead of at least 12 months at peaks and 6 months at troughs for the business cycles from 1948 to 1982' (Cullity and Moore in Moore 1990, p. 59). Since then comparable long-leading indexes have been replicated for Australia, Japan, France, Germany and the United Kingdom (see esp.: Cullity and Moore 1988; Boehm and Moore 1991a, 1991b; Moore, Cullity and Boehm 1993, in which Appendix A sets out the components of the long-leading indexes in each country; and Moore, Boehm and Banerji 1992, 1994. The performance of the long-leading index developed for Australia compares favourably with that for the United States, as can be seen from a comparison of the respective long-leading, short-leading and coincident indexes in Charts 1 and 2.

8.3 Adjustments to growth rates of composite indexes to aid forecasting of both classical and growth cycles

The composite indexes are constructed to assist in reading changes in the general *level* of business activity by adjusting each index so that its rate of growth is equal to the annual average rate of change computed for a recent selected period as the trend rate of growth in real GDP of the particular country, as noted in the footnotes to Charts 1 and 2, respectively. As observed by Boehm (1998, p. 38) and Boehm and Summers (1999, pp. 268 and 270):

> This procedure is consistent with the neo-classical growth model developed by Solow (1970, see esp. p. 2) in which a key growth fact is that real GDP grows at a roughly constant rate over relatively long periods of time. Hence, with the trend rate of growth of each index equal to the rate of growth of the economy as a whole, any differences in the growth rates of the indexes month by month are due to short-run factors.

Thus we can conclude, for instance, that the U.S. economy is expanding faster (slower) than its average annual trend rate of growth when the rate of increase in the U.S. coincident index is above (below) 2.9 per cent.

We can, of course, make a reliable reading of the classical cycle of a country from the level of the coincident index itself. However, as explained also in Boehm (1998, pp. 37-40) and Boehm and Summers (1999, pp. 268-71) in their EIA for Australia, one of the most helpful, consistently reliable and relatively straightforward techniques so far developed to monitor and *forecast jointly both* classical and growth cycles is the per cent change six-month smoothed growth rates of the long-leading, short-leading and coincident indexes, respectively, as reported in Charts 1 and 2. A detailed description of the art of identifying business cycles with the assistance of the smoothed rates of growth of the composite indexes is provided by Zarnowitz and Moore (1982; see also Moore 1983, Ch. 4).

The smoothed growth rates are computed as the ratio of the respective current month's index to the average of the twelve preceding months. Since the interval from the current month to the middle of the twelve month average is 6.5 months, the ratio is raised to the 12/6.5 power to put it on an annual rate basis. Boehm (1998, pp. 37-8) explains:

> The result, expressed as a percentage change at annual rate, is called a six-month smoothed rate and in ... [Charts 1 and 2] is placed in the current month. However, in comparisons with the business cycle turning points and in forecasting turning points, the smoothed growth rate needs to be moved three months back in order to centre it, on statistical grounds, with the corresponding turning point.

(See also Boehm and Summers 1999, p. 274, n. 12.)

It is interesting and instructive to note how the course of the business cycle in terms of both classical and growth cycles, as identified for the United States and

Australia in Tables 1 and 2, respectively, and forecasts of its future course, can be relatively easily and convincingly seen by following the growth rates in Charts 1 and 2, respectively, for both countries. The course of the business cycles refers to two essential aspects of it: first, the direction and approximate level of economic activity; and secondly, the turning points (the peaks and troughs) of both classical and growth cycles. Thus in reading either chart, in conjunction with the respective Table 1 or 2, it can be seen that one of the earliest indications that a business cycle expansion appears to be coming to an end is when the smoothed growth rate of the long-leading index moves, for instance, for the United States below the trend rate of 2.9 per cent; and then (allowing for the average leads between the indexes noted above) when this is fairly soon seen also in the short-leading index and within about six months or so is also followed by the growth rate of the coincident index similarly falling below the trend rate. The trend rate used is shown by the bold line at 2.9 per cent in each panel for the United States in Chart 1 and at 3.0 per cent for Australia's long-leading index and 2.7 per cent for Australia's short-leading and coincident indexes in Chart 2. The differences in trend rates used for Australia's long-leading index and the short-leading and coincident indexes arise from the different periods for which the growth rates are derived at the sources of their computation, as explained in the 'note' and 'sources' to Chart 2. Both Charts 1 and 2 distinguish clearly between a growth slowdown (or recession) and a real (classical) recession. If only a growth recession occurs, the actual growth rate of the coincident index moves below the trend rate but remains positive. On these occasions the growth rates of both leading indexes may briefly become negative (reflecting volatility in some components of the index), but usually does not remain so for long without the coincident index growth rate doing so as well. When the coincident index growth rate becomes negative and continues so

for at least six months (see: Boehm and Moore 1984, p. 41; and Boehm 1987, p. 16 on NBER rules) a real recession is probably being indicated. Other NBER criteria in fixing turning points apply in determining each business cycle chronology. Boehm (1998, pp. 39-40) explains further:

> The peak of the growth cycle occurs about the time that the coincident index growth rate (centered statistically, as noted above,) moves below the trend rate; and, if a real recession occurs, the classical cycle peak (sometimes with a short lag after the growth cycle peak; see Tables 1 and 2) is experienced approximately when the coincident index growth rate (centered) becomes negative.
>
> The beginning of a recovery phase of the classical cycle from a recession is foreshadowed when the leading index growth rate (centered) rises above zero while the coincident rate (centered) is probably still negative. The classical trough occurs approximately when the coincident growth rate (centered) becomes positive. This may lead by a month or so or be coincident with the growth cycle trough (Tables 1 and 2). The growth cycle trough takes place when the coincident growth rate (centered) exceeds the trend rate of growth.

(See also Boehm and Summers 1999, p. 270.)

It is also instructive and important to note how the reading of the long-leading, short-leading and coincident indexes can be used by economic policy-makers and forecasters to furnish a prompt monitoring of what may be expected in the way of economic fluctuations in the coming months as foreshadowed by the long-leading and short-leading indexes. This can be done in the light of what is currently being experienced as portrayed in the coincident index. Recall, as noted above, that the long-leading index provides a fairly reliable forecast of, on average, twelve months at peaks and six months at troughs and the short-leading index of about six to nine months at peaks and three months at troughs of what may be anticipated to be seen in the coincident index. For instance, Chart 1 highlights at a glance the three classical recessions in the United States in 1980, 1981-82 and July 1990 to March 1991, as reported in Table 1. The chart reveals how these had in each case been foreshadowed

by the long-leading and short-leading indexes. Chart 1 also records the relatively mild growth slowdown in the mid-1990s and how this had also relatively mildly been anticipated by both leading indexes. Chart 2 in comparison with Table 2 similarly highlights: first, how the two classical recessions in Australia in 1981-3 and 1989-92 were clearly foreshadowed in the ways expected by the long-leading and short-leading indexes; and secondly, how only growth slowdowns should have been expected - as, indeed, they were experienced - between November 1985 and March 1987 and between about December 1995 and January 1997, altogether valuable information for policy-makers, forecasters and others. In short, for both the United States and Australia, the long-leading and short-leading indexes would have exhibited, as expected of them, very helpful information during the periods shown in Charts 1 and 2 of what could reasonably be expected by policy-makers and others in their short-term forecasts regarding the business cycle.

Another aspect worthy of brief recognition here and that is discussed more fully in Boehm (1998, pp. 40-41) and Boehm and Summers (1999, p. 271) is that the smoothed growth rate technique developed by Moore and his colleagues at CIBCR and ECRI overcomes difficulties and uncertainties experienced in using the phase-average trend method. This method was developed by Boschan and Ebanks (1978) in their endeavour to improve the trend-fitting methodology of the NBER. The difficulties and uncertainties in measuring the deviation from trend, while working well historically, arise especially over the last few months of the series being studied and sometimes reacts misleadingly and substantially from one recent month to another. This may occur when updates of the series are made and if the series is volatile in one month alone, particularly the latest month. For these reasons Layton and Moore (1989, p. 380) also favoured the analysis of the per cent change six-month

smoothed growth rate technique (as exploited in this paper) rather than using the deviations from trend. The deviations from trend analysis is an aspect of EIA that would justify more detailed analysis, particularly since the trend and cycle may be intricately related.

9. Summary and conclusion

This paper has outlined key aspects of the development of EIA and its contribution to providing essential economic indicators and indexes to aid more fully the understanding of both business cycle experiences and prospects in the coming months for an increasing number of countries in North America, Europe and Asia-Pacific.

The success of EIA, its longevity and its more intensive development in individual countries, notably initially in the United States but then its spread globally since the mid-1970s, testify much to Dr Geoffrey Moore's initiatives and enthusiasm. Furthermore, our much clearer understanding today of economic fluctuations as they are happening in major market-oriented countries, and our ability to forecast more accurately how these fluctuations are likely to unfold in each country in the coming months, owe much to Moore's pioneering role in the development of the methodologies involved in EIA and their continuing improvement. Indeed, without Moore's substantial role, this paper could largely not have been written at this point in time along the lines it has regarding the comparative cyclical experiences of the countries included in Tables 3 to 5. Recent notable additions (inspired largely by Moore, as were the comparable indexes for other countries) have been the development of leading and coincident indexes for India (see: Dua and Banerji 1999; Banerji and Dua 2000; and Dua and Banerji 2001a and 2001b).

Finally, Moore's major contribution can also be seen in the timely, instructive and helpful assessments that his former colleagues at ECRI are continuing to offer and to develop further regarding the business cycle and inflation prospects of the United States and of an increasing number of other countries. These assessments in respect to the United States are being made with the aid of both the national and the sectoral leading and coincident indexes initially developed under Moore's directorship and briefly referred to above. Clearly, EIA on both macro and micro bases has much to contribute to assist economists, policy-makers and others in following closely and explaining relatively accurately the current state of business activity and its likely course in the coming months. ECRI now furnishes up-to-date readings of the current state of the business cycle and its prospects in the months ahead individually for 15 other market-oriented countries as well as for the United States; that is, just over double the number of countries - namely, the G7 countries - that Moore had set as his initial target when he began his IEI project in the early 1970s.

Table 1: Phases of Business Cycles, United States, 1948-2000

Growth Cycles						Classical Cycles					
Dates of peaks and troughs by month and year (d)		Duration in months				Dates of peaks and troughs by month and year (e)		Duration in months			
Peak	Trough	Contraction: Peak to trough	Expansion: Trough to peak	Cycle Peak to peak	Cycle Trough to trough	Peak	Trough	Contraction: Peak to trough	Expansion: Trough to peak	Cycle Peak to peak	Cycle Trough to trough
1	2	3	4	5	6	7	8	9	10	11	12
7/48	10/49	15				11/48	10/49	11			
3/51	7/52	16	17	32	33						
3/53	8/54	17	8	24	25	7/53	5/54	10	45	56	55
2/57	4/58	14	30	47	44	8/57	4/58	8	39	49	47
2/60	2/61	12	22	36	34	4/60	2/61	10	24	32	34
5/62	10/64	29	15	27	44						
6/66	10/67	16	20	49	36						
3/69	11/70	20	17	33	37	12/69	11/70	11	106	116	117
3/73	3/75	24	28	48	52	11/73	3/75	16	36	47	52
12/78						1/80	7/80	6	58	74	64
	12/82	48	45	69	93	7/81	11/82	16	12	18	28
3/85*	11/86*	20	27	75	47						
2/89*	7/93*	53	27	47	80	7/90	3/91	8	92	108	100
1/95*	11/95*	10	18	71	28						
7/00*(c)			56	66							
Averages (b):		23	25	48	46			11	51	62	62
Standard Deviations(b):		13	12	17	20			3	30	32	29

Notes:

(a) The last seven growth cycle dates marked by asterisks have been identified by the author and are based on United States' trend-adjusted coincident index only.

(b) The average duration and standard deviations are rounded to full months.

(c) Preliminary.

Sources:

(d) CIBCR 1995, p. 26 until the trough in 12/82 and then from the coincident composite index only supplied by ECRI.

(e) As selected by the NBER and published in CIBCR 1995, p. 25.

Table 2: Phases of Business Cycles, Australia, 1951-2000

Growth Cycles						Classical Cycles					
Dates of peaks and troughs by month and year		Duration in months				Dates of peaks and troughs by month and year		Duration in months			
Peak	Trough	Contraction: Peak to trough	Expansion: Trough to peak	Cycle Peak to peak	Cycle Trough to trough	Peak	Trough	Contraction: Peak to trough	Expansion: Trough to peak	Cycle Peak to peak	Cycle Trough to trough
1	2	3	4	5	6	7	8	9	10	11	12
4/51	11/52	19				4/51	9/52	17			
8/55	1/58	29	33	52	62	12/55	12/57	24	39	56	63
8/60	9/61	13	31	60	44	9/60	9/61	12	33	57	45
4/65	1/68	33	43	56	76						
1/71	3/72	14	36	69	50						
2/74	10/75	20	23	37	43	7/74	10/75	15	154	166	169
8/76	2/78	18	10	30	28	8/76	10/77	14	10	25	24
9/81	5/83	20	43	61	63	9/81	5/83	20	47	61	67
11/85	3/87	16	30	50	46						
11/89	12/92	37	32	48	69	12/89	12/92	36	79	99	115
12/95*	1/97*	13	36	73	49						
7/00*(c)			42	55							
Averages (b):		21	33	54	53			20	60	77	80
Standard Deviations (b):		8	9	12	14			8	47	45	48

Notes:

(a) The last three growth cycle dates marked by asterisks are based on Australia's trend-adjusted coincident composite index only.

(a) The average duration and standard deviations are rounded to full months.

(b) Preliminary.

Sources:

(c) Columns 1, 2, 7 and 8 from Boehm and Moore (1984, pp. 42 and 43), and updated by the author (following the same procedure and) using the latest data in the Melbourne Institute's databank for the series taken into account, as explained in the text.

Table 3: Average Duration of Growth Cycles in Twelve Countries and Three Groups of Countries, Various Periods, 1948-98

Country	Period	Number of cycles	Average duration in months			
			Contraction: Peak to trough	Expansion: Trough to peak	Cycle	
					Peak to peak	Trough to trough
1	2	3	4	5	6	7
Australia	1951-98	10	23 (8)	31 (9)	53 (12)	54 (14)
Canada	1950-96	13 (b)	18 (6)	22 (11)	40 (13)	40 (15)
France	1957-96	8	24 (10)	31 (17)	57 (18)	56 (22)
Italy	1956-93	8	23 (11)	30 (14)	53 (17)	51 (22)
Japan	1953-97	10 (c)	19 (6)	33 (16)	52 (19)	52 (17)
Malaysia	1970-98	9	18 (8)	17 (8)	36 (15)	35 (10)
New Zealand	1966-96	9 (d)	20 (6)	21 (11)	40 (14)	37 (8)
South Korea	1966-97	7	20 (5)	29 (11)	48 (13)	52 (10)
Taiwan	1963-98	8	23 (12)	27 (14)	51 (16)	50 (14)
United Kingdom	1951-96	9	27 (9)	31 (10)	59 (10)	59 (17)
United States	1948-97	12	24 (10)	23 (9)	46 (16)	47 (18)
West Germany	1951-97	10	24 (11)	28 (11)	53 (18)	52 (18)
Four countries: Europe (e)	1957-90	6 (f)	26 (8)	40 (23)	66 (30)	58 (20)
Five Countries: Pacific (g)	1959-90	6	23 (8)	34 (15)	58 (13)	57 (22)
World Economy: Eleven Countries (h)	1957-90	8 (i)	20 (8)	30 (12)	50 (15)	49 (20)

Notes:
(a) The figures in parenthesis in columns 4 to 7 are standard deviations of the respective average durations rounded to full months.
(b) Thirteen from peak to peak and fourteen from trough to trough.
(c) Ten from peak to peak and nine from trough to trough.
(d) Nine from peak to peak and eight from trough to trough.
(e) Includes France, Italy, United Kingdom and West Germany.
(f) Six from peak to peak and five from trough to trough.
(g) Includes Australia, Japan, New Zealand, South Korea and Taiwan.
(h) Excludes Malaysia from the twelve countries listed above.
(i) Eight from peak to peak and seven from trough to trough.

Sources:
For United States, as for Table 1, columns 1 and 2; for Australia, as for Table 2, columns 1 and 2; and for other countries, computed from data in CIBCR, *IEI,* various issues.

Table 4: Average Duration of Classical Cycles in Twelve Countries and a Group of Four European Countries, Various Periods, 1948-97

Country	Period	Number of cycles	Average duration in months			
			Contraction:	Expansion:	Cycle	
			Peak to trough	Trough to peak	Peak to peak	Trough to trough
1	2	3	4	5	6	7
Australia	1951-92	6	20 (8)	60 (47)	77 (45)	80 (48)
Canada	1953-92	5	14 (6)	76 (50)	88 (49)	91 (48)
France	1957-93	5	29 (14)	51 (30)	79 (26)	84 (24)
India	1964-97	5	10 (2)	65 (41)	76 (41)	75 (39)
Italy	1963-94	6	14 (4)	44 (33)	57 (34)	58 (36)
Japan	1954-97	2	16 (1)	160 (88)	140 (86)	238 (10)
Malaysia	1974-98	2	10 (2)	131 (12)	140 (14)	143 (12)
New Zealand	1967-91	4	12 (6)	58 (43)	70 (42)	71 (46)
Taiwan	1973-98	5 (b)	8 (3)	50 (21)	58 (23)	63 (19)
United Kingdom	1951-93	5	27 (12)	70 (51)	93 (52)	98 (46)
United States	1948-91	8	11 (3)	52 (30)	63 (32)	62 (29)
West Germany	1966-97	4	19 (8)	70 (27)	91 (33)	90 (29)
Four countries: Europe (c)	1966-93	3	18 (9)	85 (23)	102 (31)	106 (19)

Notes:
(a) As for note (a) of Table 3.
(b) Five from peak to peak and four from trough to trough.
(c) Includes France, Italy, United Kingdom and West Germany.

Sources:
For United States, as for Table 1, columns 7 and 8; for Australia, as for Table 2, columns 7 and 8; for India, computed from data in Dua and Banerji 1999, Table 1; and for other countries, computed from data in CIBCR, *IEI*, various issues.

Table 5: Comparison of Growth Cycle Turning Points in the United States With Corresponding Turns from 1960 or Later in Eleven Market-Oriented Countries and Four Groups of Countries, Various Periods, 1960-98

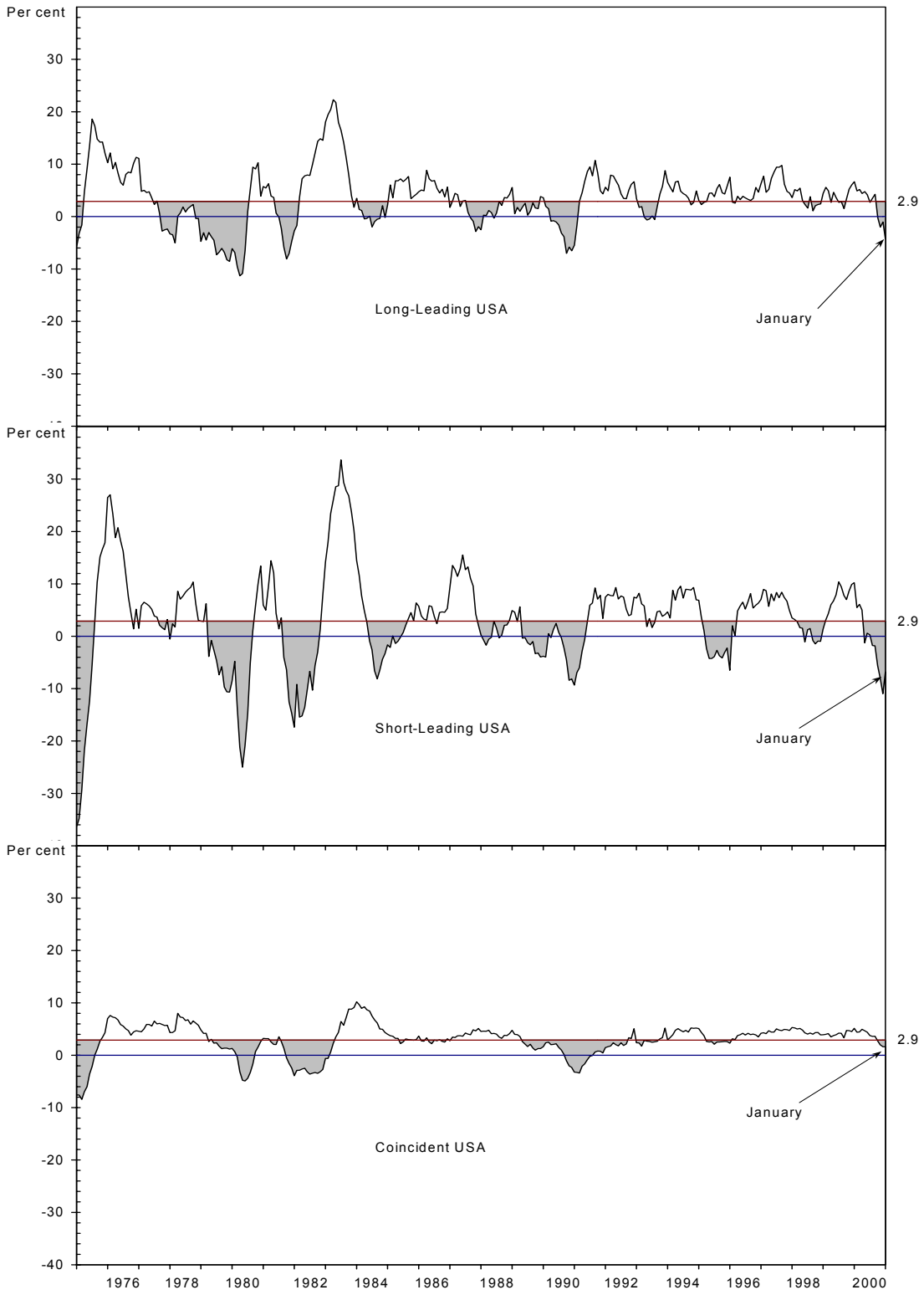
Country	Total period available	Median lead (-) or lag (+) on US's turns in months (a)		Mean lead (-) or lag (+) on US's turns in months (a)	
		Peak	Trough	Peak	Trough
1	2	3	4	5	6
Australia	1960-98	+10	+6	+11(13)	+7 (5)
Canada	1960-96	0	+1	+4 (7)	-1 (6)
France	1960-96	+8	+5	+7(11)	+2 (11)
Italy	1960-93	+11	+6	+8 (8)	+9 (7)
Japan	1960-97	+15	+10	+18 (8)	+10 (7)
Malaysia	1970-98	+8	0	+8 (8)	+5 (10)
New Zealand	1966-96	+13	+3	+11 (8)	+4 (10)
South Korea	1966-97	+7	+1	+9 (11)	-3 (14)
Taiwan	1963-96	-4	-3	-2 (7)	-8 (8)
United Kingdom	1960-96	+3	+2	+2 (8)	0 (10)
West Germany	1960-97	+10	+2	+8 (14)	+2 (9)
Four countries: Europe (b)	1960-90	+7	+7	+5 (11)	+3 (12)
Five countries: Pacific (c)	1960-90	+4	+4	+7 (10)	0 (12)
Ten countries: excluding USA (d)	1960-93	+8	+7	+2 (15)	+5 (11)
Eleven Counties (e)	1960-90	0	0	+5 (6)	-1 (9)

Notes:
(a) The median leads or lags in columns 3 and 4, and the mean leads or lags and their standard deviations shown in parenthesis in columns 5 and 6, are rounded to full months.
(b) Includes France, Italy, United Kingdom and West Germany.
(c) Includes Australia, Japan, New Zealand, South Korea and Taiwan.

Sources:
(d) Excludes Malaysia from countries listed above (as well as USA).
(e) Excludes Malaysia from countries listed above and includes USA.

Computed from data as used for Table 3 above.

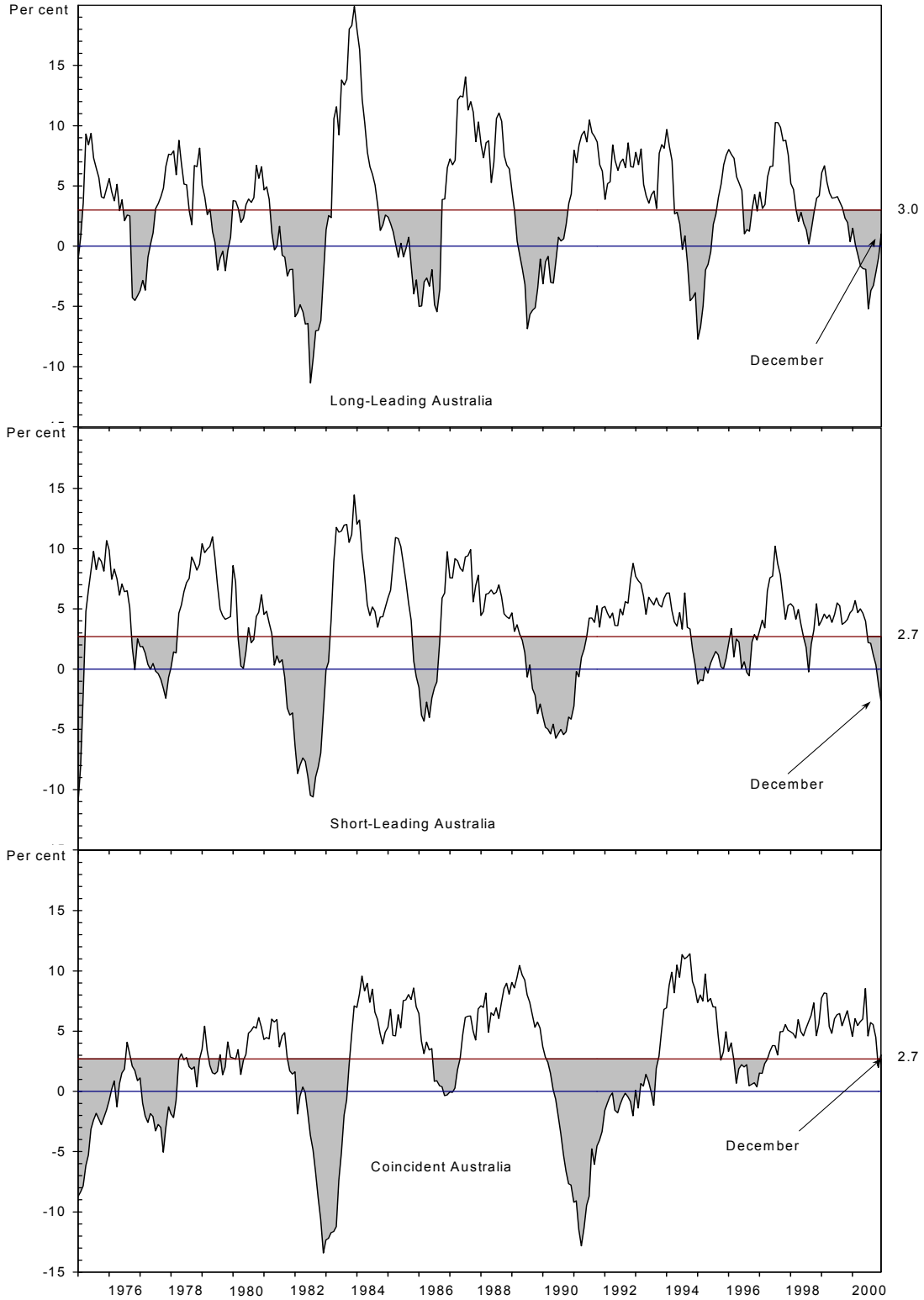
Chart 1: Growth rates in the long-leading, short-leading and coincident indexes, USA, 1975-2001 (six month smoothed percentage change at annual rate).



Note: The bold lines at 2.9 per cent indicate the annual average rate of change—1975-1991—in the indexes (based on the rate of change in real GDP during the period).

Sources: Economic Cycle Research Institute, New York.

Chart 2: Growth rates in the long-leading, short-leading and coincident indexes, Australia, 1975-2000 (six month smoothed percentage change at annual rate).



Note: The bold line at 3.0 per cent for the long-leading index indicates the annual average rate of change—1975-1991—in the index, and the bold lines at 2.7 per cent for the short-leading and coincident indexes indicate the annual average rate of change—1985-1995—in the indexes (in each case based on the rates of change in real GDP during the respective periods).

Sources: The long-leading index, Economic Cycle Research Institute, New York, and the short-leading and coincident indexes, Melbourne Institute of Applied Economic and Social Research.

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