A Review of Some Methodological Issues in Identifying and Analysing Business Cycles

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1. Introduction and changing views regarding the persistence of business cycles

There are four main objectives in this paper: first, to promote the theoretical and empirical benefits of defining business cycles in terms of both classical and growth cycles; second, to note, however, that a major thrust of recent theoretical and empirical analyses of the business cycle has been in terms of deviations from trend (that is, growth cycles); third, to question the appropriateness of the widespread practice (in the deviations from trend analyses) of using a single series, generally real gross domestic product (GDP), as a proxy for the business cycle instead of using (when available) a composite index of coincident indicators; and fourth, (in further development of the first objective,) to observe some of the important implications and advantages for economic and social policy-making, and for economic forecasting, from identifying and distinguishing between classical and growth cycles. This distinction gains in importance in the light of the changing views regarding the persistence of business cycles. An important and general conclusion of this paper is that it seems clear that the quality of business cycle analysis can be raised, both theoretically and empirically, and in both academic and official circles.

In the process of the analysis it will be seen that several major studies have confused, or incorrectly compared classical cycles with growth cycles; or been silent on the distinction between them. This weakness or lack in recent (and some earlier)

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studies of business cycles should itself make the review undertaken in this paper worthwhile. It will also be seen that meantime a substantial effort has been made to understand business cycles, reflecting the considerable revival of interest in this subject from about the beginning of the 1970s. After much attention in the 1950s and the first half of the 1960s to the subject of economic fluctuations, along with that of economic growth, interest in and concern about business cycles, as noted in Boehm (1990, p. 27):

> … waned as the experience of the 1960s led an increasing number of economists to raise the question of whether the business cycle was obsolete: witness the conference held in 1967 "on the possible obsolescence of the 10-year business cycle and the various patterns of long- and short-term fluctuations that have characterized capitalistic economic life" (Bronfenbrenner, 1969, p. v).

Again, recently (in 1997 and 1998), questions about the continuance of the business cycle have been prompted by the long classical expansions being experienced, for instance, in the United States and Australia. As explained in more detail below, the classical expansion in the United States has completed its seventh year since March 1991; and in Australia it is in its sixth year since December 1992 (see column 8 in Tables 1 and 2, respectively). These relatively long expansions and the prospects of them continuing have increasingly dimmed the memory of an increasing number of commentators regarding the persistence of the business cycle; or it has at least questioned their belief in its persistence and raised the possibility of it being 'dead'. For instance, Colleen Ryan, in the *Australian Financial Review [AFR]* (28 January 1997, p. 1), in an article titled 'Has the US fallen off the business cycle?' stated: 'Indeed, so optimistic is the outlook that some economists are suggesting the old boom and bust business cycle has left the US economy for good'. Australia's continuing long expansion led Australia's Federal Treasurer (the Hon. Peter Costello) optimistically to suggest (*AFR*, 7 July 1997, p.10): 'We ought to be looking at a cycle

that runs in the decades, rather than the experience of the `80s and `90s which was bursts of growth followed by severe downturns'. A little earlier, the Governor of the Reserve Bank of Australia, (in a talk on 15 May 1997) more realistically commented (Macfarlane, 1997, p. 3):

> Ideally, we should try to eliminate the business cycle (and recessions) altogether, but that would be too utopian an aspiration. The business cycle has been declared dead before, only to re-assert itself. I do believe, however, that if inflation is kept under control, this expansion will be a lot longer than its predecessors and any subsequent downturn kept milder than in the past.

The Economist (5 April 1997, p. 13), in reflecting on 'the great surge in share prices in America and elsewhere', (with share prices in the United States '… soaring by around 80% over the past two years …'), also commented realistically:

> Perhaps, said optimists, the business cycle was dead. Perhaps profits and share prices could continue ever upwards …. [B]ut bulls should note that the death of the business cycle was never plausible. All previous expansions have eventually pushed up inflation and hence short-term interest rates. Bond prices then fall, to be followed down by shares before the economy slides into recession.

Weber (1997, p. 65) suggested warily in his article titled 'The End of the Business Cycle?':

> For both empirical and theoretical reasons, in advanced industrial economies the waves of the business cycle may be becoming more like ripples.
>
> The dampening of the business cycle will change the global economy and undermine assumptions and arguments that political economists use to understand it. "History counsels caution," Alan Greenspan warned the [United States] Senate banking committee in February 1997, about "visions of such 'new eras' that, in the end, have proven to be a mirage." Greenspan is surely right to warn against too easily accepting that the present is fundamentally different from the past ….

As in the 1970s, so again in the late 1990s and into the next millennium, it is clearly expected that business cycles will persist and continue to be experienced in industrialised market economies, though probably changing in some important respects as economies develop. This clearly justifies the review in this paper of some

leading methodological issues in order to identify and analyse adequately the on-going cycles and the co-movements of key economic variables.

In the next section the term business cycle as used in this paper is defined and a brief review is made of the empirical evidence of classical and growth cycles, using for illustration the experiences in Australia and the United States. The expectation that business cycles will continue adds to the merit – for both theoretical and policy purposes – of distinguishing between classical and growth cycles. However, it is noted in section 3 that the emphasis in a number of recent theoretical and empirical studies of business cycles has been, (as mentioned in the opening paragraph above) in terms only of deviations from trend, that is, in terms of growth cycles; and generally there has been little or no attention to turning points (because of the interest in moments). Section 4 raises questions of possible weaknesses and limitations of some of the conclusions of these recent studies through using a single series (such as real GDP) to represent the business cycle. In section 5 a brief review is made of the merits of using economic indicator analysis for theoretical and policy purposes in order to study the persistence (that is, the duration) of business cycles and to compare the co-movements among key variables during each business cycle; and to identify, distinguish between and forecast both classical and growth cycles. Section 6 provides a summary and conclusion of the analysis.

2. Definition and empirical evidence of classical and growth cycles

The term 'business cycle' in this paper, as indicated above, is used to refer to either or both classical and growth cycles. Classical cycles are defined as recurring expansions and contractions in the *absolute level* of aggregate economic activity. They are, as Pagan (1997b, p. 20) aptly put it, the '… hills and valleys in a plot of the *levels* of the

series …' representing the general level of economic activity. Growth cycles, on the other hand, are defined as recurring fluctuations in the *rate of growth* of aggregate activity relative to the long-run trend rate of growth.[1] So growth cycles, as noted above, refer to the deviations of the series from trend.

A descriptive definition of business cycles that has been widely acknowledged, at least as a starting point, was first formulated by Wesley Mitchell (1927, see esp. pp. 468-9) at the National Bureau of Economic Research (NBER), New York, 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 particularly to classical cycles which have historically been the main concern of business cycle studies at the NBER. However, Table 1 reveals that there was no classical contraction in the United States between February 1961 and December 1969, a period of 106 months. This contributed to the growing view among an increasing number of economists and policy-makers in general that the business cycle was 'dead', as noted above. Moreover, Table 2 shows that a classical upswing continued in Australia from September 1961 to July 1974, a period of 154 months. There was also a long classical upswing at the time in Canada. Cross (1982, p. xxvi) records the upswing from February 1961 to May 1974, a period of 159 months; while the CIBCR (1998, p. 53) dates the expansion on recent comprehensive revised data as

[1] For a stylised illustration of business cycles in terms of classical and growth cycles, see Boehm and Liew, 1994, p.5.

being even longer from February 1961 to April 1981, a period of 242 months (see also CIBCR, 1997, p. 33). These experiences, particularly in the United States, contributed to a revival of interest in growth cycles. This interest was especially manifested in research work at the NBER by Mintz (1969, 1972, 1974). Mintz's allowance for growth cycles as well as classical cycles justified a revision of the Burns-Mitchell definition of business cycles as quoted above, to the extent, as Mintz (1974, pp. 6-7) explains 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'.[2]

Tables 1 and 2 illustrate several important aspects for the purposes of this paper regarding both theoretical studies and policy-making. One 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 both countries which did not lead on to classical cycles. Another aspect concerns the purpose and usefulness for theoretical and policy objectives of distinguishing between classical and growth cycles and identifying the turning points themselves. The use of economic indicator analysis to aid the study of the stylised facts of business cycles, and to identify and forecast both classical and growth cycles, is considered further in section 5 of this paper. However, the analyses in recent theoretical and empirical studies of business cycles have been mainly backward-looking exercises in terms of a comparison of the deviations from trend of key economic variables with those of real GDP. It will be appropriate next to review briefly a representative selection of these analyses.

[2] For an earlier discussion of the definitions of classical and growth cycles, see Mintz, 1972, esp. pp. 45-6.

3. Emphasis in recent theoretical and empirical studies on deviations from trend

A central feature of much combined theoretical and empirical work on business cycles since Lucas's (1977) influential article on 'Understanding Business Cycles' has been to define business cycles as deviations of 'real GDP' or 'aggregate real output' from trend. The economic setting involves viewing the business cycle occurring in industrial market economies experiencing sustained growth. Furthermore, the pattern of analysis in the 1990s in identifying the stylised facts of business cycles has largely followed the procedure adopted by Kydland and Prescott (KP) (1990). In KP's study of the U.S. cyclical experience, they state (p. 4, italics in original):

> We follow Lucas in defining *business cycles* as the deviations of aggregate real output from trend. We complete his definition by providing an explicit procedure for calculating a time series trend that successfully mimics the smooth curves most business cycle researchers would draw through plots of the data. We also follow Lucas in viewing the business cycle facts as the statistical properties of the comovements of deviations from trend of various economic aggregates with those of real output.

Studies which have, in turn, largely followed the KP methodology in analysing the empirical regularities and irregularities involving the study of persistence (positive serial correlation) and co-movement (positive cross-sectional correlation) in key macro-economic variables include Wolf (1991) for the United States; Backus and Kehoe (1992) for ten countries (namely: Australia, Canada, Denmark, Germany, Italy, Japan, Norway, Sweden, United Kingdom, and United States); Blackburn and Ravn (1992) for the United Kingdom; Kim, Buckle and Hall (1994) for New Zealand; Crosby and Otto (1995) for Australia; Serletis and Krause (1996) for the United States; and Fisher, Otto and Voss (1996) for Australia. Brandner and Neusser (1992), in updating their 1990 working paper (with the same title) examining the stylised facts of business cycles in Austria and Germany, pursue an analysis which, as they recognise, is similar to KP's.

The number of specific economic aggregates compared with real GDP (or output) vary from study to study. The variables generally examined include real expenditure for consumption and investment and components of both for the private and public sectors; exports and imports; production inputs for aspects of labour and capital; and aspects of nominal variables including notably money supply and prices.

As mentioned in section 1 above, there has been little attention to business cycle turning points in the above studies which follow the KP methodology. Where reference was made to turning points, no distinction was drawn between classical and growth cycle turning points. For instance, brief mention is given to turning points for Austria by Brandner and Neusser (1992, pp. 72-3). But the turns used appear to be for the classical cycle whereas the growth cycle would have been more revelant for their analysis involving deviation from trend. Similarly, Backus and Kehoe (1992, p. 880) compare their results with those of Friedman and Schwartz (1982) who used the NBER classical cycle reference dates for the United States and the United Kingdom; but the more comparable for Backus and Kehoe would also have been the growth cycle reference chronology. KP (1990, p. 17) were explicit in their 'Concluding Remarks' in stating: 'Let us reemphasize that, unlike Burns and Mitchell [1946], we are not claiming to measure business cycles'. This KP conclusion reflects the important policy consequence of RBC theory (as will be explained in more detail by the author elsewhere) that there is no need to pay attention to the timing of turning points since one leaves any adjustments required during a recession or boom to the market forces, thereby not interfering with the 'invisible hand' (see, for instance, Mankiw, 1989, p. 83).

It should also be noted that following Lucas (1977) there had been several influential studies in the 1980s developing the particular methodology which was

further progressed and popularised by KP (1990) involving various aspects of the auto- and cross-correlations and standard deviations of key economic aggregates. These studies include: Hodrick and Prescott (1980) and their revised version of this paper in Hodrick and Prescott (1997), Lucas (1980), Kydland and Prescott (1982), Long and Plosser (1983), Plosser (1989), and Danthine and Girardin (1989). These earlier studies should justifiably be taken into account and their contributions assessed in a more comprehensive review of the attempts to explain business cycles than undertaken in this paper.

4. Problems arising from the use of a single series to represent the business cycle

4.1 Need for a monthly measure of aggregate economic activity

A general objective of the studies listed in the first paragraph of the previous section (and which follow the KP methodology) was to see whether the selected key variables have remained consistently pro-, counter-, or acyclical with those of real GDP (or output). It clearly may be very useful to know for theoretical and empirical studies the cyclical behaviour of specific key variables during business cycles. A question being raised in this paper is whether the use of the data available of a single series such as real GDP is the most appropriate series to provide a proxy for the business cycle. Several studies also compare their results for a particular country with the results reported in one or more of the earlier studies listed above. Comparisons are also made in some cases with the results of studies before the 1990s on the stylised facts of business cycles, notably the findings of Friedman and Schwartz (1963, 1982).But generally more consideration could have been given in the recent studies to possible reasons for any conflicting or contrasting conclusions with the results of earlier

researchers for other countries, or for changes identified during the selected period for the specific country under review.

One important reason probably contributing to the contrasting or conflicting conclusions drawn concerning the pro-, counter-, or acyclical movements of key variables could be the relatively poor or varying quality of an economic variable; and also, and not least, the use of a single series such as real GDP to represent the business cycle. Moreover, that series itself has been subject to more or less important revisions, as discussed below.

Ideally what is required, as discussed in Boehm (1987), is a precise and accurate measure of the aggregate economic activity of a nation as soon as possible after the event. We could define the *ideal* measure of the aggregate economic activity as *monthly* real GDP or, for Australia (to allow for irregular weather influences on the harvest), real GNFP (gross non-farm product). Though no such series is available it is nevertheless worth pondering what it would mean to have a series which accurately, and without requiring later revisions, measures the total economic activity and which would therefore clearly reflect business fluctuations. An important reason for looking to GDP (or GNFP) possibly providing the required ideal measure is because it could be the most comprehensive of the official statistical series which approximates the aggregate economic activity.

If we had this ideal measure of the aggregate economic activity, we could then base our theoretical and empirical studies of the stylised facts of business cycles concerning persistence and co-movements of key macro-economic variables with those of the ideal measure. The ideal measure of monthly real GDP (or GNFP) could also be used to provide the basis for identifying reference cycle chronologies and hence phases of the cycle, both classical and growth, to which we could relate all other economic

indicators, including the leading and lagging indicators. We would still be interested in statistical indicators whose cyclical patterns are roughly coincident with monthly real GDP (or GNFP). This interest would be essentially because of the importance to business cycle analysis and economic forecasting of key areas reflecting aspects of the current state of economic activity, such as industrial production, household income, retail trade, employment, and unemployment. However, if we already had the ideal measure, we would not be concerned with these roughly coincident indicators to obtain a picture of the general course and the level of aggregate economic activity.

But, as the U.S. Department of Commerce (1984, p. 65) acknowledged in discussing the 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 applies equally to other countries. Thus, in the absence of the ideal measure of monthly real GDP (or GNFP), we select roughly coincident indicators that, when combined in a composite index, will, as far as possible, truthfully reflect the aggregate economic activity. For the selection of these indicators, criteria are used, (as discussed in Zarnowitz and Boschan, 1977, pp. 171-3; and U.S. Department of Commerce, 1984, p. 70, n. 1), to identify the statistical series that historically appear to have accurately represented the current economic activity. Similarly, Stock and Watson (1991, pp. 63-4), in considering the question of 'What do the leading indicators lead?', explain their construction of 'a probability model of the coincident economic indicators'. Their model

> … is based on the notion that the comovements in many macroeconomic variables have a common element that can be captured by a single underlying, unobserved variable. In the abstract, this variable represents the general "state of the economy." The problem is to estimate the current state of the economy, that is, this common element in the fluctuations of key aggregate time-series variables.

In support of their development of ‘the coincident indicator model’, Stock and Watson (1991, p. 65) recognise that

> Individual series measure more or less well-defined concepts, such as the value of all goods and services produced in a quarter or the total number of individuals working for pay. But these series measure only various facets of the overall state of economic activity; none measure the state of the economy [in Burns and Mitchell’s (1946) terminology, the “reference cycle”] directly. Moreover, even the concepts that the series purport to measure are measured with error.

Oppenländer (1994, p. 718) agreed that ‘… the indicators [used in the construction of the coincident composite index] implicitly define a variable that can be thought of as the “overall state of the economy” (Stock and Watson [1988] p. 1) …’.

4.2 Illustrations of cyclical changes following revisions to earlier estimates of Australia’s real GDP and real GNFP

Measurement errors mean that the estimates of the real GDP and GNFP series that are available, for instance, for Australia, fall a long way short of the ideal series envisaged above. 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, especially for recent quarters, but also extending back to earlier quarters (see Lim, 1985). Nor does any other single statistical series individually satisfy our requirements for analysis of the overall state of economic activity.

It is instructive to note the extent of the cyclical changes in estimates of real GDP and real GNFP for Australia which have resulted from attempts to remove measurement error and from other revisions of the data published earlier. Revisions might reasonably be expected to occur with the most recent quarterly estimates of GDP or GNFP until the data on which the estimates are based become more fully available. Revisions to earlier estimates may arise when the constant price series is re-based on a more recent year. Revisions may also arise from the more regular updates of seasonal adjustment factors and of benchmarks used from surveys or

censuses. When measurement error is eliminated as far as possible and revisions are made, the turning points should then be expected to settle down. The statistical evidence shows that this is not always the case.

Table 3 reports the turning points identified in the estimates of GDP(I); (that is, the income-based measure of GDP). A review is made in the next sub-section of the expenditure and production approaches to measuring GDP. A leading objective of setting out the relatively straight-forward but basic facts in, for instance, Tables 3 and 4, is to highlight aspects regarding the changing turning points of the data that could be important to take into account in assessing the empirical implications of the results of studies of the stylised facts of business cycles. On the other hand, it is also important not to overstate any problems resulting from revisions and the shifting of business cycle turning points. Only further empirical tests (not undertaken here) may show how significant particular revisions have been for the purposes of particular analyses. The fundamental objective is to achieve the highest possible quality analyses of business cycle experiences. Table 3 reveals that, apart from the more or less expected revisions to recent quarters, there have also been important and continuing revisions with earlier turning points. For instance, the table shows that the peak in 11/76 (that is, November 1976), as identified in both June 1981 and May 1984, moved to 5/76 in the data available at March 1986. It appears[3] to have remained there through to the data available at January 1993, but in May 1995 this peak had returned to 11/76 and appears to have remained there since. Table 3 shows that other

[3] It is appropriate to say 'appears' in this context since the turning point analysis of the national account series has not been run at the times of every quarterly update when revisions of earlier data during the period under consideration would also have been reported.

shifts in the earlier turning points for GDP(I) also occurred; for instance, a corresponding peak in 11/68, as originally identified for the data available at June 1981, had moved to 5/70 in May 1984, then to 8/71 for March 1986 and April 1988, back to 5/70 in January 1993; and then it appears to have returned to 8/71 since May 1995. Another example concerns the trough in 2/72, as identified in June 1981 and moving to 8/72 in May 1984, then back to 2/72 in April 1988, and returning to 8/72 in May 1995.

The importance of these shifts can partly be assessed in the light of the extent to which they lengthen or shorten the respective duration of the specific fluctuation in GDP in relation to the corresponding growth cycle fluctuation; or more particularly, what influences or distortions do shifts in the turning points of GDP have on the correlation between the variables under examination? For instance, the shift of six months from 11/76 to 5/76 occurred during a downward phase of the growth cycle from 8/76 to 2/78, a duration of 18 months. The importance of this shift may have been lessened by it overlapping the peak of the growth cycle in 8/76. But probably a more significant shift was that of the peak in GDP(I) from 11/68 to 5/70 and then to 8/71 when the growth cycle contraction was only about 14 months from 1/71 to 3/72. It should be allowed that there have at times also been some revisions in the growth cycle chronology itself at the selected dates shown in Table 3, mostly for the most recent turns. This is reflected in the fact that it is generally necessary to view the latest identified turn as ‘preliminary’. Moreover, a measure of GDP is not included in the Melbourne Institute’s coincident index for Australia. The gross product series included in the index (as discussed in more detail below) is GNFP(I). But the turns in GDP(I) have been taken into account in fixing business cycle chronologies (both classical and growth). The turns in GDP(I) are included along with the clusters of the

turns in the six components of the coincident index in deriving the median of each cluster, as discussed further later. The inclusion of GDP(I) in this way allows for some influence of the farm sector (see Boehm and Moore, 1984, especially p. 42). It should also be noted that it is helpful to use the growth cycle chronology in Table 3 and similar following tables in order to line up the corresponding turns in the specific series, in this case GDP(I). Hence Table 3 and similar tables below are more important in highlighting the changes from time to time in the location of particular turns in the specific series itself.

There is also the problem of the varying experience of one or two extra cycles in real GDP(I) which do not correspond with the latest growth cycle chronology for the selected dates shown in Table 3. We discuss the problem of extra cycles further below.

The experience of important shifts in the turning points for real GDP(I) has also applied to estimates of Australia's real GNFP(I), but not always at the same time or to the same extent for corresponding turns, as a comparison of Tables 3 and 4 reveals. For instance, Table 4 shows that a peak in 11/73 in the data available at June 1981, and then at May 1984 and March 1986 moved to 2/73 in January 1987 (not shown in Table 4) and April 1988, then to 8/73 in January 1993 and back to 2/73 in May 1995 where it remained in February 1996, during 1997, and at June 1998. But to some extent there appear to have been less changes in the turning points of real GNFP(I) than in real GDP(I). However, in both series a trough was identified in 5/83 in the data as available at March 1986 to January 1993, and as reported for both in Tables 3 and 4. Then this trough for both series moved to 2/83 for the data available at May 1995 and at all dates since. By contrast, 5/83 has consistently appeared as a trough in

both Australia's coincident composite index and growth cycle chronology. In fact, 5/83 has been one of the easiest turning points to fix.

4.3 A brief review of some aspects of the development of Australia's National Accounts

Economic research analysts and policy-makers in Australia are very fortunate that the ABS pays close attention to achieving the highest possible 'accuracy and reliability' in the production of Australia's *National Accounts* (see successive issues of ABS Cat. no. 5216.0, particularly, for instance, Ch. 13 in ABS,1983; and section 5 in ABS 1990a. It also appears that the quality of the estimates of Australia's national income and expenditure have improved significantly since their first publication soon after World War 11. For our purposes this includes especially the accuracy and reliability of the cyclical changes portrayed in the national account estimates. The ABS (1990a, p. 35) stated:

> The absolute size of revisions to initial estimates is of most concern to users. The average size of revisions is quite high for many series, particularly in relation to the average quarterly growth rate for those series. However, in current price original terms, … GDP and the other major summary aggregates, can be considered reliable in that the average level of revision is low compared with the average quarterly movement for each series.
> … The significance of revisions to gross non-farm product in the 1980s is similar to that applying in the 1970s.

The ABS's 'subjective accuracy grading' in 1990 of both the annual and quarterly estimates of GDP and GNFP was 'good'; that is, the estimates of both series are believed on the ABS's grading to have a 'margin of error' of '± less than 5%' (see ABS, 1990a, pp. 35 and 40).

The ABS (1998e, pp. 15-17) has described its planned developments of further improvements in the quality of the *Australian National Accounts*. It is expected that the 'major innovations' in constructing the accounts over 'the next few years' will

mean '… that the level of revision will improve once the changes are bedded down' (ABS, 1998e, p. 15).

Meanwhile the ABS has been publishing during the 1990s four estimates of real GDP and GNFP. The development of the Melbourne Institute's economic indicator project in the late 1970s and early 1980s centered around the income-based GDP series. The initial publication of quarterly estimates of the expenditure-based GDP series was made in 1960. The estimates of GDP(I) has continued to be a more appropriate series for indicator analysis than GDP(E), with the former series (on the ABS's own research) experiencing much smaller relative revisions and not showing evidence of systematic bias (see ABS, 1998d, p. 6). The publication by the ABS of quarterly estimates of GDP(I) and GDP(E) was followed by the introduction of quarterly estimates of the production-based GDP series in 1988. This was naturally followed by the publication in the early 1990s of an average of the three GDP series. In examining which is best of the four GDP series, Aspden (1990, p. 65) concluded: 'All in all, the facts seem to point to GDP(A) as being the best indicator of short-term movements, although at some future time preference may be given GDP(P)'.This conclusion favouring GDP(A) is supported in one important respect in Table 5 by this series registering only two extra cycles compared with four extra in both GDP(I) and GDP(E) and three extra in GDP(P) during the period 1960 to 1997. It is instructive to present the growth cycle chronologies for the total period available for the four series in Table 5 so that we can see how each has performed cyclically. Moreover, studies have been made of the stylised facts of business cycles for Australia using exclusively at various times each of the four GDP series. For instance, Crosby and Otto (1995) used GDP(A) in their deviations from trend analysis. However, in their opening paragraph they appear to be confusing classical and growth cycles by defining (see p.

68, n. 1) a recession as '… successive quarters of negative GDP growth'. The opening sentence of their paper (p. 55) states: 'Since 1959 the Australian economy has experienced approximately ten recessions, the most recent in 1991-92'. But Table 2 shows only eight growth cycle contractions between 1960-92 and five classical contractions. It appears from Table 5, columns 3 and 4, that their 'ten recessions' include the two extra cycles compared with the chronology reported in Table 5, columns 1 and 2. It will be appropriate to comment in more detail later on the misleading conclusions that may be drawn if one uses the popular rule (attributed to Arthur Okun) of defining a recession as two consecutive quarters of negative growth in real GDP. Fisher, Otto and Voss (1996) used both GDP(E) and GDP(P) over the period 1959-95 during which, as Table 5 reveals, GDP(E) experienced four extra cycles and GDP(P) three extra. Here it is also appropriate to suggest that previously where the Melbourne Institute has relied on GDP(I) in economic indicator analysis, having done so from the first development of this analysis before GDP(A) became available, it would now seem appropriate to switch to GDP(A) where a GDP series is used.

Though GDP(A) seems to be a preferable series to use as a short-term economic indicator, it is nevertheless appropriate to note from the brief historical evidence of GDP(A) which we have available, and are able to present in Table 6, that GDP(A) has also experienced revisions in its cyclical experience. This should, of course, have been expected in view of revisions to its components, as noted in some detail above for one of them, namely GDP(I). Table 6 shows changes in a peak from 8/76 at January 1993 to 11/76 at April and June 1998 and in the trough from 5/83 at January 1993 to 2/83 at April and June 1998. Table 6 also shows that the peaks and troughs in GDP(A) at April and June 1998, respectively, remained unchanged until the peak in 2/96 at

April 1998 moved to 8/95 in June. The peak in GNFP(A) in 2/96 at April 1998 (Table 6, column 9) moved back even further to 11/94 at June 1998 (column 11). This experience reinforces the earlier evidence in Tables 3 and 4 which would support analyses of the stylised facts of business cycles not including the data for the latest two years or so if one uses a GDP or GNFP series. This is apart from the allowance that generally needs to be made for the influence of extra cycles.

While there appears to be a case to switch to the use of GDP(A) in economic indicator analysis, this may not necessarily support GNFP(A) being used instead of GNFP(I), or to switch to GNFP(P), at least on extra cycle grounds, with these three GNFP series each containing only one extra cycle between 1960 and 1997 (see Table 5, section B). GNFP(I) has been used (as noted above) as one of the six series in the Melbourne Institute's coincident composite index since its first development in the early 1980s.

An important factor contributing to the greater number of extra cycles in the GDP series shown in Section A of Table 5 than for the GNFP series in Section B of the table (especially in respect to GNFP(A), GNFP(I) and GNFP(P)) is the greater number of classical and growth cycles in the farm sector. This is demonstrated in Table 7 which reveals that during the period 1960 to early 1997 Australia's farm sector 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. Table 7 shows that the classical cycle in the farm sector has had an average duration from peak to peak or trough to trough of just over three years compared with just over twice that duration of nearly or about seven years in the total economy. Furthermore, while the average classical expansion phase in the farm sector has been only about two years

compared with an average contraction phase of just over a year, by contrast in the total economy since 1960 the classical expansion phase has averaged nearly five and a half years while the average contraction phase averaged just over one and a half years. It is interesting to observe in passing that the farm sector in the United States has also experienced more classical cycles (and more growth cycles) than the total economy. However, the United States has not done so to the same extent as Australia, the U.S. classical cycle in the farm sector since 1960 displaying an average duration of just over four years compared with five and a half years in the total economy. The evidence for Australia supports strongly a preference for the GNFP series of the national accounts, especially the average, income and production series in studies of Australia's cyclical experiences. On the other hand, the total economy experienced much greater variability in the duration of individual phases and cycles than did the farm sector. This is manifested in Table 7 in the generally much higher standard deviations of contraction and expansion phases and total cycle durations for the total economy than for the farm sector.

However, the farm sector has declined fairly rapidly in relative importance as a share of GDP in industrialised market economies. This has meant that the marked instability of the farm sector has been one important factor contributing to the decline in the volatility of GDP, as observed for the United States by DeLong and Summers (1986, p. 685). The share of Australia's real gross farm product as a proportion of its real GDP has declined from 5.9 per cent in 1960 to 3.9 per cent in 1997. Boehm (1993, pp. 8-9) shows that the share of GDP at factor cost for agriculture, forestry, fishing and hunting (predominantly agriculture) as a proportion of total Australian GDP has declined substantially from an average of just above 20 per cent in the first four decades of the twentieth century to about 16 per cent in the mid-1950s, 13 per

cent in the early 1960s, to 7 per cent around 1980 and just above 4 per cent in the early 1990s. As Calomiris and Hanes (1998, p. 18) observed, the general independence of fluctuations in the farm sector from the main business cycle in industrialised economies has received inadequate attention in macroeconomic history and economic analysis.

4.4 ABS's experience in using GDP(A) as the 'reference series'

The ABS has been developing a leading economic index since the early 1990s and reporting since mid-1993 'an experimental composite leading indicator' [CLI] of the Australian business cycle (see, esp.: Salou and Kim 1992a, 1992b and 1993a; and ABS 1993b, 1993c and 1994.) The ABS (1997b, p. vii) stated: 'The reference series for the CLI is the business cycle of Australia which is defined here as the deviation of the trend in constant price Gross Domestic Product (GDP(A)) from its historical long-term trend'. Updates of the CLI since 1993 have been reported quarterly (in ABS, Cat. 1350.0) shortly after the release of the quarterly *Australian National Accounts*. The ABS (1993c, p. xv) explained: 'The CLI is a single time series produced by aggregating eight individual economic indicators. It is calculated as a simple average of the short-term movements in the indicators …' (see ABS, 1993c, Table 2 on p. xvi).The turning points in the CLI have been related to the turning points in 'the reference series'. The ABS (1993b, p. 2) further explained:

> Constant price GDP(A) is the ABS' preferred measure of general economic activity and is also the reference measure of economic activity used by most decision makers in Australia. It is the concept of output which has the broadest economic coverage possible across industries, economic agents, income, expenditure and output. GDP(A) is the most accurate measure available of the Australian GDP ….
>
> Some previous analyses of the business cycle, particularly in the United States and Australia (Boehm and Moore, … [*AER*, 1984, pp. 34-56]), have focused on aggregate economic activity represented by a cluster of economic indicators. The advantage of using GDP(A) is that it is an aggregate built on the solid theoretical foundations of the system of national accounts. A thorough discussion of the

advantages of using a measure of GDP is found in Cross(1982).

However, Cross (1982, p. xxii) appears mistaken in his claim that ‘the NBER has determined its reference dates by when turning points in over 600 individual series cluster in time’ (see also Cross, 1982, p. xxiii). It is well known that the NBER initially examined hundreds of statistical series in order to understand and identify business cycle experiences, as reported in Burns and Mitchell (1946). Cross refers to various publications prepared by economists working at or in conjunction with the NBER, namely papers by Mintz (1974), Moore (1954, 1958, and1967), Zarnowitz (1963a) and Zarnowitz and Moore (1977). These publications reported particular aspects of the ongoing developments and improvements in the identification by the NBER of classical cycle turning points in the United States. For instance, Moore (1967; reprinted in Moore, 1983, Ch. 1) listed nine key areas of business activity covering especially the labour market (notably employment and unemployment), industrial production, personal income, and manufacturing and trade sales which became the main core of series being monitored for the United States. Meantime, as Moore explains, composite indexes for selected series had also been constructed to help in identifying business cycle turning points. Moreover, Cross is silent on the considerable cooperation between the NBER and the U.S. Department of Commerce from the latter half of the 1930s and through the following decades in the development of economic indicator analysis. This cooperation led to the selection of a ‘short list’ of roughly coincident indicators. The list included five series in the early 1970s and was reduced to four in the mid-1970s (namely: number of employees on non-agricultural payrolls, index of industrial production, personal income, and manufacturing and trade sales; with total unemployment rate (inverted) being the omitted series in the mid-1970s. Composite indexes were constructed for both short

lists, that is, initially with five series and then four, in order to assist in identifying turning points of the classical cycle, as mentioned above. (For more details on these developments and the short lists, see Zarnowitz and Boschan, 1977.)

Composite leading and lagging indexes were also constructed and reported from 1961 together with the coincident and other indicators by the U.S. Department of Commerce in *Business Cycle Developments*, later renamed *Business Conditions Digest* (see Zarnowitz, 1972a, p. 16, n. 32).

Cross recognised that revisions occur in GDP estimates, but he does not report any progressive turning point findings for Canada in regard to peaks and troughs as is done for Australia in Tables 3 and 4. However, Cross (1982, p. xxiv) stated: 'The revisions process has changed the perception of the amplitude of business cycles, but has not altered the quarterly pattern of peaks and troughs in the Canadian economy in the postwar period, even during the exceptionally large revisions to GNP in the early 1970's'. It needs to be allowed that the turning points reported for Australia in Tables 3 and 4 are for the growth cycles in real GDP(I) and real GNFP(I), respectively. Cross's statement above applies to Canada's classical cycle experience in respect to real GNP. However, the same cannot be said for the classical cycle in Australia's real GDP(I) as stated by Cross for Canada, at least for the turning points for the data available at the dates shown in Table 8 from June 1981 on. The turns at those dates probably overlap with Cross's period only for June 1981. The data for Australia available at June 1981 show a classical cycle peak in real GDP(I) at 11/60 followed by a trough in 8/61. But there were no corresponding classical turning points in real GDP for the classical reference peak for Australia in 7/74 and trough in 10/75. A (relatively minor) peak and trough in real GDP in 5/77 and 11/77, respectively, were identified at June 1981. However, both these turns were not identified in the updated

estimates of real GDP thereafter for the dates shown in Table 8. The classical trough in real GDP in 8/61 at June 1981 had moved to 5/61 at April 1988, but had returned to 8/61 at January 1993 and appears to have remained there since. The peak recorded in GDP in 11/60 at June 1981 had moved to 8/60 in May 1984 and has remained there. In our analyses in May 1984 and March 1986 a minor classical cycle was found in real GDP with a peak in 11/73 and a trough in 5/74. But in the national accounts data reported from April 1988 on, no corresponding classical turns have been found in real GDP in the 1970s for the two classical reference cycles shown in Table 8 (columns 1 and 2); that is, after a classical trough in real GDP in 5/61 at April 1988 and thereafter with this trough returning to 8/61 from January 1993 and on, the next turning point in real GDP appears not to have occurred until a classical peak in 5/82 with the data available at April 1988. This peak moved to 8/81 at January 1993 and then to 11/81 at May 1995 and on. A classical trough in 5/83 from May 1984 to January 1993 moved to 2/83 from May 1995 on, as also occurred with the growth cycle in real GDP, as shown in Table 3.

The analysis and problems reported above and encountered in using a single series to represent the reference cycle clearly still affirms in 1998 the position adopted by the NBER and Mintz (1974, p. 9) when she commented:

> Another familiar objection to the NBER cycle concept suggests that a single indicator, the GNP or the GNP gap, is preferable to the NBER indicator list. The definition of growth cycles as cycles in the trend-adjusted GNP is rejected here for the same reasons for which the NBER has rejected the definition of classical business cycles as cycles in the GNP. These reasons are that investigations have shown how uncertainties in the measurement of GNP and the necessarily very frequent revisions (which often reach back a number of years) increase the likelihood of selecting the wrong turns. [See note below *.] Moreover, GNP data are not available monthly, whereas a monthly reference chronology is required.
>
> * In a footnote at this point, Mintz stated (p. 107):
> For the definitive investigation of GNP revisions and their effects on GNP turning points, see Rosanne Cole, *Errors in Provisional Estimates of Gross*

National Product (New York: NBER, 1969) especially pp. 73-81.

For an excellent study of the effects of dating reference cycles by GNP cycles, see two articles by Victor Zarnowitz, "On the Dating of Business Cycles," *Journal of Business of the University of Chicago*, April 1963, and "Cloos on Reference Dates and Leading Indicators: A Comment," *ibid.*, October 1963.

For a striking example of repeated back-and-forth shifts of a trough through GNP revisions, see Rendigs Fels and C. Elton Hinshaw, *Forecasting and Recognizing Business Cycle Turning Points* (New York: NBER, 1968), p. 29. For general arguments against reliance upon a single measure, see Mitchell, *What Happens During Business Cycles*, p. 11, and Geoffrey H. Moore, "What is a Recession?", *American Statistician*, October 1967.

For a contrary view, see George W. Cloos, "How Good are the National Bureau's Reference Dates?" *Journal of Business*, January 1963[a; and see also Cloos, 1963b].

Lim (1985, p. 27), in reviewing the 'discrepancies and revisions' in 'GDP growth rates', supported the NBER approach in concluding

> … that forecasters and policy makers should not rely solely on published estimates of GDP growth as indicators of economic activity since these estimates (quite apart from publication lags) do not necessarily reflect underlying conditions. A range of variables, such as embodied in the indicator approach (see Boehm and Moore 1984) should be monitored and used to ascertain the state of economic activity.

It is suggested in section 5.1 below that a solution to the problems highlighted above (in respect to a single series such as real GDP) would be to use a coincident composite index (such as the Melbourne Institute's) as a much more robust proxy for the business cycle.

In a 'Review of the Experimental Composite Leading Indicator' (in ABS, 1997a, p. vii), the ABS reported: 'Until the March quarter 1991, the CLI has predicted turning points in the reference series with a two quarters lead on average … [as illustrated by the ABS's Table 1]. However, its performance appears to have deteriorated since then'. The ABS shows that one aspect of the deterioration involves a shifting of two turning points in its reference series (that is, in GDP(A)) to one quarter earlier than previously reported by the ABS. One turn, as now reported on the ABS's method of identification, concerns the peak shown in section A of Table 9,

column 5, as 11/81. This had previously been reported to be in the March quarter 1982 (see ABS, 1997a, p. vii). The second turn concerns the trough reported in section A of Table 9, column 6, to be in 5/91. This had previously been identified to be in the September quarter 1991. Both changes, as the ABS explained, reduced the lead of its CLI. Another and important aspect, as explained by the ABS (1997a, p. vii), appears to be that

> The cycle in the deviation of GDP(A) trend from its historical long-term trend from the June quarter 1994 to the March quarter 1996 was strongly driven by the farm sector.
> Since the CLI does not have a farm production related component, it is not well equipped to predict farm sector driven cycles.

The ABS (1997a, p. xii) decided that (italics in original): 'In future, the CLI will be published against both the current *reference series* and the non-farm component'. A further question that needs to be addressed (including by the ABS) is revealed in Table 5 which shows that GDP(A) has generated more turning points than we have identified for Australia's growth cycle chronology. The additional turning points in GDP(A) are shown as 'extra cycles' in Table 5 (section A). The ABS identified a peak in GDP(A) in 5/94 and a trough in 5/95 (as reported in section A of Table 9, columns 5 and 6). These turns also appear (at the time of the publication of ABS, 1997a) to be an extra cycle (in relation to the growth cycle chronology then identified with a preliminary peak in 12/95; see Table 9, columns 1 and 2). This follows if we recognise that the peak of 2/96 in GDP(A) (see Table 9, column 5) corresponded with the preliminary peak in 2/96 in GDP(I) (at July 1997, as shown in Table 3, column 7,) which, in turn, corresponded with the then preliminary growth cycle peak in 12/95 (Table 9, section A, column 1). It appears that a review is needed of the following statement (in ABS, 1997a, p. viii; bold and italics in original):

> The March quarter 1997 update of the CLI showed that the CLI was coincident with

> the **June quarter 1994 peak** in the *reference series*, lagged by one quarter at the **June quarter 1995 trough** in the *reference series* and has not shown signs of a turning point corresponding to the **March quarter 1996 peak** in the *reference series* [see Table 9, section A, columns 3 to 6]. The deterioration in the prediction of the last three turning points in the *reference series* raises questions about the predictive performance of the CLI.

It seems, however, that the problem may not lie with the predictive power of the ABS's CLI, as the ABS felt during 1997 and early 1998. If GDP(A)'s peak in 5/94 and trough in 5/95 (as identified on ABS's methodology) make an extra cycle then the CLI peak in 5/94 could have been anticipating with a lead of seven quarters the peak of 2/96 in GDP(A), (as shown in section A of Table 9, column 5). This would mean that there had not been the deterioration in the predictive power of CLI as suggested by the ABS, and as noted above. The question of whether GDP(A) had experienced an extra cycle with a peak in 5/94 and a trough in 5/95 in relation to both the Melbourne Institute's growth cycle chronology and the ABS's CLI was clarified when the data for CLI and GDP(A) were extended for the whole of 1997 and for the March quarter 1998, as shown in Table 9, section B, columns 3 to 6. Meantime, it may seem reasonable *prima facie* for the ABS to continue in September and December 1997 to view the peak in 2/96 in GDP(A) as not being predicted by ABS's CLI. (see ABS:1997b, p. vii and 1997c, p. xix, respectively). However, in the updates of CLI and GDP(A) reported by the ABS in March and June 1998 (see charts in ABS: 1998a, p. 13 and 1998c, p. 7, respectively,) it appears that the turning points of CLI and GDP(A) according to the ABS are as shown in Table 9, section B, with the extra cycle in GDP(A) now appearing more clearly to be a trough in 5/95 and a peak in 11/95 following the peaks in CLI and GDP(A) being coincident in 5/94 and the trough in CLI in 8/95 leading by six quarters the trough in GDP(A) in 2/97

The reading of the chart in ABS, 1998f, (p. 9) incorporating the update of CLI and GDP(A) for the June quarter 1998 continues to exhibit an extra cycle in GDP(A) in comparison with CLI with a trough in 5/95 and a peak in 11/95. The ABS (1998f, pp. 9 and 11) also notes that the recent updates of CLI and GDP(A) appear to have restored, or really maintained (when allowance is made for the extra cycle in GDP(A), as explained above,) the predictive performance of CLI with it recording a peak in 8/97 and GDP(A) a peak in 11/97 (as identified by the ABS and shown in Chart 1 in ABS, 1998f, p. 9). The peaks identified by the ABS in CLI and GDP(A) in 8/97 and 11/97, respectively, appear (on this author's assessment) preliminary.

Another aspect, which is revealed by Table 5 (columns 3 and 4, and which is not pursued in detail here), is that the ABS's turning points in the deviations from trend of GDP(A) shown in Table 9 (columns 5 and 6) do not correspond entirely with the Melbourne Institute's turning points of GDP(A) shown in Table 5. One reason for the differences is probably the different methods used by the ABS and the Melbourne Institute to compute the deviations from trend. The ABS uses Henderson moving averages as a filter to extract the business cycle (see, for instance, ABS, 1993b, pp. 11 and 20). The Melbourne Institute's method for this paper is that developed at the NBER by Boschan and Ebanks (1978) and is known as the phase-average trend method. It is also interesting to note that the two extra cycles in the 1990s identified by the ABS, as shown in section B of Table 9 (columns 5 and 6) were not found as extra cycles by the NBER method (see Table 5, columns 3 and 4).

4.5 Weaknesses in using annual data for cyclical analyses

One reason why Kim, Buckle and Hall (1994, p. 71) found that some of their results contradict or contrast with some findings of Mendoza (1991) and Backus and Kehoe (1992) could be the use of annual data by both Mendoza and Backus and Kehoe.

Any cyclical analysis using annual data must be viewed with considerable circumspection since annual data may distort and provide misleading results through smoothing the course of the cycle and manifesting a less volatile appearance than actually occurred and as seen in monthly or at least quarterly data. As stated in Boehm (1991, pp. 192-3), in his review of Britton (1986) and Britton's use of annual data for a considerable part of his study,

> The weaknesses of annual data gain in importance when the phases are relatively mild and short, and sometimes no longer or little longer than a year [or even less than a year; see Tables 1 and 2] as on occasions occurs with both the contraction and expansion phases of growth cycles. Moreover, the contraction phases of classical cycles are sometimes less than a year. Annual data may also reduce the precision possible with quarterly and preferably monthly data in fixing turning points in order to measure more precisely the duration of a full cycle and to assess the degree of periodicity. The limitations of annual data have long been recognized (see Burns and Mitchell 1946, p. 43 and Ch. 6; Boehm 1971, p. 37). Burns and Mitchell [1946, p. 43] explained:
>
> > While we consider it desirable to economize effort in handling secular trends and random movements, experience has taught us not to economize effort by working with annual data. As Chapter 6 shows in detail, annual data are exceedingly crude materials for comparing the cyclical behavior of different activities in the same period or of the same activity in different periods. They obscure timing relations, they make it impossible to trace cyclical patterns with confidence, often they obscure and sometimes they obliterate cyclical fluctuations.

The weakness of using annual data applied to the earlier studies by Licari and Gilbert (1974), King and Plosser (1984) and Plosser (1989). Recent studies which have used annual data exclusively and for which their results should be treated with substantial reservation, at least as far as cyclical experiences are concerned, include Mendoza (1991), Englund, Persson and Svensson (1992), Woitek (1996), Iyodo (1997), Moosa

(1997, 1998) and Castañeda *et al*. (1998). Christodoulakis *et al.* (1995) use quarterly and annual data since 1960 in their 'Comparisons of Business Cycles in the EC'. It would be interesting and instructive to compare the results of any study using annual data with those that are obtained using preferably monthly or at least quarterly data. It is, of course, recognised that monthly and or quarterly data were not available for some of the studies listed above and where annual data were used.

4.6 General summary

In the course of section 4 two problems have been highlighted in respect to the reliance of a number of recent studies on a single series, notably real GDP, as a proxy for the business cycle. The problems are, first, the shifting of turning points over time. The second concerns the 'extra cycles' which are not found in a comprehensive economic indicator analysis. Both problems raise important questions about the appropriateness of using a single series for the purpose of following Lucas (1977) and Kydland and Prescott (1990) in identifying as accurately as possible the experiences of persistence and the co-movements of deviations from trend of other key variables with those of the single series. These studies of the stylised facts of business cycles appear not to have considered to what extent their use of a single series to represent the business cycle could account for some of the conflicting or contrasting conclusions drawn concerning the pro-, counter- or acyclical movements of key variables. However, it has not been an aim of this paper to examine this aspect or to discuss the conflicting or contrasting conclusions themselves.

It will be of considerable interest to monitor the improvements in the Australian national accounts currently being made by the ABS (see ABS, 1998e, pp. 15-17). The effects of the ABS's replacement of the present constant price measures by annually

re-weighted chain volume estimates will be especially important to observe. It could mean, as the ABS (1998e, p. 15) has suggested, that the historical findings, as we have seen in Tables 3 to 6, 8 and 9 involving problems of extra cycles and of revisions in shifting the turning points in the various GDP measures, may not be a reliable guide to the quality of the current and future measures of the national accounts when the improvements now being undertaken are completed. There is also the problem of using annual data. It is surprising to see this practice continuing, despite the criticisms and attention drawn to the weaknesses of using annual data for short-term cyclical analysis.

In this summary it is also worth observing that in the studies listed in the opening paragraph of section 3 above, no study recognized that the deviation from trend analysis had been used in Mintz's (1969, 1972 and 1974) revival of interest in growth cycles. A possible reason for the silence regarding Mintz's work is that the later studies were not apparently concerned, as was Mintz in the NBER tradition of Burns and Mitchell, with, first, identifying the turning points and the duration of the phases of cycles, and secondly, distinguishing between classical and growth cycles. For instance, in respect to business cycle peaks, Collard (1996, pp. 917-18) noted: 'To EBC theorists the very notion of an upper turning point sounds a little old-fashioned and it does not greatly exercise them: the top of the boom is merely where the impulse response function reaches a maximum before dipping down again'. The lack of more explicit attention to turning points and the duration of cycles raises interesting and important questions. These questions include the extent of the usefulness of these later studies in providing an adequate general understanding of business cycles and in aiding policy-makers and forecasters concerning the likely timing and direction of the future course and level of economic activity. This leads to

a further consideration of the merits, for both theoretical and policy reasons, of distinguishing between classical and growth cycles, as in Tables 1 and 2.

5. Merits in using economic indicator analysis for studying co-movements of key variables and for forecasting classical and growth cycles

5.1 Advantages in exploiting a coincident composite index

It appears that a more appropriate and helpful methodology than using a single series for the reference cycle would be to use, if available, a series that is not only less subject to revisions but also represents or indicates more closely and accurately the general course and level of economic activity. One such series would be the country's coincident composite index that is a major product of economic indicator analysis. Coincident indexes are now available for most major industrialised market economies. The OECD has developed leading composite indexes since the mid-1970s for 'Member countries' and has recognised the usefulness of having a 'reference series' around which its indicator system is built (see OECD, 1987, esp. Chs 1 to 4). An increasing weakness of the OECD's economic indicator system, however, is its reliance on a 'total industrial production index' in each country for the reference series. The OECD recognises (see OECD, 1987, pp. 24-7) that while a series for industrial production is a real series; is closely related to, but more promptly available than real GDP; and there is a high degree of comparability and consistency in its measurement by member countries, nevertheless, the share of industrial production in total economic activity has been declining significantly. The OECD (1987, p. 12) noted: 'The production industries may account for only 35 per cent of total OECD GDP in 1983 as opposed to 40 per cent in 1960 …'. This decline has continued. The OECD explains further that it settled in favour of industrial production as '… a single

readily available variable, essentially identical for all countries …' whereas GDP estimates were '… available on a quarterly basis for only about half of the [24] OECD Member countries and annually for the others …'. There would be considerable merit in the OECD developing a comprehensive coincident index for each member country, or employing the internationally comparable coincident indexes now developed by other institutions (for instance, those developed at the CIBCR for 14 countries, or ECRI (Economic Cycle Research Institute, New York) for 13 countries,) for use in conjunction with the OECD's leading index in monitoring and forecasting the course and level of business activity in its member countries. The use of a coincident index as an essential part of a 'reference series' would be consistent with the course that the NBER and Mintz would follow, as explained above.

The comparison reported in Table 10 of the timing variability at growth cycle turning points of corresponding turns in the deviations from trend of real GDP(A), GDP(I), GNFP(A), GNFP(I) and the Westpac-Melbourne Institute's coincident index for Australia reveal a much more consistent performance for the coincident index. It must be allowed, of course, that the coincident index is taken into account in fixing the growth cycle chronology. But so are GDP and GNFP. The Australian coincident index is presently constructed from six series, three being quarterly, namely: real GNFP(I), real household income and an index of industrial production; and three monthly series: real retail turnover, total employed labour force and unemployment rate (inverted) The inclusion of the three monthly series which are available in advance of the national account series means that the coincident index is more up-to-date than it would be if it relied only on a quarterly series such as GDP or GNFP. The monthly series generally identify well the approximate state of the economy. A

detailed description of the construction of Australia's coincident index is provided in Boehm and Moore (1984).

The process of fixing the business cycle chronologies reported, for instance, in Table 2 for Australia, involves viewing turning points in three parts: first, the turns of the coincident index itself; secondly, the cyclical turning points of the components of the coincident index which tend to occur in clusters (and for Australia including in this cluster the turning points of real GDP); and thirdly, the median of each cluster. The clusters can generally be identified fairly easily. The further rules that are taken into account in fixing the turning points are described in Boehm and Moore (1984, esp. pp. 38 and 40-2).

One important strength of the coincident index itself is that it is much less subject to revisions or changes than is a single series (and notably the national accounts). This is partly because the combination of the six components reduces the effects of measurement problems relating to errors or later revisions of a series, especially where the early estimates of a series are based on preliminary information. It particularly means that the coincident index generally exhibits a more accurate and stable reading of the course of each phase of the business cycle and of the turning points than would a single series.

Some economists have questioned the inclusion of the two labour market series in the coincident index; (see, for instance, Pagan, 1996, p. 13, n. 11). But one argument in favour of their inclusion is that the labour market situation (in terms of both the level of employment and the unemployment rate) generally manifests important evidence on political and social grounds as well as economic of the current state of an economy. Retail turnover also furnishes helpful information on the current state of business activity. Fundamentally, in the absence of the 'ideal' monthly measure of

'aggregate economic activity', as discussed in section 4.1 above, what is defined as the current state of business activity concerns or includes what economists, policy-makers, business people and the community in general believe needs to be taken into account to describe accurately (for economic, political and social purposes) the current health of an economy on both micro and macro bases. In brief, the combination of the six key variables in the coincident index involving production, income, trade and the labour market does this well by capturing important and different aspects of the overall current state of economic activity. We are thereby provided with a more comprehensive, timely and reliable reading of the current state of business activity than could be obtained from a single series. Similarly, the leading index (combining series which have a proven record of generally anticipating well the future course of business activity) have also been found to provide more robust forecasts than any single component of the index on its own. For instance, Auerbach (1982, see esp. pp. 594-5) concluded that the exclusion from the U.S. leading index of series which do not individually appear to be performing well for forecasting purposes actually worsened the performance of the index in out-of-sample predictions.

It is worth commenting further here on the popular, including with the media, and frequently quoted (but crude and often misleading) rule that a classical recession occurs if and when there are two consecutive quarters of negative growth in real GDP (see, for instance: ABS, 1993b, p. v; Crosby and Otto 1995, pp. 55 and 68, n. 1; Pagan 1997a, p. 1; and van Wel 1998, p. 1). But this has not been a consistently reliable rule for both the United States and Australia. For instance, for the United States you would have missed the classical recession in the early 1960s (see Table 1, columns 7 and 8). This applies to both the former real GDP series constructed on a fixed-base year method (see U.S. Department of Commerce,1994, p. 42) and the recently

introduced GDP series measured on a chain-weighted method (see U.S. Department of Commerce, 1997, p. 15). Other recessions in the United States would have been believed to be shorter and to have a different timing and duration than shown in Table 1 (columns 7 to 9). For Australia, using GDP(A) and GNFP(A), you would not have missed any recessions, but their duration and timing would have been significantly different from the results in Table 2. In particular, some recessions would have lagged by up to about a year and been of shorter duration than shown in Table 2, column 9. Alternatively, if you had used for Australia the income-, expenditure- or production-based estimates of either GDP or GNFP, you would have found recessions not only of shorter duration but also some 'false alarms'; that is, you would have found two consecutive quarters of negative growth when other evidence exhibits no classical recession.

It was noted above that van Wel (vW) (1998) identified the recession phases of Australia's classical cycle by using the definition of two consecutive quarters of negative growth. Though vW's results are not surprising, it is nevertheless difficult to see how it could be concluded by vW (p. 2) that this resulted in phases 'very similar' to those determined by Boehm and Liew (BL) (1994) (and as also in Table 2 (columns 7 to 12) of this paper). For instance, (for comparison placing turning points in the mid-month of a quarter read by vW to contain a peak or trough), the peak identified by vW in 11/73 leads by 8 months the corresponding peak in BL's article in 7/74 (as also in Table 2, column 7); the trough of vW's in 8/74 leads BL's in 10/75 by 14 months, followed by a peak for vW in 5/77 which lags by 9 months BL's in 8/76; and vW's peak in 5/82 lags BL's in 6/81 by 11 months. Moreover, vW (1998, p. 2) is incorrect in stating that BL used only a 'coincident index' to identify

Australia's turning points. These were determined as stated in the sources of Table 2 in this paper.

5.2 Forecasting classical and growth cycles with the aid of economic indicator analysis

The coincident composite index is not only useful as a more reliable proxy of the business cycle than a single series such as real GDP. It can also be used for purposes of economic policy-making – along with a leading composite index – to furnish reliable short-term forecasts of the likely course of economic activity in both classical and growth cycle contexts. A reliable reading of the classical cycle can, of course, be made simply from the *level* of the coincident index, a feature of economic indicator analysis that appears not to be always recognised or understood. It is the raw data reporting the level of the coincident index or, more particularly, the peaks and troughs of this index which contribute to the fixing of the classical cycle chronology. Moreover, it can tell you at a glance much about the current state of the economy, including the direction and level of economic activity. But perhaps the most helpful, consistently reliable and straightforward technique 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 leading and coincident indexes, respectively, as presented in Chart 1.[4]

The smoothed growth rates in Chart 1 are obtained by computing the ratio of the current month's index to the average of the twelve preceding months. The interval from the current month to the middle of this twelve month average is 6.5 months. Hence the ratio is raised to the 12/6.5 power to put it on an annual rate basis. The

[4] For a detailed description of a system of monitoring business cycles with the aid of the smoothed rates of growth in the composite indexes of leading and coincident indicators, see Zarnowitz and Moore (1982); and Moore (1983, Ch. 4).

result, expressed as a percentage change at annual rate, is called a six-month smoothed rate and in Chart 1 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.

The smoothed growth rate method has been found more suitable and generally less volatile than others, such as taking the per cent change on the corresponding month of the previous year. However, it is important to allow that the annual growth rates of the indexes fluctuate month by month, as can be seen in Chart 1. Furthermore, the growth rate in the leading index in a particular month does not mean that the economy is (necessarily) going to grow at that rate at any time in the future. What it does mean is that when there are, for instance, periods of above (or below) trend growth in the leading index, the economy is likely to experience similar growth also in the coincident index (that is, in the current economic performance) in the months ahead. The composite indexes themselves are made useful as indicators of changes in the general *level* of economic activity by adjusting each index so that its rate of growth is equal, in Australia's case, to the annual long-term trend rate of 2.7 per cent (or 0.22273 per cent per month) computed from the trend rate of growth of real GDP, at present for the selected period of 1985-95. 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. It means that we can conclude, for instance, that the Australian economy is growing faster (slower) than its annual trend

rate of growth when the rate of increase in the coincident index is above (below) 2.7 per cent.

One of the first signs that an expansion phase of the business cycle may be coming to an end is a decline in the smoothed growth rate of the leading index. This change would be more clearly foreshadowed when the leading index growth rate moves below the trend rate of 2.7 per cent. The trend rate is shown by the dotted line in both panels of Chart 1. This chart is very helpful in distinguishing between a growth slowdown (or recession) and a real (classical) recession. When it is only a growth slowdown, the actual growth rate of the coincident index falls below the trend rate of growth but the rate generally remains positive. It is possible that during a growth slowdown, the growth rate of the leading index may briefly become negative, reflecting some short-term volatility in the index. But it is generally unlikely to do so for more than a month or so without the coincident index growth rate within a short time doing so as well. If the coincident rate becomes negative and remains so for at least six months (see: Boehm and Moore, 1984, p. 41; and Boehm 1987, p. 16 on NBER rules), this probably indicates a real recession. Other criteria used in fixing the turning points of business cycles also apply in fixing the cyclical chronology relevant to the period. 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.

Thus the growth rates of the leading and coincident indexes can be very useful to economic policy-makers in the respective readings that they promptly provide of the prospects of the economy as foreshadowed by the leading index and the current state of the economy as portrayed by the coincident index. The leading index furnishes a fairly reliable forecast of, on average, six to nine months ahead of what can be expected to be seen in the coincident index.

Chart 1 highlights at a glance the two classical recessions in 1981-83 and 1989-92. These were clearly anticipated by the leading index. The chart also demonstrates the two growth slowdowns in 1985-87 and 1995-97. Again, both slowdowns were foreshadowed by the leading index and, as the leading index also generally anticipated, both slowdowns were not followed by a classical recession. It is worth observing here that in the latter half of the 1980s when the Melbourne Institute was establishing its indicator project and offering its monthly report on it to potential subscribers in government, business and community circles in general, Chart 1 proved to be one of the more successful means in promoting the project, including to non-economists.

Boschan and Ebanks (1978) developed the phase-average trend method involving the concept of a non-linear trend in attempting to improve the NBER's trend-fitting methodology following the apparent significant slowdown in the long-term trend rate of growth in the first half of the1970s. An objective is to identify the trend so that it would itself be free as far as possible from the short-term effects of cycles.

Nevertheless, their method is consistent with the fact that the trend and cycle may be intricately related. The method works well historically, but it has difficulties and uncertainties in measuring the deviation from trend over the last few months of the series being studied, and may react misleadingly – sometimes considerably from one recent month to another when updates of the series are made – if series included in an index are volatile in one month alone, especially the latest month. The OECD (1987, p. 12) records the problems it has experienced with the phase-average trend method, notably in '… calculating trend estimates over the most recent period, particularly the most recent uncompleted cyclical phase'. Similar problems arise in using other deviation from trend methodologies. This has, of course, made the reading of the current state of the economy and short-term economic forecasting with the deviations from trend approach uncertain and hazardous, and often misleading from one month to another with, for instance, the economy appearing 'clearly' to be in an expansion in one month, a contraction the next, but back to an expansion the next. For these purposes the per cent change six-month smoothed growth rate technique, as used for Chart 1, has proven to be superior. Layton and Moore (1989, p. 380) came to the same conclusion favouring the analysis of growth rates directly rather than looking at deviations from trend. The deviation from trend analysis is an area of economic indicator analysis that warrants further detailed research and development if it is to aid consistently the reading of the current state of the economy and short-term economic forecasting.

Comprehensive economic indicator analyses may also include a lagging index. This involves series which habitually reach their turning points later than the corresponding business cycle turns revealed by the coincident indicators. These turns had still earlier been foreshadowed by the leaders, as noted above. The later turns in

the laggers reflect previous changes in the rate and level of economic activity, thereby helping to confirm the changes already seen in the leading and then in the coincident indicators. Moreover, a lagging index inverted may be used as a long-leading index (see Moore, 1978; reprinted in Moore 1983, pp. 361-7; for detailed discussions of the development of a lagging index for Australia and of its components and performance, see: Boehm and Moore 1984; and Boehm, 1987, esp. pp. 14-16).

6. Summary and conclusion

Much recent theoretical and empirical interest in business cycles has been concentrated on the stylised facts of business cycles relating especially to the corresponding cyclical timing characteristics of key economic variables. The analyses have particularly involved the regularities and irregularities in terms of auto- and cross-correlations and standard deviations of macroeconomic variables in relation to the movements of real GDP as a proxy of the business cycle. Explanations of business cycles in terms of the timing of turning points, the durations of the upswing and downswing phases of business cycles, and the amplitude of each phase appear to have attracted less interest. However, it is in respect to the timing, actual duration and amplitude of the phases of business cycles as well as the nature of the co-movements of key variables that policy-makers (in both government and business circles) are essentially concerned. The timing and mix of economic policies may also benefit considerably through the distinction made in economic indicator analysis between classical and growth cycles, thereby aiding an understanding of the amplitude of particular phases in terms of the magnitude of the change in the level of business activity. For instance, it is particularly important for economic policy-makers to know if a growth slowdown foreshadowed by the leading index and occurring in the

coincident index is likely to lead also to a classical (real) recession and then how deep and prolonged the recession appears likely to be. This contrasts with modern business cycle theory which offers little theoretical explanation of the amplitude of economic fluctuations (see also Collard, 1996, esp. p. 923).

The recent major interest in the stylised facts of business cycles involving the cyclical behaviour of key economic variables in terms of deviations from trend may be seen as more of a backward-looking analysis than a forward-looking exercise involved with the aid, for instance, of leading and coincident composite indexes in monitoring and forecasting the course of expansions and contractions in business activity; and in the process the identification of turning points to aid economic forecasting and the choice of economic policies to fit the anticipated cyclical fluctuations. Nevertheless, the knowledge furnished by the backward-looking cyclical experiences involving particularly the cyclical nature of the co-movements of key variables during business cycles would also be instructive for policy-makers.

The results of a number of recent studies reporting the cyclical experiences concerning persistence and the co-movements of key variables in respect to real GDP (or output) have probably been weakened by their use of GDP as a proxy for the business cycle. This use generally appears not to have been questioned or justified. The contributors (some of whom are listed in section 3 above) to business cycle analysis in terms of ‘deviations from trend’ have been silent on the attention given by Mintz (1974, esp. pp. 9-10) to the weaknesses inherent in using a single series such as real GDP as a proxy for the business cycle. The analysts reporting the co-movements of key variables with those of real GDP (or output) need to justify this methodology and to consider what effect revisions (hopefully making for greater accuracy in the measurement of, for instance, GDP itself) and the occurrence of extra cycles may have

on the results that they have reported. It would also be of special interest to know whether more robust, reliable and permanent results from a long-term point of view would be provided by studying cyclical persistence and the co-movements of key variables with the aid of a coincident composite index . This index should furnish a more reliable proxy of the business cycle and be much less subject to revisions than tends to be a single series such as real GDP. Inter-country comparisons of the cyclical experiences of key variables obtained from using a coincident index should also provide more consistent and useful results, especially where the coincident indexes are constructed, as far as feasible, on a comparable international basis. This applies, for instance, to the Westpac-Melbourne Institute's index which is largely comparable with the coincident indexes constructed previously by the CIBCR and now FIBER (Foundation for International Business and Economic Research, New York),and those constructed by ECRI (see also Boehm and Moore, 1984).

Thus a subject for further research highlighted by this paper is the need for a comparative study of the empirical results from using alternatively real GDP (or real GNFP in the case of Australia) on the one hand and a coincident index on the other. This study could compare the respective cyclical experiences regarding persistence and the co-movements of key variables during the business cycle on national and international bases; and to discover especially to what extent, if at all, the results differ, and if consistent or variable patterns occur over different periods both nationally and internationally. The statistical results on turning points presented in this paper clearly suggest that more reliable evidence of cyclical experiences regarding persistence and the co-movements of key variables should be obtained from using a more comprehensive series such as a coincident index to represent the business cycle

rather than of using, as has been the widespread practice, a single series such as real GDP.

Finally, since many economists justifiably view the estimates of real GDP as the most comprehensive (readily available) single measure of aggregate economic activity, a subject also for further detailed research (than undertaken for this paper) is why real GDP spawns ‘extra cycles’; that is , extra to the cycles which are identified via a comprehensive economic indicator analysis which follows the NBER business cycle methodology. This analysis would generally involve a short list of key selected roughly coincident series including real personal (or household) income, real GDP (or GNFP), industrial production, employment, unemployment and real retail trade, together with a composite index of those series.

Table 1: Phases of Business Cycles, United States, 1948 - 97

Growth Cycles						Classical Cycles					
Dates of peaks and troughs by month and year (c)		Duration in months				Dates of peaks and troughs by month and year (d)		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
9/84*	1/87*	28	21	69	49						
3/89*	8/92*	41	26	54	67	7/90	3/91	8	92	108	100
12/94*	10/96*	22	28	69	50						
Averages (b):		23	23	46	47			11	51	62	62
Standard deviations(b):		10	9	16	17			3	30	32	29

Notes:

(a) The last six growth cycle dates marked by asterisks are based on United States' trend-adjusted coincident index only.

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

Sources:

(c) CIBCR, *IEI*, January / February 1998, p. 52.

(d) As selected by the NBER and published in CIBCR, *IEI*, January / February 1998, p. 52.

Table : Phases of Business Cycles, ust alia, 19 1 - 97

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	Contrac-tion: Peak To trough	Expan-sion: Trough to peak	Cycle Peak to peak	Cycle Trough to trough	Peak	Trough	Contrac - tion: Peak to trough	Expan-sion: 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
8/95	8/97(b)	24	32	69	56						
Averages (a):		22	31	53	54			20	60	77	80
Standard deviations (a):		7	9	12	14			8	47	45	48

Notes:

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

(b) Preliminary.

Sources:

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 □: Coa□ ison of Ti□ in□f Co□ □esondin Tu□ nin Points of □ oth Cycles and □eal P□ □□, ust□ alia, at Selected □ates, 1971-98

Growth cycle Chronology		Chronologies in GDP(I) identified in deviations from trend for data available at: June 1981		May 1984		March 1986		April 1988		Jan. 1993	
P	T	P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1/71	3/72	11/68	2/72	5/70	8/72	8/71	8/72	8/71	2/72	5/70	2/72
2/74	10/75	11/73	11/75	11/73	11/75	11/73	11/75	11/73	11/75	8/73	11/75
8/76	2/78	11/76	11/77	11/76	11/77	5/76	11/77	5/76	11/77	5/76	11/77
9/81	5/83			8/81	5/83	5/81	5/83	5/81	5/83	5/81	5/83
11/85	3/87							8/85	5/86	8/85	5/86
11/89										5/89	
Extra cycles:					5/74		5/74				
				5/75		5/75					
		2/79		2/79	2/80	2/79	8/79	2/79	8/79	2/79	8/79

		May 1995		Feb. 1996		July 1997		Dec. 1997		June 1998	
P	T	P	T	P	T	P	T	P	T	P	T
1/71	3/72	8/71	8/72	8/71	8/72	8/71	8/72	8/71	8/72	8/71	8/72
2/74	10/75	11/73	11/75	11/73	11/75	11/73	11/75	11/73	11/75	11/73	11/75
8/76	2/78	11/76	11/77	11/76	11/77	11/76	11/77	11/76	11/77	11/76	11/77
9/81	5/83	8/81	2/83	8/81	2/83	8/81	2/83	8/81	2/83	8/81	2/83
11/85	3/87	8/85	5/86	8/85	5/86	8/85	8/86	8/85	8/86	8/85	8/86
11/89	12/92	5/89	5/92	5/89	8/91	5/89	5/92	5/89(b)	5/92(c)	5/89	5/92
8/95	8/97(a)					2/96(a)		8/96 (c)		8/95	2/97
Extra cycles:			5/74		5/74		5/74		5/74		5/74
		5/75		5/75		5/75		5/75		5/75	
		2/79	5/80	2/79	5/80	2/79	5/80	2/79	5/80	2/79	5/80

Notes:
(a) Preliminary.
(b) Recorded as 8/89 in October 1997.
(c) A minor cycle.

Sources:
Columns 1and 2 from Table 2, columns 1 and 2; other columns computed from seasonally adjusted data in ABS, Cat. no. 5206.0, various issues.

Table 4: Comparison of Timing of Corresponding Turning Points of Both Cycles and Real GNFP(I), Australia, at Selected Dates, 1971-98

Growth cycle Chronology		Chronologies in GNFP(I) identified in deviations from trend for data available at: June 1981		May 1984		March 1986		April 1988		Jan. 1993	
P	T	P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1/71	3/72	5/70	2/72	5/70	2/72	5/70	2/72	5/70	2/72	5/70	2/72
2/74	10/75	11/73	11/75	11/73	11/75	11/73	11/75	2/73	11/75	8/73	11/75
8/76	2/78	11/76	11/77	11/76	11/77	11/76	11/77	8/76	11/77	5/76	11/77
9/81	5/83			5/81	5/83	5/81	5/83	5/81	5/83	5/81	5/83
11/85	3/87							8/85	2/87	8/85	5/86
11/89										5/89	
Extra cycles:				2/79	2/80	2/79	8/79				

		May 1995		Feb. 1996		July 1997		Oct. 1997		June 1998	
P	T	P	T	P	T	P	T	P	T	P	T
1/71	3/72	5/70	2/72	5/70	2/72	5/70	2/72	5/70	2/72	5/70	2/72
2/74	10/75	2/73	11/75	2/73	11/75	2/73	11/75	2/73	11/75	2/73	11/75
8/76	2/78	11/76	11/77	11/76	11/77	11/76	11/77	11/76	11/77	11/76	11/77
9/81	5/83	8/81	2/83	8/81	2/83	8/81	2/83	8/81	2/83	8/81	2/83
11/85	3/87	8/85	5/86	8/85	5/86	8/85	8/86	8/85	8/86	8/85	8/86
11/89	12/92	5/89	8/91	5/89	8/91	5/89	5/92	5/89	5/92	5/89	5/92
8/95	8/97(a)			11/94		11/94		11/94		11/94	2/97
Extra cycles:		2/79	5/80	2/79	5/80	2/79	5/80	2/79	5/80	2/79	5/80
							5/95(b)				
						2/96(b)					

Notes:
(a) Preliminary.
(b) A minor cycle.

Sources:
As for Table 3.

Table : Coa ison of Ti in of Co esondin Tu nin Points in e iations f o T end in ouc asu es of eal P and P ith oth Cycle Ch onolo , ust alia, 19 - 97

Section

Growth cycle Chronology		GDP (A)		GDP(I)		GDP(E)		GDP(P)	
P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
8/60	9/61	8/60	8/61	8/60	8/61	5/60	8/61	8/60	8/61
4/65	1/68	11/64	11/67	5/65	11/67	11/64	5/68	11/64	11/67
1/71	3/72	11/68	8/72	8/71	8/72	11/70	2/72	11/68	8/72
2/74	10/75	11/73	11/75	11/73	11/75	11/73	5/74	11/73	5/75
8/76	2/78	11/76	11/77	11/76	11/77	2/76	11/77	8/76	2/78
9/81	5/83	8/81	2/83	8/81	2/83	8/81	5/83	2/82	2/83
11/85	3/87	8/85	2/87	8/85	8/86	5/85	8/86	8/85	2/87
11/89	12/92	8/89	5/92	8/89	5/92	8/89	5/91	8/89	5/92
8/95	8/97(a)	8/95	2/97	8/95	2/97	8/95	2/97	2/96	2/97
Extra cycles:			5/66		5/66				5/66
		2/67		2/67		11/68	2/70	2/67	
				2/69	11/70				
					5/74				
				5/75					
		2/79	5/80	2/79	5/80	11/79	5/80	11/78	5/80
						11/87	8/88		
						2/94	2/95	8/94	5/95

Section B

Growth cycle Chronology		GNFP (A)		GNFP(I)		GNFP(E)		GNFP(P)	
P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
8/60	9/61	8/60	8/61	8/60	8/61	5/60	11/61	8/60	8/61
4/65	1/68	5/65	5/66	5/65	11/66	11/64	5/66	11/64	5/66
1/71	3/72	5/70	2/72	5/70	2/72	11/70	2/72	5/70	8/72
2/74	10/75	11/73	11/75	2/73	11/75	11/73	5/74	11/73	2/76
8/76	2/78	11/76	11/77	11/76	11/77	2/76	11/77	8/76	11/77
9/81	5/83	8/81	2/83	8/81	2/83	8/81	5/83	2/82	2/83
11/85	3/87	8/85	2/87	8/85	8/86	11/85	2/87	11/85	2/87
11/89	12/92	8/89	5/92	5/89	5/92	8/89	5/91	8/89	8/92
8/95	8/97(a)	11/94	2/97	11/94	2/97	8/95	2/97	8/94	2/97
Extra cycles:						8/67	5/68		
		11/79	5/80	2/79	5/80			11/79	5/80
						11/87	8/88		
						11/92	8/93		

Note:
(a) Preliminary.
Sources:
Columns 1 and 2 from Table 2, columns 1 and 2; other columns computed from seasonally adjusted data in ABS, 1998g.

Table : Coa ison of Ti in of Co esondin Tu ninPoints of oth Cycles, eal P and P , ust alia, at Selected ates, 19 -97

Growth cycle chronology		Chronologies in GDP(A) and GNFP(A) identified in deviations from trend for data available at:									
		Real GDP(A)						Real GNFP(A)			
		Jan. 1993		April 1998		June 1998		April 1998		June 1998	
P	T	P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
8/60	9/61	na	na	8/60	8/61	8/60	8/61	8/60	8/61	8/60	8/61
4/65	1/68	na	na	11/64	11/67	11/64	11/67	5/65	5/66	5/65	5/66
1/71	3/72	na	na	11/68	8/72	11/68	8/72	5/70	2/72	5/70	2/72
2/74	10/75	na	11/75	11/73	11/75	11/73	11/75	11/73	11/75	11/73	11/75
8/76	2/78	8/76	11/77	11/76	11/77	11/76	11/77	11/76	11/77	11/76	11/77
9/81	5/83	8/81	5/83	8/81	2/83	8/81	2/83	8/81	2/83	8/81	2/83
11/85	3/87	8/85	2/87	8/85	2/87	8/85	2/87	8/85	2/87	8/85	2/87
11/89	12/92	8/89		8/89	5/92	8/89	5/92	8/89	5/92	8/89	5/92
8/95	8/97(b)			2/96	2/97	8/95	2/97	2/96	2/97	11/94	2/97
										8/97	
Extra cycles:					5/66		5/66				
				2/67		2/67					
		2/79	5/80	2/79	5/80	2/79	5/80	11/79	5/80	11/79	5/80

Notes:
(a) na: data not available
(b) Preliminary.

Sources:
As for Table 3.

Table 7: Comparison of Classical Cycle Turning Points in Farm Sector and Total Economy, Australia, 1960-97

Gross Farm Product						Total Economy					
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)
	5/60										
11/62	5/63	6	30		36	9/60	9/61	12	33	57	45
2/65	8/65	6	21	27	27						
8/66	11/67	15	12	18	27						
11/68	8/70	21	12	27	33						
8/71	5/73	21	12	33	33	7/74	10/75	15	154	166	169
11/78	2/81	27	66	87	93	8/76	10/77	14	10	25	24
2/82	5/83	15	12	39	27	9/81	5/83	20	47	61	67
5/85	11/85	6	24	39	30						
5/87	5/88	12	18	24	30						
11/90	11/91	12	30	42	42	12/89	12/92	36	79	99	115
2/94	2/95	12	27	39	39						
2/97			24	36							
Averages (a):		14	24	37	38			19	65	82	84
Standard Deviations (a):		7	14	17	18			9	50	48	52

Note:
(a) The average durations and standard deviations are rounded to full months.

Sources:
Columns 1 and 2 computed from seasonally adjusted data in ABS 1998g, Table 48; columns 7 and 8 from Table 2, columns 7 and 8.

Table 8: Comparison of Timing of Corresponding Turning Points of Classical Cycles and Real GDP, Australia, at Selected Dates, 1971-98

Classical cycle Chronology		Chronologies in GDPI) identified in raw data available at: June 1981		May 1984		March 1986		April 1988		Jan. 1993	
P	T	P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
9/60	9/61	11/60	8/61	8/60	8/61	8/60	8/61	8/60	5/61	8/60	8/61
7/74	10/75	nt	nt	11/73(a)	5/74(a)	11/73(a)	5/74(a)	nt	nt	nt	nt
8/76	10/77	5/77(a)	11/77(a)	nt	nt	nt	nt	nt	nt	nt	nt
9/81	5/83			5/82	5/83	8/82	5/83	5/82	5/83	8/81	5/83
12/89	12/92									2/90	8/91

		May 1995		Feb. 1996		July 1997		Dec. 1997		June 1998	
P	T	P	T	P	T	P	T	P	T	P	T
9/60	9/61	8/60	8/61	8/60	8/61	8/60	8/61	8/60	8/61	8/60	8/61
7/74	10/75	nt	nt	Nt	nt	nt	nt	nt	nt	nt	nt
8/76	10/77	nt	nt	Nt	nt	nt	nt	nt	nt	nt	nt
9/81	5/83	11/81	2/83	11/81	2/83	11/81	2/83	11/81	2/83	11/81	2/83
12/89	12/92	2/90	5/91	2/90	5/91	2/90	5/91	2/90	5/91	2/90	5/91

Notes:

(a) A minor cycle.

(b) nt: no corresponding turn.

Sources:

Columns 1 and 2 from Table 2, columns 7 and 8; other columns computed from seasonally adjusted data in ABS, Cat. no. 5206.0, various issues.

Table 9: Comparison of Timing of Corresponding Turning Points of Melbourne Institute's Growth Cycle Chronology with ABS's Experimental Leading Indicator and Reference Series, Australia, 1971 - 97

Growth cycle Chronology(d)		ABS's series (e)			
		Experimental leading indicator (CLI)		Reference series: Real GDP (A)	
Peak	Trough	Peak	Trough	Peak	Trough
(1)	(2)	(3)	(4)	(5)	(6)
Section A: Incorporating national accounts data available at March quarter 1997					
	3/72		11/71		5/72
2/74	10/75	2/73	2/75	11/73	8/75
8/76	2/78	5/76	2/78	8/76	11/77
9/81	5/83	5/81	11/82	11/81	2/83
11/85	3/87	2/84	8/86	8/85	11/86
11/89	12/92(a)	11/88	2/91	11/89	5/91
12/95(a)		5/94	8/95	2/96	
Extra cycles:		2/79	5/80	11/78	5/80
				5/94	5/95
Section B: Incorporating national accounts data available at March quarter 1998					
11/89	8/93	11/88	2/91	11/89	8/91
8/95	8/97(b)	5/94	8/95	5/94	2/97
		8/97			
Extra cycles:		5/92(c)	11/92(c)	2/93 (c)	8/93(c)
					5/95
				11/95	

Notes:
(a) Preliminary with data available at June 1997.
(b) Preliminary with data available at August 1998.
(c) A minor cycle.

Sources:
(d) As for Table 2, columns 1 and 2.
(e) Columns 3 to 6: Section A, ABS, 1997a, p. vii; Section B, as read from chart in ABS, 1998c, p. 7.

Table 1: Comparison of Timing Variability at Both Cycle Turning Points of Corresponding Turning Points in Deviations from Trend of Real GDP(A), GDP(I), GNFP(A), GNFP(I) and Coincident Composite Index, Australia, 1960-97

Growth cycle chronology		Leads (-) and lags (+) in months of chronologies in deviations from trend for data available at June 1998 for:									
		GDP(A)		GDP(I)		GNFP(A)		GNFP(I)		Coincident composite index	
P	T	P	T	P	T	P	T	P	T	P	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
8/60	9/61	0	-1	0	-1	0	-1	0	-1	0	0
4/65	1/68	-5	-2	+1	-2	+1	-20	+1	-14	-5	0
1/71	3/72	-26	+5	+7	+5	-8	-1	-8	-1	0	0
2/74	10/75	-3	+1	-3	+1	-3	+1	-12	+1	0	0
8/76	2/78	+3	-3	+3	-3	+3	-3	+3	-3	0	-4
9/81	5/83	-1	-3	-1	-3	-1	-3	-1	-3	0	0
11/85	3/87	-3	-1	-3	-7	-3	-1	-3	-7	+2	0
11/89	12/92	-3	-7	-3	-7	-3	-7	-6	-7	0	0
8/95	8/97(a)	0	-6	0	-6	-9	-6	-9	-6	0	0
Median		-3	-2	0	-3	-3	-3	-3	-3	0	0
Mean		-4	-2	0	-3	-3	-5	-4	-5	0	0
Standard Deviations		8	3	3	4	4	6	5	4	2	1
Extra cycles:			5/66		5/66						
		2/67		2/67							
				2/69	11/70						
					5/74						
				5/75							
		2/79	5/80	2/79	5/80	11/79	5/80	2/79	5/80		

Note:
(a) Preliminary.

Sources:
Columns 1 and 2 from Table 2, columns 1 and 2; columns 3 to 10 computed from data in Table 5, columns 3 to 6; and columns 11 and 12 computed from Melbourne Institute's coincident index.

Insert chart…..

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