WHAT IS A RECESSION?: A REPRISE.

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Abstract

This paper draws its title from a paper written over 30 years ago by Geoffrey H. Moore (1967). Why the need for a reprise? First, there would appear currently to be somewhat diverging views – particularly in Australia – as to what properly constitutes a recession. Second, largely as a result of this, in Australia and many other countries other than the US, there is no single widely-accepted business cycle chronology for the country in question. This paper will argue that in addition to an output dimension, there are other important dimensions to aggregate economic activity which need to be taken into account in determining the business cycle, viz., income, sales and employment. As such, our perspective would seem to be at odds with the apparent position taken by other recent Australian commentators on this issue who argue that GDP is all that is needed to represent Australia's business cycle. We will also argue strongly against using the currently popular 'two negative quarterly growth rate' rule in dating the onset of a recession.

1. INTRODUCTION

This paper draws its title from a paper written over 30 years ago by Geoffrey H. Moore (1967). [1] Moore worked closely with Burns and Mitchell (1946) at the National Bureau of Economic Research (NBER), founded the Centre for International Business Cycle Research in 1979 and, most recently, was the founding director of the Economic Cycle Research Institute (ECRI) in New York in 1996. Moore was also a member of the NBER's business cycle dating panel which has over the last couple of decades provided academics, researchers, analysts, commentators and political scientists with the 'official' and universally accepted US business cycle chronology[2].

Why the need for a reprise? First, there would currently appear to be somewhat diverging views – particularly in Australia - as to what properly constitutes a recession. Second, largely as a result of this, in Australia and many other countries other than the US, there is no single widely-accepted business cycle chronology for the country in question. This is potentially quite serious. The existence of a commonly accepted chronology allows a proper analysis of previous recessionary/expansionary episodes in terms of the timing of various events - and, of these, most importantly, the time paths of the various macroeconomic policy variables - prior to, during, and

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[1] Geoffrey Moore died early in 2000. His contribution to business cycle analysis over more than 50 years was profound and he will be sadly missed by his many friends and colleagues.

[2] A country's business cycle chronology is the set of dates (desirably, monthly) corresponding to the aperiodic peaks (the last month of an expansionary episode) and troughs (the last month of a recessionary episode) in its business cycle. Prior to 1979 these dates were determined in the US by the NBER. Since then, the business cycle dating panel - under the auspices of the NBER - has determined the dates. Apart from Moore, it consists of six other members from various US-based universities, each recognised as an expert in business cycle analysis.

after the business cycle episode. Such analyses provide very valuable insights into the conduct of policy then and in the future, and for the sake of consistency, they require a general acceptance of the specifics of the country's chronology.

The most widely quoted conceptual definition of the business cycle is that due to Burns and Mitchell (1946), viz.

> Business cycles are a type of fluctuation found in the aggregate economic activity of nations…: 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.(p.3)

The current divergence in views as to how to date the business cycle stems from the rather ill-defined concept of 'aggregate economic activity' mentioned in the above definition. It has recently been suggested by some that the concept of aggregate economic activity can be well represented by a single macroeconomic time series of aggregate production, usually selected as quarterly (or - in recent times and in some countries - monthly) constant price Gross Domestic Product.[3]

Others argue that such an approach is inadequate and is at odds with the spirit and the demonstrated approach of the NBER. The alternate view holds that, in addition to an output dimension, there are also other important dimensions to 'aggregate economic activity' which need to be taken into account in determining the business cycle, viz., income, sales and employment. Whilst the additional measures may be expected to show similar patterns to output over the long term, in particular macroeconomic episodes their time paths over the short term can be sufficiently different from measured GDP as to be of material importance to the task of properly and precisely dating the peaks and troughs in the business cycle.

This paper will argue that the latter perspective is the more appropriate. As such, our perspective would seem to be at odds with the apparent position taken by other recent Australian commentators on this issue; eg. Pagan (1997), Harding and Pagan (1999), and even to some extent and somewhat surprisingly, Boehm (1998), Boehm and Summers (1999). However, we would argue our approach is more consistent with Moore (1967,1982), Stock and Watson (1991) and the NBER itself.

A subsidiary, but nonetheless important, issue relates to the popular common approach followed by analysts in Australia and elsewhere that the onset of recession (and recovery) may be adequately and meaningfully determined using the simple rule usually attributed to Arthur

[3] Some commentators suggest non-farm GDP and others argue in favour of GDP(A) as opposed to any of GDP(I), GDP(P), or GDP(E).

Okun[4], viz that, given the economy is in an expansion (recession), the onset of recession (recovery) is dated by the advent of two consecutive quarters of negative (positive) growth.
We will argue that this is overly arbitrary and simplistic and amounts to neither a necessary nor a sufficient condition for determining the beginning or the end of a recession. Indeed, as we will show, had such a rule been used in conjunction with US GDP (alone) then three of the nine official post-WWII US recessions would not have been recognised. On this issue, others have also recently advised against the use of such an overly simplistic recognition rule (eg., Harding and Pagan(1999)).

The paper is organised as follows. In the next section we provide our reasons for arguing that approaches to dating the business cycle which are based upon GDP alone are inadequate and at odds with what should be considered as constituting 'the business cycle'. At the very least we argue that such an approach is entirely at odds with those NBER researchers who pioneered the study of the business cycle. In Section 3 we provide some empirical analysis of the US which illustrates the shortcomings of such an approach. Brief conclusions are provided in the final section.

2. THE BUSINESS CYCLE: ITS CONCEPT AND MEASUREMENT

Conceptualising the Business Cycle

As noted above, Burns and Mitchell's definition of the business cycle does not make explicit the notion of 'aggregate economic activity'. Recently, some have argued that a satisfactory proxy for this is now GDP, being as it is the most comprehensive measure we have of a nation's total production in a given period. After all, GDP is about as aggregate a measure of output as possible.

The essence of the argument is that only annual estimates of US GDP were available in the 1920s and 1930s when Mitchell and his associates at the NBER were developing the methods of determining the US business cycle chronology. However, what was wanted was a monthly chronology and it was therefore necessary for many alternative - but imperfect - macroeconomic time series to be studied. Even with the introduction of quarterly GDP estimates, the desire for a monthly chronology still necessitated the need to analyse alternative monthly measures of economic activity so as to pinpoint the precise month in which to fix the relevant turning point.

On this narrow, output-based view of what Burns and Mitchell meant by the concept of 'aggregate economic activity', if one was content with a quarterly chronology then all that would be required would be to determine - in some suitable way - the turning points in quarterly GDP. By corollary, if a monthly measure or estimate of GDP were ever to become available then its turning points would be all that would be needed to determine the required chronology and no additional series need be investigated. Some recent contributors to this area of business cycle literature in Australia would seem to have this view.

[4] The origin of this convention of referring to this type of rule as Okun's Rule is somewhat clouded. Harding and Pagan (1999), for example, use this convention. However, a strong case can also be made that the rule may have stemmed originally from Julius Shiskin (1974).

For example, Pagan (1997) based his entire paper about understanding the business cycle on the analysis of GDP and argued for doing so as follows.

> …there is some common factor, Ft, to sectoral outputs… and it is this factor which produces …the cycle. If we form a weighted average… as is done with GDP…[then] GDP might be regarded as the common factor…(p3)

Further, Pagan and Harding (1999) twice quoted Burns and Mitchell (1946, p72, 73) themselves as implicitly preferring the single measure of GDP as the best proxy for 'aggregate economic activity'. As they (Pagan and Harding) stated (p15): "As Burns and Mitchell (1946,p72) noted it is difficult to go past GDP as the single index".

Given the pre-eminence of Burns and Mitchell in business cycle research it is perhaps important to clarify as best we can this particular point. The full range of relevant Burns and Mitchell quotes is as follows (p72, 73)[5]:

> Aggregate activity can be given a definite meaning and made conceptually measurable by identifying it with gross national product. However, for the purposes of analyzing business cycles, it is better to restrict the total to the portion of the national product that passes through the "market"…. Similar restrictions apply to other measures of aggregate activity that might be used, such as the physical volume of production or the volume of employment…. Unfortunately, no satisfactory series of any of these types is available by months or quarters for periods approximating those we seek to cover.'

Given the above, and their explicit reference to employment, we do not think it is necessarily self evident that, if available for direct comment today, Burns and Mitchell would go along with being characterized as believing that "it is difficult to go past GDP as the single index" to represent 'aggregate economic activity'.

Finally, rather surprisingly, Boehm (1998) and Boehm and Summers (1999) also appear to have this view.[6] For example, in Boehm and Summers (1999, p.13-14), they write

> We could define the *ideal* measure of aggregate economic activity as monthly real GDP. Though no such series is available, it is nonetheless worth pondering what it would mean to have a series which accurately, and without requiring later revisions, measures total economic activity and which would therefore clearly reflect business fluctuations…. The ideal measure of monthly real GDP could also be used to provide the basis for identifying reference cycle chronologies and hence, phases of the business cycle. We would still be interested in [other] statistical indicators …such as industrial production, household income, retail trade, employment, and unemployment. However, if we had the ideal measure, we

[5] We say "full" because others have neglected the middle couple of sentences of the quote provided in the text and which we believe are quite crucial to deriving the spirit of Burns and Mitchell's intent.

[6] "Surprisingly", because Boehm worked very closely with Moore (see later) and has, for many years, been a leading Australian exponent of the 'many-series' approach to determining a country's business cycle chronology.

> would not be concerned with using these roughly coincident indicators to obtain a measure of the general course and the level of aggregate economic activity… [I]n the absence of the ideal measure of monthly real GDP we select [these] roughly coincident indicators that will, when combined in a composite index, give a reasonably accurate picture of aggregate economic activity.

It would seem pretty clear from the above quote that Boehm (and Summers) philosophically subscribes to the view that the only reason for analyzing series other than GDP and combining them (along with GDP) into a composite index is the absence of a reliable monthly measure of real GDP. This is at odds, we believe, with the NBER (both the original progenitors of business cycle analysis and more modern exponents such as Stock and Watson), as well as with the thinking of one of the greatest proponents of the leading indicator approach to understanding the business cycle, viz Geoffrey Moore. In what follows we attempt to explicate this position.

Before proceeding we should clarify one important point. It is certainly true that one significant advantage of analyzing a range of macroeconomic series which are known to be roughly coincident with the cycle is that, as is well-known, almost all macroeconomic time series are subject to substantial measurement error and are quite often revised very significantly. Thus, the existence of this measurement error issue is very strong justification in and of itself for avoiding reliance on a single macroeconomic time series – such as GDP – to determine a business cycle chronology.

However, we believe the motivation for looking at a range of measures other than GDP (even if available monthly) is much more profound than simply the recognition of such measurement error. Rather it goes to the very heart of the philosophical question of what we should think of as constituting the business cycle (and, most importantly, a recession). We believe it should be explicitly regarded as more than simply a downturn in measured output. In particular – and most crucially - it must also encompass employment dimensions.

Thus, the inclusion of series such as retail sales, industrial production and GDP in a list of series to determine turning points of the business cycle may be regarded as attempts to 'triangulate' on the current state of demand and output production in the economy. However, the inclusion of series such as household income, employment and the unemployment rate is explicit recognition of the importance of recognizing the impact which output and demand fluctuations have on the economic welfare of the members of a community as reflected in their employment and income levels.

Whilst one can argue that the inclusion of output measures indirectly captures these effects, the relationship between output growth and employment is not very precise and can vary quite significantly both over any given cycle and between cycles. For example, the most recent recessions in Australia and the US in the early 1990s were both followed by quite a long period of very slow output growth. The result was that in Australia, for instance, whilst output began to grow steadily again after five quarters, there was virtually no employment growth at all for quite some time and unemployment actually continued to climb for almost another year.

An important clue to the spirit of Burns and Mitchell's views as to how to suitably define aggregate economic activity may be gleaned from Burns (1952), viz.

> And if business cycles are not one phenomenon, but a congeries of interrelated phenomena, any distinction between the problem of how business cycles run their course and how our economic organization works cannot but be artificial (p36)

And

> To Mitchell a business cycle meant more than a fluctuation in a single aggregate such as national income or employment. It also meant that the fluctuation is recurrent, and that certain repetitive features run through the recurrences. And especially it meant that the fluctuation is diffused through economic activity -- appearing, as a rule, in prices as well as industrial activities, in markets for securities as well as for commodities and labor, in processes of saving and investment, in finance as well as in industry and commerce.(p36)

And, finally, as far as that other great original architect of the NBER approach to analyzing business cycles is concerned, we have the following from Moore (1982). In relation to the above-defined definition of Burns and Mitchell and the term 'aggregate economic activity', he noted:

> No single measure of aggregate economic activity is called for in the definition because several such measures appear relevant to the problem, including output, employment, income and [wholesale and retail] trade… Use of several measures necessitates an effort to determine what is the consensus among them, but it avoids the arbitrariness of deciding upon a single measure…(p98)

Here Moore is quite clearly indicating there are several important dimensions to the concept of a business cycle (rather than just produced output). In addition, he is also recognizing that the use of several series certainly complicates the dating process but that this is to be preferred to the use of a single series. Relatedly, we note the NBER itself continues to state[7]

> The NBER does not define a recession in terms of two consecutive quarters of decline in real GNP. Rather, a recession is a period of significant decline in total output, income, employment, and trade, usually lasting from six months to a year, and marked by widespread contractions in many sectors of the economy.

Furthermore, James Stock and Mark Watson of the NBER have continued the work begun by Burns, Mitchell and Moore and, although they employ more modern statistical methods in their approach, they too acknowledge the fundamental importance of looking at a range of complimentary indicators rather than relying simply on GDP as the proxy for the business cycle. As they say:

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[7] This quote is taken from NBER website http://www.nber.org/cycles.html as at 9 May, 2001.

> One approach …. is to pick an important economic time series, say employment or GNP, as the object of interest…. From the perspective of business cycle analysis, however, this approach is rather limited. 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. (p65)

And

> The 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…. This unobserved variable – the state of the economy – must be defined before any attempt can be made to estimate it…. This section presents a parametric "single-index" model in which the state of the economy… is an unobserved variable common to multiple aggregate time –series…. The single index model is estimated using data on industrial production, real personal income, real manufacturing and trade sales, and employment…(p64)

Even more recently Crone (2000) of the Philadelphia FED had this to say about dating and analyzing the business cycle.

> When someone asks, "How's the economy doing?", it's often not clear which measure to point to. Should we refer to the unemployment rate, job growth, or some broader measure like the change in gross domestic product (GDP). …Each of these statistics has some information. But none has all the information we are looking for, and they sometimes give conflicting signals about where we are in the business cycle….. A partial solution to this dilemma is to combine several measures into a composite index of current… economic activity. (p.3/4)

In sum, we feel that the evidence is quite incontrovertible that the view of Burns, Mitchell and Moore – the creators of business cycle analysis – was that they firmly believed there was more to dating the cycle than just using GDP. This view would still seem to pre-dominate at the NBER and the US FED. Furthermore, we would argue that this was - and is - not simply the recognition of the existence of measurement error in macroeconomic time series (although this is certainly part of the story) and the unavailability of a monthly measure of real GDP. Rather , it is much more to do with the fundamental philosophical view that the proper characterization of the 'business cycle' or the 'state of the economy' involves an employment and income dimension as well as measured output. Thus, even if a monthly – and even if perfectly measured – series of real GDP were to be available then we would argue this would certainly not be all that would be required as the 'ideal measure' for business cycle dating.

Measuring (Or Dating) the Business Cycle

The other important issue we want to address is the recent popularity – even amongst important policy agencies – of the so-called 'two consecutive negative quarterly growth rate' dating rule

for determining the date of the onset of recession. The analogous rule for dating the end of a recession is 'two consecutive positive quarterly growth rate' rule.

As noted earlier, such a rule has been attributed by some recent authors to Arthur Okun but there is evidence to suggest that it may have originated with Julius Shiskin (1974). This is very ironic as Shiskin was a firm believer in the 'many series' approach to dating business cycles, was one of the most significant original contributors to the methods of composite index construction, and would never have subscribed to such a simplistic – and potentially dangerous and misleading - approach to the matter of business cycle dating.

In fact, Shiskin provided quite a comprehensive list of recession-spotting rules-of-thumb to assist policymakers and the general public understand the nature of a business cycle contraction. Shiskin's intention, of course, was for these rules to be used in conjunction with each other as confirmatory signals of recession. Just one of these was the 'two negative growth rate' rule. As sometimes happens with such things, with no great theoretical justification, it has been this single rule which seems to have survived and captured the attention of many. In what follows below – and in the next section - we argue that such a 'rule' is neither a necessary nor a sufficient condition for defining a recession.[8]

Consider how the use of such a rule may produce quite a non-sensical set of business cycle reference dates, particularly when it is combined with the use of GDP alone as the measure of the business cycle. One could well imagine a period of very depressed economic activity associated with falling output and employment and with unemployment climbing, but two large negative quarterly growth rates in GDP just happen to have one or two barely positive growth rates intervening between them. To use such a rule blindly to conclude that such a country was not in recession would be not only patently silly but also quite dangerous when used in real time if it meant that much needed policy changes were postponed for many months or not even implemented at all. Similarly, to automatically conclude that a country was in recession simply because of two minutely negative quarterly growth rates in GDP - particularly if they occurred simply because they followed on from one or two quarters of unusually strong quarterly growth - seems just as misguided.

The aforegoing two scenarios are not merely academic supposition. As noted by one of us elsewhere (Banerji and Niemira (2000)), both of these situations have occurred recently in the case of Japan. The very severe Japanese recession of the mid-1970s would not have been recognized on account of the absence of two consecutive negative quarterly growth rates in GDP. Conversely, again on this criterion, Japan would have been considered to have experienced two more recessions between 1992 and 1999 in addition to the two widely recognized ones.

In order to avoid these anomalous situations in dating recessions it is necessary to do three things.

[8] We also refer the reader back to the abovementioned quote from the NBER's website where it explicitly eschews the 'two consecutive growth rate rule'.

First, as noted above, analysts must look to more than GDP or any other single series. Rather, a range of measures covering employment, unemployment, income, and sales in addition to output measures need to be investigated to determine whether a business cycle turn has occurred.

Second, turning points in these individual series need to be determined but not by the 'two consecutive quarterly growth rate rule'. Rather, we recommend that the widely used and accepted algorithm developed by Bry and Boschan (1971) should be used. This computer algorithm comes closest to replicating the detailed and thorough manual approach developed over many years at the NBER for the purpose of turning point recognition.

Third, in determining the appropriate date for a business cycle turn, a consensus date needs to be arrived at among the cluster of dates suggested for a particular turn by the application of the Bry-Boschan algorithm to the various series in question. This has traditionally been done subjectively. However, a computer algorithm being developed by Don Harding of the Melbourne Institute is also very promising as an alternative to the subjective approach.[9]

In the next section we present some interesting empirics pertaining to the US economy which relate to the issues traversed in this section.

3. EMPIRICAL CONSIDERATIONS

The primary concerns of this paper is the adequacy of GDP alone and the use of the 'two consecutive growth rate rule' as the basis for determining business cycle dates. Since the NBER business cycle chronology for the U.S. is widely accepted, we can test the proposition empirically, to verify the extent to which business cycle dating based on such an approach would have matched the NBER chronology.

Until 1995, fixed-weight real GDP figures were used officially in the U.S., and chain-weighted real GDP data were used thereafter. Thus, the analysis can be done using both fixed-weight and chain-weighted GDP.

Based on these GDP figures, the recession dates can be determined using Okun's Rule, described earlier. Alternatively, they can be determined by the Bry-Boschan (BB) method which, as noted above, is an algorithmic formulation of the NBER procedure for determining cyclical turning points in time series. Since the GDP data are quarterly, while the NBER business cycle chronology uses monthly dates, the GDP figures are assumed to be centered in the middle month of the quarter for the purposes of comparison.

A comparison of the business cycle dates obtained on the basis of these GDP figures is revealing. As Table 1 shows, both the BB method and Okun's rule, whether used on fixed-weight or chain-weighted GDP data, yield results that are significantly different from the NBER chronology.

[9] The interested reader could contact Don Harding at the Melbourne Institute of Applied Economic and Social research (University of Melbourne) directly for further information.

Specifically, the BB method misses three recessions (1948-49, 1960-61 and 1980) out of the nine seen since 1948 when used on fixed-weight GDP, and misses two recessions (1960-61 and 1969-70) when used on chain-weighted GDP. Okun's Rule misses two recessions (1960-61 and 1980) when used on fixed-weight GDP, and misses one recession (1960-61) when used on chain-weighted GDP. Notably, all four methods miss the 1960-61 recession, and in addition, both methods miss the 1980-81 recession when used with fixed-weight GDP.

In addition, these GDP-based rules place the business cycle peak and trough dates too early or too late quite often. As Table 1 shows, the mean absolute error (MAE) in the placement of the start or end of recessions is 2.3 months for the Okun/chained method, 1.8 months for the BB/fixed method, and 1.6 months for both the Okun/fixed and BB/chained methods. Furthermore, the largest absolute errors for these methods were 9, 6, 6 and 5 months respectively. It is telling that, of the identified TPs, fully 50% of the recession start and end dates were placed in the wrong quarter by the Okun/chained and BB/fixed methods, while 43% of those dates were placed in the wrong quarter by the Okun/fixed and BB/chained methods.

It is evident, therefore, that the determination of recession start and end dates based on quarterly GDP numbers is highly problematic. The worst results exhibited here show a third of all the recessions missed, half of the remaining recession dates placed in the wrong quarter, and up to a nine-month error in the placement of a recession date. But even the best results show one of the nine recessions missed, almost half of the remaining recession dates placed in the wrong quarter, and up to a five-month error in the placement of a recession date. It is clear that whether a simple approach like Okun's rule is used, or a sophisticated approach like the Bry-Boschan procedure is employed, the dates of recessions cannot be accurately determined based on quarterly GDP alone.

The question then is, would the use of monthly GDP solve the problem? Since there is no monthly US GDP series, to answer this question we need to construct a monthly GDP series from the available published quarterly series to get an approximation to what a series might look like. And of course, once again, monthly GDP can have fixed-weight or chain-weighted versions. The procedure we adopt here to estimate a monthly GDP series from the available quarterly series is based on using the monthly coincident indicators of economic activity used in the construction of the Economic Cycle Research Institute's (ECRI's) coincident index (excluding the unemployment rate), viz., industrial production, real manufacturing and trade sales, real personal income and nonfarm employment.

A multiple regression using quarterly averages of these four variables as the independent variables and quarterly fixed-weight real GDP as the dependent variable yields an adjusted R-square of 0.9990. When chain-weighted GDP is used, the regression yields an adjusted R-square of 0.9992. In either case, the predictive power of the relationship is extremely strong.

The monthly GDP is then estimated as follows:

1) First, the regression equation coefficients are used to produce a preliminary estimate of the monthly GDP by applying the estimated coefficients to the monthly data on the four explanatory variables over the sample period.

2) Next, summing over the three months of each quarter produces a quarterly equivalent of this series.

3) The ratio of actual GDP for each quarter to this series produces a quarterly adjustment factor, which when repeated for the three months of each quarter produces a monthly adjustment factor series.

4) Multiplying this monthly adjustment factor series by the preliminary estimate of the monthly GDP produced in the first step yields the final estimate of the monthly GDP.

The key question is how well this constructed monthly GDP can be used to determine the dates of recessions. Here, Okun's Rule is not applicable as we are dealing with monthly data, and so the Bry-Boschan procedure is used to determine the cyclical turning points for each of the monthly GDP series.

As Table 2 shows, the chain-weighted version of monthly GDP still misses one of the nine recessions (1969-70), while the fixed-weight version misses two recessions (1948-49 and 1960-61), compared with two and three recessions respectively when the Bry-Boschan method was used with quarterly GDP.

The monthly GDP series also quite often places the business cycle peak and trough dates too early or too late. The MAE in the placement of the start or end of recessions is 1.5 months for the chained-weight monthly version and 1.2 months for the fixed-weight monthly version, compared with 1.6 months and 1.8 months respectively when the Bry-Boschan method is used with quarterly GDP. The largest absolute error is 5 months for the chained-weight monthly version and 7 months for the fixed-weight monthly version, compared with 5 months and 6 months respectively when the Bry-Boschan method is used with quarterly GDP. Finally, 44% of the recession start and end dates were placed in the wrong quarter by the chained-weight monthly version and 43% were placed in the wrong quarter by the fixed-weight monthly version, compared with 43% and 50% respectively when the Bry-Boschan method is used with quarterly GDP.

Thus, in summary, there is some improvement in performance when the constructed monthly GDP is used in place of the quarterly series in terms of the number of recessions missed, but it is not at all clear that monthly GDP is better in terms of correctly dating the start and end of recessions. Of course, it perhaps goes without saying that even to get this small improvement it was necessary to make use of the information available in precisely the other series beyond GDP which we argue are relevant to business cycle dating anyway!

One alternative then to using this additional information from other relevant macroeconomic business cycle indicators to construct a monthly GDP series is to explicitly use a constructed index of coincident economic indicators to date business cycles. The version maintained by ECRI contains chain-weighted real GDP, industrial production, real manufacturing and trade sales, real personal income, nonfarm employment and the (inverted) unemployment rate. We also constructed another version of this coincident index using fixed-weight GDP.

The improvement compared with the GDP measures is immediately obvious from Table 2. Very importantly, neither the chain-weighted nor the fixed-weight version of the coincident index misses any of the nine recessions. However, the coincident indexes still do place the business cycle peak and trough dates a little too early or too late, but less often than the GDP measures. The MAE in the placement of the start or end of recessions is now less than a month; viz. 0.9 months for the chained-weight coincident index and 0.7 months for the fixed-weight coincident index, compared with 1.5 months and 1.2 months respectively for the chain-weighted and fixed-weight monthly GDP.

The largest absolute error is 5 months for both the chained-weight and fixed-weight coincident indexes, compared with 5 months and 7 months respectively for the corresponding versions of the monthly GDP. Furthermore, in the case of the coincident indexes this 5 month error (at the peak in Aug 1957!) is clearly quite an outlier. Other than this single early TP, in all other instances since the 1950s the TPs in the coincident indexes are remarkably accurate. For example, the fixed-weight version results in 14 of the remaining 17 TPs having a zero or a one month lead, with the other remaining three having a 2 month lead. On the other hand, the fixed weight version of monthly GDP only has nine TPs within a one month difference from the NBER TPs.

Finally, 33% of the recession start and end dates were placed in the wrong quarter by the chained-weight coincident index and 28% were placed in the wrong quarter by the fixed-weight coincident index, compared with 44% and 43% respectively for the corresponding versions of the monthly GDP.

Thus, despite a correlation of 0.9994 between the chain-weighted versions of the coincident index and monthly GDP, and a similarly high correlation for their fixed-weight versions, it is clear that the coincident indexes perform better than the corresponding monthly GDP measures in dating business cycle turning points. This is also despite the fact that the monthly GDP is estimated on the basis of the coincident indicators used in the coincident indexes themselves.

However, because the coincident index is specifically designed to capture cyclical movements in the economy, there are likely to be small divergences between the coincident index and the monthly GDP estimated from the coincident indicators, especially in the vicinity of cyclical turning points. Even such small divergences around turning points, which are the start and end dates of recessions, may be enough to substantially alter the dates of the turning points, despite the very high linear correlation between the two time series when calculated over all data points. That is why the use of a coincident index and monthly GDP for the purpose of dating recessions can lead to very different results in spite of their strong correlation.

Clearly, in empirical terms, GDP on its own, whether quarterly or monthly, chain-weighted or fixed-weight, is a poor tool for dating business cycles. For one thing, it misses cycles altogether, unlike the coincident index. Also, even where it does not miss the cycle, the placement of the start and end dates of recessions based on GDP alone is consistently less accurate than when based on the coincident index.

Of course, even the coincident index does not do a perfect job of dating the business cycle, but it does do a much better job than any version of GDP alone. However, it should be emphasized that the coincident index is just a summary measure, and is not meant to do the job by itself in any case. In fact, the NBER recession dates are based on a consensus of the dates of the cyclical turning points of the kinds of coincident indicators that make up the ECRI coincident index. Thus, the point is that, while the coincident index may not be perfect, a GDP measure alone, whether monthly or quarterly, is even less appropriate.

4. FINAL REMARKS

As noted in the introduction, the existence of a commonly accepted business cycle chronology allows a proper analysis of previous recessionary/expansionary episodes in terms of the timing of various macroeconomic and financial events of interest. Of these, most importantly, are the time paths of the various macroeconomic policy variables prior to, during, and after the business cycle episode. Such analyses provide very valuable insights into the conduct of policy then (and therefore in the future), and for the sake of consistency, they require a general acceptance of the specifics of the country's chronology.

In this paper we have argued strongly that the proper conceptual definition - and therefore the proper dating - of the business cycle requires more than simply an analysis of quarterly GDP. We have argued that other measures, particularly employment measures, but also sales and income measures, must figure prominently in any definition and analysis of a country's business cycle.

Furthermore, in contrast to some others, we have argued that this is not simply because of the non-availability of a monthly measure of GDP or because of the existence of measurement errors in most macroeconomic time series. On the contrary, we argue that fundamentally a business cycle must be defined in terms of more than just the measured output of an economy. We have argued that a careful analysis of the seminal writings on the topic – including the earliest work by the pioneers of business cycle research, viz. Burns and Mitchell – strongly point to the necessity of incorporating dimensions other than purely output measures into a proper definition of the business cycle.

A related but nonetheless quite separate issue relates to the issue of the approach which should be used for determining the cyclical turning points in a series – GDP or any other. On this point we have also argued strongly against the commonly used 'two consecutive negative (positive) growth rate rule' as a useful rule of thumb for dating the occurrence of turning points. When used to date recessions, we have argued that this can lead to quite serious errors in terms of the determination of specific dates, can quite easily spuriously miss recessions altogether, and can also spuriously point to recessions when they did not in fact occur.

The empirical evidence corroborates the basic premise of this paper, that GDP, quarterly or monthly, is a poor way to determine the start and end dates of recessions. The fact that GDP is not – and should not – be the major determinant of recession dates was recently underscored in an NBER article authored by the chairman (Hall, 2001) of its business cycle dating committee.[10]

At the time this paper was written (May, 2001), the latest GDP growth number had just been reported as 2.0% for the first quarter of 2001, double that in the previous quarter. Nevertheless, Hall noted in his article that "the data normally considered by the committee indicate the possibility that a recession began recently" based on back-to-back declines in industrial production and employment. Hall did go on to say that – at that time – the declines were still quite small and it was therefore still too early to know for certain whether a recession had occurred in the US.

However, irrespective of whether the US was, or was not, in a recession in early 2001, the important thing for our purposes was that Hall explicitly defined a recession as "a significant decline in activity spread across the economy, lasting more than a few months, visible in industrial production, employment, real income, and trade." Among those indicators, according to Hall, "industrial production and employment are the two most important measures considered by the NBER in developing its business cycle chronology."

Providing a clear insight into how the NBER chronology is determined, he observes that, as far as the 1990/91 recession was concerned, "the NBER picked July as the 1990 peak date because it lay between the June peak in employment and the September peak in industrial production." There can hardly be a clearer affirmation of the importance of both output and employment, along with other coincident indicators, in determining the widely accepted NBER recession dates.

At the root of the matter is the philosophical notion that what defines "an economy" is much more than a broad measure of output. Also, business cycles are characterized by cyclical co-movements of the key coincident indicators, whose turning points collectively demarcate the periods of recession and expansion. Thus, it is not appropriate to use a single measure of output, regardless of frequency, as the unique basis for determining the dates of recessions. Rather, what is called for is the determination of the consensus of such coincident indicators about the date of each cyclical turning point[11].

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[10] The reader is referred to the NBER website address (http://www.nber.org/cycles/recessions.html) for the article.

[11] The recession start and end dates based on such a procedure, comparable to the NBER approach, is available for 16 other economies at http://www.businesscycle.com/research/intlcycledates.html

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TABLE 1. US Business Cycle Dating Performance of GDP – months difference from NBER TP Date

US Business Cycle		Chain-Weighted GDP,		Chain-Weighted GDP,		Fixed-Weight GDP,		Fixed-Weight GDP,	
Troughs	Peaks	BB method		Okun's Rule		BB method		Okun's Rule	
	Nov-48	0	0	0	0			0	0
Oct-49		-5	5	1	1			1	1
	Jul-53	-2	2	-2	2	-2	2	-2	2
May-54		-3	3	-3	3	0	0	0	0
	Aug-57	0	0	0	0	0	0	0	0
Apr-58		-2	2	-2	2	-2	2	-2	2
	Apr-60								
Feb-61									
	Dec-69			-4	4	-4	4	-4	4
Nov-70				-9	9	-6	6	0	0
	Nov-73	0	0	-6	6	0	0	-6	6
Mar-75		-1	1	-1	1	-1	1	-1	1
	Jan-80	1	1	1	1				
Jul-80		1	1	1	1				
	Jul-81	1	1	1	1	1	1	1	1
Nov-82		-3	3	-3	3	-3	3	-3	3
	Jul-90	-2	2	-2	2	-2	2	-2	2
Mar-91		-1	1	-1	1	-1	1	-1	1
Missed Cycles		2		1		3		2	
Mean Error		-1.1		-1.8		-1.7		-1.4	
Mean Absolute Error			1.6		2.3		1.8		1.6
Largest Absolute Error			5.0		9.0		6.0		6.0
Wrong quarter		43%		50%		50%		43%	

TABLE 2. Comparison of US Business Cycle Dating Performance Using an Estimated Monthly GDP Series and the ECRI monthly Coincident Index – months difference from NBER TP.

US Business Cycle Troughs	Peaks	Chain-Weighted Monthly GDP		Fixed-Weight Monthly GDP		Chain-Weighted Coincident Index		Fixed-Weight Coincident Index	
	Nov-48	-1	1			-1	1	-1	1
Oct-49		-5	5			0	0	0	0
	Jul-53	-2	2	-2	2	-2	2	0	0
May-54		-4	4	-1	1	0	0	0	0
	Aug-57	0	0	0	0	-5	5	-5	5
Apr-58		-2	2	-2	2	0	0	0	0
	Apr-60	-3	3			-2	2	-2	2
Feb-61		-2	2			-2	2	-2	2
	Dec-69			-3	3	-2	2	-2	2
Nov-70				-7	7	0	0	0	0
	Nov-73	0	0	0	0	0	0	0	0
Mar-75		0	0	0	0	0	0	0	0
	Jan-80	0	0	0	0	0	0	0	0
Jul-80		0	0	0	0	-1	1	-1	1
	Jul-81	1	1	1	1	0	0	0	0
Nov-82		-1	1	-2	2	1	1	1	1
	Jul-90	-1	1	-1	1	-1	1	-1	1
Mar-91		-2	2	0	0	0	0	0	0
Missed Cycles		1		2		0		0	
Mean Error		-1.4		-1.2		-0.9		-0.7	
Mean Absolute Error			1.5		1.2		0.9		0.8
Largest Absolute Error			5		7		5		5
Wrong quarter		44%		43%		33%		28%	