General Distribution **OCDE/GD(96)147**

PROCEDURES FOR CONSTRUCTING COMPOSITE INDEXES: A RE-ASSESSMENT

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Paris 1996

43114

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TABLE OF CONTENTS

1. Introduction

This paper discusses various methodologies for constructing composite indexes. Frequently, the cold fact is that such discussions, carried on in the abstract, are merely intellectual exercises in which experience, mathematical background, and statistical training mix in different proportions. To appraise different methodological approaches responsibly, it is necessary to scrutinise the actual findings or results to which the different approaches lead. In other words, the merit of an approach should not be judged solely in the abstract[1]. We seek to blend our recommendations about the construction of composite indexes which are based on logical considerations with our findings about where the different approaches would actually lead one.

There has been impressive growth in research on leading indicators and indexes in recent decades. Starting in the early 1970's, Geoffrey H. Moore and Philip A. Klein began an International Economic Indicator (IEI) project at the National Bureau of Economic Research and subsequently continued this work at the Centre for International Business Cycle Research, first at Rutgers University and then at Columbia University. This research continues at the new Economic Cycle Research Institute (ECRI) in New York City. The U.K. Central Statistical Office (CSO) has also done considerable work in this area. Statistics Canada has created indexes for the Canadian economy. Furthermore, the Organisation for Economic Co-operation and Development (OECD) has regularly published leading indexes for its member countries. Important research has also been accomplished at the U.S. Department of Commerce and the National Bureau of Economic Research. (The Commerce Department's work has recently been taken over by the Conference Board).

A survey of all of this work would require a major research effort. Fortunately, our assigned task is a more modest one. Our goal is twofold. First, we are charged with reviewing the current methodology used at the OECD to construct its leading indexes and to offer suggestions for change based on logical considerations. Second, we compare the performance of the OECD leading composite indexes for the United States with composite indexes which use the same components but are constructed using alternative methodologies for the construction of the composite index. In addition, we performed the same exercise with the Conference Board's leading index and its components.

2. The OECD Methodology for Constructing Leading Composite Indexes.

The salient features of the OECD approach to the development of leading composite indexes can be briefly sketched: (1) Its reference cycles, i.e. its chronology of peak and trough dates, are determined by the peak and trough dates of industrial production indexes, after appropriate adjustments for trend effects. The OECD emphasises a growth cycle chronology; (2) Its criteria for the selection of leading indicators rests on the relationships which show up in lead/lag tables and cross- correlation analysis; (3) It detrends the components of its leading composite index by using the Boschan-Ebanks phase- average-trend approach and (4) In the construction of the composite indexes the OECD prefers to reduce the irregular components of the various indicator series to approximately equal smoothness by taking moving averages equal in length to the MCD (months for cyclical dominance) of the respective series and then adjusting the average cyclical amplitude of each series to equal a constant. It achieves the latter by normalising (standardising) each component by the use of the average absolute deviations of the ratio of the series to its phase-average trend, from the mean of this ratio; (5) The standardised components selected are aggregated into a

[1] Cf. Burns, Arthur F., "Current Research in Business Cycles", in The Frontiers of Economic Knowledge, Princeton University Press, Princeton, 1954, p. 270.

composite index. (6) A process called trend restoration is then used to express the indicator in a form easily comparable with the reference cycle. This is done by multiplying the amplitude adjusted indicator by the trend of the reference series in its original units which was calculated earlier by the phase-average trend method.

The OECD approach to the construction of leading composite indexes mitigates problems which some have associated with the Moore-Shiskin methodology. Specifically, it blunts the problem that the trend or irregular movements could possibly at times dominate the index. However, the approach can also cause other problems. These include: (1) The artificial nature of the trend which needs to be reestimated every month ; (2) The fact that the removal of the trend will likely shift turning points; and (3) If the trend is non-linear, the magnitude of the shifts in turning points will vary.

These shifts, however, are only a symptom of a more basic problem which the removal of the trend in the component series creates, i.e. the attempt at the total removal of trend is inconsistent with the classical "cycle of experience." The term cycle of experience relates to the actual configuration of the cyclical processes to which each economic activity is subject. This includes cyclical timing, amplitudes, asymmetrical expansions and contractions, different patterns at peaks and troughs, and so on. As Mitchell pointed out, trends and cycles are inseparable influence each other. Further, he observed "cyclical fluctuations are so closely interwoven with secular changes in economic life that important clues to the understanding of the former may be lost by mechanically eliminating the latter[2].

It is therefore clear that removing the trend impairs the integrity of the classical cycle of experience, although it may be consistent with a "deviation cycle of experience", if any. The deviation cycle has been used by the OECD, the British Central Statistical Office and others but it is often noted that trend removal is a relatively arbitrary process. Therefore the deviation cycles which could result from different detrending procedures could vary considerably in their character. As noted above, the OECD uses the phase average trend in its procedures. Although the composites created by this approach may be consistent with deviation cycles of various kinds, they are not consistent with the classical cycle. However, the relevance of the classical cycle has been reaffirmed by the U.S., the U.K., Canadian, Australian, German, and Japanese experiences of the 1990's.

This makes it logical to construct composite indexes that are consistent with both classical and growth cycles. This can be accomplished by combining series into composites without detrending the components, and then subsequently detrending the resulting composite indexes if necessary.

3. A New Approach.

Boschan and Banerji reviewed the various standardisation procedures and compared the advantages and disadvantages of each[3]. They sought to retain the advantages of the various alternatives and to surmount the disadvantages. Their paper stressed that the procedure of standardisation requires the resolution of two important issues, namely what is the appropriate procedure for calculating the standardisation factor and what is the appropriate treatment of the component series into which the standardisation factor is to be divided.

Let us review their treatment of the first of these issues. They reasoned that since the purpose of standardisation is to adjust for cyclical amplitudes, it is important that the trend and irregular movements

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[2] Burns and Mitchell, Measuring Business cycles, 1946, p. 270.

[3] Boschan, Charlotte and Anirvan Banerji, "A Re-assessment of Composite Indexes", in Klein, Philip A. (Ed.) Analysing Modern Business Cycles, Sharpe, Armonk, 1990, pp. 206-225.

not complicate the computation of the standardisation factor. They agreed that the OECD had adopted an appropriate solution to that. The OECD uses deviations from trend as the basis for estimating that factor. In addition, it uses the phase-average-trend method for computing trend which is good because it captures the trend through the cyclical average better than alternative approaches.

Boschan and Banerji also recommended that the problem of irregularity in the time series can be dealt with through some moving average procedure. In any case, they proposed that a smoothed detrended series be used for calculating the standardisation factor. Finally, they recommended that the standard deviation be used instead of an absolute average measure as the standardisation factor. They based this recommendation on some compelling reasons of tractability.

Summing up this point, they suggested that the standard deviation of the smoothed detrended series be used as the standardisation factor.

We turn now to the second of the main issues involving standardisation. This issue relates to the nature of the series to be standardised. This involves a number of considerations.

First, we must deal with the question of amplitude-stationarity[4]. The implicit assumption behind amplitude adjustment, effected by dividing each series by a single number, is that the cyclical amplitude of the series remains about the same over time. It is important not only that the series used to calculate the standardisation factor have amplitude-stationarity, but also that the series into which the standardisation factor is divided have the same characteristic. Every series to be standardised must be first examined individually and then transformed to achieve amplitude stationarity as is appropriate in the particular case. For example, this may be done by first taking logarithms of some of the time series to be standardised.

Second, we must address the question whether the component series is to be trend adjusted or smoothed in any way prior to the division by the standardisation factor. When the standardisation factors are derived from deviations from trend, the factors themselves are sensitive to the trend being used. However, if the series being standardised are also deviations from trend, the index becomes critically dependent on the nature of the artificial separation between trend and cycle.

To repeat, when computing the standardisation factor, it is necessary to compute the cyclical amplitude from smoothed, detrended series to eliminate the distortion resulting from trend and irregular movements. Nonetheless, there is no compelling reason to detrend the series to be standardised. The historical objections to the artificial separation of trend and cycle remain important, and the arbitrary shift in turning points caused by detrending suggest that it is inadvisable to detrend the series to be standardised.

There may, of course, be occasions when the growth cycle or deviation cycle analysis will prove beneficial to the business analyst, but in these cases the analysis can proceed by the simple elimination of the trend from the composite itself. In those cases, the lead/lag relationship among the components of the index is not distorted in the process of constructing the index.

Growth cycle and business cycle analysis are not substitutes for one another. They are complementary tools and their usefulness may change over time, across countries and across sectors of the economy within a country. Thus, it is desirable to construct composite indexes which can be used for either type of analysis by simply removing a trend when needed rather than forcing a choice between classical business cycle or growth cycle analysis.

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4 Stationary of cyclical amplitude can be achieved if the variance of the series about its trend line, measured separately for each cycle, remains invariant from cycle to cycle.

The suggestions above have been incorporated into a new procedure for constructing composite indexes that has recently been adopted by the Economic Cycle Research Institute (ECRI). The first objective of this procedure is to insure that each component included in the index is amplitude-stationary. This is done by taking the logarithms of indicators whose cyclical amplitudes are likely to be proportional to their levels. In the case of other indicators, like growth rates which are likely to have amplitude stationarity in the first place, the series are used directly. Each amplitude-stationary component is then divided by its standardisation factor, i.e. the standard deviation of the detrended stationary series. The standardised series are then weighted and added together to get the composite index. Lastly, this composite may be smoothed, trend and amplitude adjusted, and rebased to match a target series. If growth or deviation cycle analysis is desired, the deviations of the index from trend can be calculated or the growth rates of the index can be calculated.

4. Tests of Alternative Procedures for Constructing Composite Indexes.

To be sure, the worth of a technique cannot be judged in the abstract. The important question about any body of techniques in economics is simply whether it does or does not supply dependable answers to important questions. In the sections below, we seek to answer some of these questions.

A. Tests Using OECD Leading Indicators for Business Cycle Analysis.

Table 1 provides information about alternative approaches to the calculation of the OECD leading index for the United States. The table shows the leads of two OECD indexes within the context of the U.S. business cycle chronology from 1949 to 1991. The first of these indexes is an amplitude-adjusted index and the second is a trend restored index which is computed by multiplying the amplitude-adjusted series by the trend of a reference series (industrial production).

The amplitude adjusted index led U.S. business cycle peaks and troughs on average by 16 months and three months, respectively. Its average lead for all turning points was six months. It led every cyclical turn. The variability of the leads, however, was relatively high, particularly at peaks where the standard deviation of the leads was 10.7 months.

The OECD index after performing trend restoration also has a good record at U.S. business cycle turns. Its average lead at peaks, 13 months, was slightly less than the 16 month lead without trend restoration. However, the average lead of the trend restored index at all turns was the same as that for the amplitude-adjusted series. The standard deviation of the leads in the trend restored series was lower than that in the other OECD series. The composite led all business cycle turning points.

Table 1 also shows the lead/lag performance of the OECD leading indicator components when they are converted into a composite index using the Conference Board's methodology for the construction of composites. (The Conference Board method is the U.S. Department of Commerce method. The latter turned over responsibility for its business cycle indicators to the Conference Board in late 1995). The average lead of this index was 11 months at peaks and zero months at troughs. For all turning points, the lead was four months. This composite index led all of the peaks and 83 percent of the troughs. (It lagged the most recent trough in 1991 by 9 months).

The table also shows the performance at turning points of the OECD leading indicator components when they are used to construct indexes based on the ECRI method discussed earlier in this paper. The Economic Cycle Research Institute (ECRI) uses this approach in the construction of its composite indexes. The first of these indexes uses a multiplicative trend adjustment. This index had an average lead of 10 months at U.S. business cycle peaks and provides advance warning of two months at troughs. Its lead at all turns was six months and it preceded all business cycle turning points. The standard deviation of the leads was below that of the OECD amplitude-adjusted index but slightly higher than that of the trend restored series.

Lastly, a composite index was constructed using the ECRI approach but an additive trend adjustment was made instead of the multiplicative one. This index led by seven months at peaks, four months at troughs, and five months at peaks and troughs. It also led every cyclical turning point. The standard deviation of the leads was below that of any of the other methods.

The lead times calculated for the two indexes using the OECD procedures, however, do not take into account the delay in availability induced by the MCD smoothing of the component series. For most of the series, the MCD is three or four months and requires smoothing of the components using three or four month centred moving averages. In these cases, the moving average is centred one month before the end of the unsmoothed series. The effective lead of the index is about a month shorter than the leads mentioned earlier in the text.

B. Tests Using Conference Board Indicators for Business Cycle Analysis.

Table 2 shows the lead/lag record of the Conference Board's leading indicator components when they are used to develop composite indexes using the same five alternative approaches discussed above. Using the Conference Board's own methodology (formerly the Commerce Department's method), the average lead at cyclical peaks was 12 months, and at troughs three months. At peaks and troughs, the lead was 7 months. The composite led all of the turning points. The standard deviation of the leads was 6.1 months for all turns.

When the OECD amplitude-adjusted approach is used with the Conference Board components, the average leads at peaks, troughs, and peaks and troughs is the same as those derived by utilising the Conference Board methodology. This index also led all turning points and the standard deviation of the leads was about the same as that emerging from the Conference Board method.

When a OECD trend restored index was calculated using the Conference Board components, the results were, to put it delicately, not very good. Out of seventeen possible turning points, the computer program to select turning points came up with only four. Of these four, two were leads and two lags. We are currently examining this performance and we will comment on our findings at the October meeting.

We have also examined how the Conference Board leading indicators would have performed if the two ECRI methods were used to construct composite indexes. When the ECRI method is employed with a multiplicative trend adjustment, the index leads by 9 months at peaks, three months at troughs, and 6 months at peaks and troughs. It led all cyclical turns. Furthermore, at all turns, the standard deviation of its leads was below that of the other methodologies.

Finally, we employed the ECRI method with an additive trend adjustment instead of the multiplicative alternative. The leads in this composite were virtually the same as those derived from the index constructed using the multiplicative procedure.

C. *Tests Using OECD Indicators for Growth Cycle Analysis.*

The discussion above focused on the business cycle which is sometimes referred to as the "classical cycle." However, the OECD did not accord highest priority to the business cycle in its cyclical studies. The growth cycle approach was adopted by the OECD Secretariat at the outset[5]. The growth cycle is characterised by a period of fast growth interrupted by a period of slow growth. Table 3 shows the lead/lag record of the OECD leading indicators using OECD, Conference Board, and ECRI methodologies within the U.S. growth cycle chronology from 1966 to 1996.

The composite index constructed by using the OECD amplitude- adjusted method posted a four-month lead on average at U.S. growth cycle peaks, an eight-month lead at troughs, and a six month lead at all growth cycle turning points. It led 93 percent of the turning points. However, the standard deviation of the leads was high, i.e., seven months.

The composite index developed by restoring the trend to the amplitude adjusted index had slightly longer lead times. They were six months at growth cycle highs, eight months at lows, and seven months for all turns. This composite led all of the turning points. The standard deviation of its leads was only marginally lower than that of the alternative OECD approach.

When the Conference Board methodology was used to construct the composite index, the lead was one month at peaks, five months at troughs, and three months for all turns. This index led only 71 percent of all the turns and less than sixty percent of the cyclical highs. The standard deviation of the leads was roughly the same as those for the indexes constructed by using the two OECD methods.

The composite index developed by utilising the ECRI multiplicative trend method had a slightly smaller lead than those which emerged from the indexes developed from the OECD methods. The average lead at growth cycle peaks was two months, at troughs 8 months, and at peaks and troughs five months. It led all of the cyclical turning points. The standard deviation of the leads was much lower than those associated with the two OECD methods and the Conference Board procedure.

The ECRI approach which substitutes an additive trend adjustment for the multiplicative trend had a two month lead at peaks, seven months at troughs, and five months lead for all turns. It also led all turns and the standard deviation of the leads was low.

D. *Tests Using Conference Board Indicators for Growth Cycle Analysis.*

Table 4 discloses the lead/lag record of the Conference Board's leading indicators at U.S. growth cycle turning points using the alternative methodologies. The average leads at all turning points of the composites using the OECD's amplitude- adjusted and trend restored procedures were five and six months, respectively. The index constructed by including trend restoration led 95 percent of all turns whereas by excluding the trend the comparable statistic was 88 percent. The standard deviations of the leads for all turns for the two approaches were 7.1 and 7.5 months, respectively.

The Conference Board index constructed with the Conference Board methodology had a five month lead on average at all turns. It led 91 percent of the turning points. The standard deviation of its leads was also high.

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[5] Cf. OECD Leading Indicators and Business Cycles in Member Countries, Sources and Methods, No. 39, January 1987, p.20.

The composite index calculated by using the Conference Board leading indicators and the ECRI method with multiplicative trend adjustment had an average lead at all turning points of six months. It led 96 percent of the turning points. The variability of the leads was lower than that associated with the two OECD methods and the Conference Board approach. Its standard deviation was 6.1 months.

Finally, the composite index constructed from the Conference Board components with the ECRI approach which substitutes an additive trend adjustment for the multiplicative one had an average lead of five months at all turns. It led 100 percent of the turns. The standard deviation of its leads was 5.8 months. This was the lowest for the five approaches to the construction of this index. This approach also had the lowest standard deviation of the leads in the table relating to alternative procedures using the OECD components. The difference in the variability of the leads between the multiplicative adjustment and the additive adjustment, however, appear to be rather small.

E. Observations on Average Leads and Standard Deviations.

Charts 1 through 4 plot the effective lead of each of the five methods against the standard deviations of these leads. The one feature that stands out is the consistently lower standard deviations of the leads resulting from the use of the ECRI procedures.

F. Additional Observations on the PAT Method.

It should be noted that the preceding analysis is clearly biased in favour of the OECD procedure. This is because the OECD composite is based on deviations from the phase average trend (PAT) of the components of the index, with the PATs being reestimated every month. As users of the PAT procedure are well aware, the last several months of the trend are subject to significant revision, particularly when a new phase of a cycle is identified. Thus, assuming that we disregard any revisions in the underlying data for the purpose of this investigation, the OECD composite is still vulnerable to significant revisions every month stemming from revisions in the estimated trends in the components. Thus, a fair comparison of the OECD procedure with the Conference and ECRI procedures would require that the composites based on the OECD method be calculated in one-month increments. Given that we have well over 400 months of data, this would necessitate the calculation of the composite index close to 400 times, adding one month of data each time, and then re-estimating the PATs each time. Such an approach was impractical because of the enormous amount of work involved. The larger issue of ongoing trend revisions is one of the major problems with the OECD composite procedure, because it ensures that the apparent historical record of the OECD composite index is based on revised (and presumably improved) estimates of the trend, which may be quite different from its record in real time. If the real time record using the OECD composite method is indeed worse than the historical record we have been able to use, the ECRI method would be favoured even more than our analysis has implied.

5. Conclusions and Recommendations.

After examining the OECD and Conference Board construction methods, as well as a new method that combines the advantages of both, we recommend the new approach. This approach: (1) treats the series standardised so that amplitude-stationarity is ensured and the cycle of experience is preserved, (2) measures standardisation factors in a manner that the cyclical amplitude is undistorted by trend and irregular movements, and (3) enables the composite index to be used in the analysis of the business cycle of experience and growth cycles.

Our study disclosed that the leads of the U.S. leading indexes using OECD and Conference Board components and ECRI methods performed relatively well. In terms of effective lead times at business and growth cycle turning points, they were roughly as long as those associated with the OECD procedures and better than the Conference Board methods. In addition, the standard deviations of the leads were smaller than those associated with the other approaches.

To be sure, the results arrived at in this research on the U.S. indicators need to be confirmed by studies of other major countries. Should that occur, that would strengthen our recommendation for the adoption of the new approach suggested by Boschan and Banerji to the OECD for the construction of its composite indexes.

TABLE 1: Lead/Lag Record at U.S. Business Cycle Turning Points of OECD Leading Indicators, Using OECD, Conference board and ECRI Methods

Business Cycle Cronology		Lead (-) or Lag (+), in months									
		OECD				Conference Board		Economic Cycle Research Institute			
		Amplitude Adjusted		Trend Restored				Raw or Multi-plicatively Trend Adjusted		Additively Trend Adjusted	
Troughs	Peaks	T	P	T	P	T	P	T	P	T	P
	11/48		n.a.		n.a.		n.a.		n.a.		n.a.
10/49		n.a.		n.a.		n.a.		n.a.		n.a.	
	7/53		n.a.		n.a.		n.a.		n.a.		n.a.
5/54		n.a.		n.a.		n.a.		n.a.		n.a.	
	8/57		n.a.		n.a.		n.a.		n.a.		n.a.
4/58		n.a.		n.a.		n.a.		n.a.		n.a.	
	4/60		n.a.		n.a.		n.a.		n.a.		n.a.
2/61		-1		-1		-1		-2		-2	
	12/69		-12		-12		-10		-11		-11
11/70		-6		-6		-1		-1		-7	
	11/73		-10		-9		-4		-9		-9
3/75		-3		-3		-1		-3		-3	
	1/80		-16		-16		-15		ntc		ntc
7/80		-2		-2		-1		ntc		ntc	
	7/81		-9		-9		-7		-3		-3
11/82		-5		-5		-3		-3		-3	
	7/90		-35		-18		-18		-19		-4
3/91		-3		-3		+9		-2		-4	
Average Lead: T,P		-3	-16	-3	-13	0	-11	-2	-10	-4	-7
	T&P		-9		-8		-4		-6		-5
Percent Lead: T,P		100	100	100	100	83	100	100	100	100	100
	T&P		100		100		91		100		100
Median Lead: T,P		-3	-12	-3	-12	-1	-6	-2	-10	-3	-6
	T&P		-6		-6		-1		-3		-4
S. D. of Lead: T,P		1.9	10.7	1.9	4.1	4.3	5.7	0.8	6.6	1.9	3.8
	T&P		9.7		5.7		7.5		6.0		3.1

TABLE 2: Lead/Lag Record at U.S. Business Cycle Turns of Conference Board Leading Indicators, Using OECD, Conference Board and ECRI Methods

Business Cycle Cronology		Lead (-) or Lag (+), in months									
		OECD				Conference Board		Economic Cycle Research Institute			
		Amplitude Adjusted		Trend Restored				Raw or Multi-plicatively Trend Adjusted		Additively Trend Adjusted	
Troughs	Peaks	T	P	T	P	T	P	T	P	T	P
	11/48		n.a.		n.a		n.a		-5		-5
10/49		-5		ntc		-4		-4		-4	
	7/53		-10		ntc		-5		-6		-6
5/54		-5		ntc		-4		-5		-5	
	8/57		-21		ntc		-20		-21		-21
4/58		-3		ntc		-2		-2		-2	
	4/60		-12		ntc		-11		-11		-13
2/61		-2		ntc		-2		-3		-3	
	12/69		-11		ntc		-11		-11		-11
11/70		-1		ntc		-1		-1		-1	
	11/73		-9		4		-9		-9		-9
3/75		-1		-2		-1		-1		-1	
	1/80		-11		10		-15		-15		-15
7/80		-2		ntc		-2		-2		-2	
	7/81		-7		ntc		-8		-3		-3
11/82		-4		-11		-10		-3		-3	
	7/90		-18		ntc		-18		-1		-1
3/91		-3		ntc		-2		-4		-4	
Average Lead: T,P		-3	-12	-6	7	-3	-12	-3	-9	-3	-9
	T&P		-7		0		-7		-6		-6
Percent Lead: T,P		100	100	100	0	100	100	100	100	100	100
	T&P		100		50		100		100		100
Median Lead: T,P		-3	-11	-6	7	-2	-11	-3	-9	-3	-9
	T&P		-5		1		-5		-4		-4
S. D. of Lead: T,P		1.5	4.9	6.3	4.2	2.8	5.1	1.4	6.3	1.4	6.4
	T&P		5.9		8.9		6.1		5.4		5.6

TABLE 3: Lead/Lag Reacord at U.S. Growth Cycle Turns of OECD Leading Indicators, Using OECD, Conference Board and ECRI Methods

Growth Cycle Cronology		Lead (-) or Lag (+), in months									
		OECD				Conference Board		Economic Cycle Research Institute			
		Amplitude Adjusted		Trend Restored				Raw or Multi-plicatively Trend Adjusted		Additively Trend Adjusted	
Troughs	Peaks	T	P	T	P	T	P	T	P	T	P
	7/48		n.a.		n.a.		n.a.		n.a.		n.a.
10/49		n.a.		n.a.		n.a.		n.a.		n.a.	
	3/51		n.a.		n.a.		n.a.		n.a.		n.a.
7/52		n.a.		n.a.		n.a.		n.a.		n.a.	
	3/53		n.a.		n.a.		n.a.		n.a.		n.a.
8/54		n.a.		n.a.		n.a.		n.a.		n.a.	
	2/57		n.a.		n.a.		n.a.		n.a.		n.a.
4/58		n.a.		n.a.		n.a.		n.a.		n.a.	
	2/60		n.a.		n.a.		n.a.		n.a.		n.a.
2/61		-1		-1		-1		-2		-2	
	5/62		ntc		ntc		ntc		ntc		ntc
10/64		ntc		ntc		ntc		ntc		ntc	
	6/66		-7		-3		-3		-3		-3
10/67		-11		-11		-6		-12		-12	
	3/69		-3		-3		-1		-2		-2
11/70		-1		-6		-1		-11		-1	
	3/73		-2		-2		4		-1		-1
3/75		-3		-3		-1		-3		-3	
	12/78		4		-3		-2		-2		-2
12/82		-6		-6		-4		-4		-4	
	6/84		-9		-4		0		-4		-4
1/87		-26		-26		-25		-16		-16	
	3/89		-2		-17		-2		-3		-3
12/91		-12		-12		0		-11		-11	
	12/94		-8		-8		0		-1		-1
1/96		-3		-3		n.a.		n.a.		n.a.	
Average Lead: T,P		-8	-4	-8	-6	-5	-1	-8	-2	-7	-2
	T&P		-6		-7		-3		-5		-5
Percent Lead: T,P		100	86	100	100	85	57	100	100	100	100
	T&P		93		100		71		100		100
Median Lead: T,P		-6	-3	-6	-3	-1	0	-11	-2	-4	-2
	T&P		-4.5		-4		-1		-3		-3
S. D. of Lead: T,P		8.5	4.5	8.1	5.3	8.8	2.2	5.4	1.1	5.9	1.1
	T&P		7.0		6.8		6.7		4.9		4.7

TABLE 4: Lead/Lag Record at U.S. Growth Cycle Turns of Conference Board Leading Indicators, Using OECD, Conference Board and ECRI Methods

Growth Cycle Cronology		Lead (-) or Lag (+), in months									
		OECD				Conference Board		Economic Cycle Research Institute			
		Amplitude Adjusted		Trend Restored				Raw or Multi-plicatively Trend Adjusted		Additively Trend Adjusted	
Troughs	Peaks	T	P	T	P	T	P	T	P	T	P
	7/48		-13		-1		n.a.		cb		n.a.
10/49		-5		-8		-4		-4		-4	
	3/51		-1		-1		-7		-2		-2
7/52		-3		ntc		ntc		-2		-2	
	3/53		-2		ntc		ntc		-2		-2
8/54		-8		-9		-7		-5		-5	
	2/57		-16		-22		-19		-15		-15
4/58		-3		-3		-2		-2		-2	
	2/60		-10		-10		-11		-11		-11
2/61		-2		-3		-2		-2		-2	
	5/62		-3		-2		-3		-3		-3
10/64		-25		-19		-26		-24		-24	
	6/66		-4		-3		-3		-3		-3
10/67		-9		-8		-7		-6		-6	
	3/69		-2		-13		-2		-2		-2
11/70		-1		-8		-1		-1		-1	
	3/73		-1		-12		-1		-1		-1
3/75		-1		-1		-1		-1		-1	
	12/78		2		-2		-2		-2		-2
12/82		-5		-7		-4		-4		-4	
	6/84		-5		-2		-5		-5		-5
1/87		-21		-3		+12		-14		-14	
	3/89		+9		+15		-14		-14		-2
12/91		-12		-12		-11		-13		-11	
	12/94		0		0		0		+1		n.a.
1/96		-1		n.a.		n.a.		n.a.		n.a.	
Average Lead: T,P		-7	-4	-7	-5	-5	-6	-6	-5	-6	-4
	T&P		-5		-6		-5		-6		-4
Percent Lead: T,P		100	76	100	91	91	91	100	92	100	100
	T&P		88		95		91		96		100
Median Lead: T,P		-5	-2	-8	-2	-4	-4	-3	-2	-4	-2
	T&P		-3		-3		-3		-3		-3
S. D. of Lead: T,P		7.7	6.5	5.1	9.4	9.1	6.1	7.0	5.3	6.8	4.5
	T&P		7.1		7.5		7.6		6.1		5.8

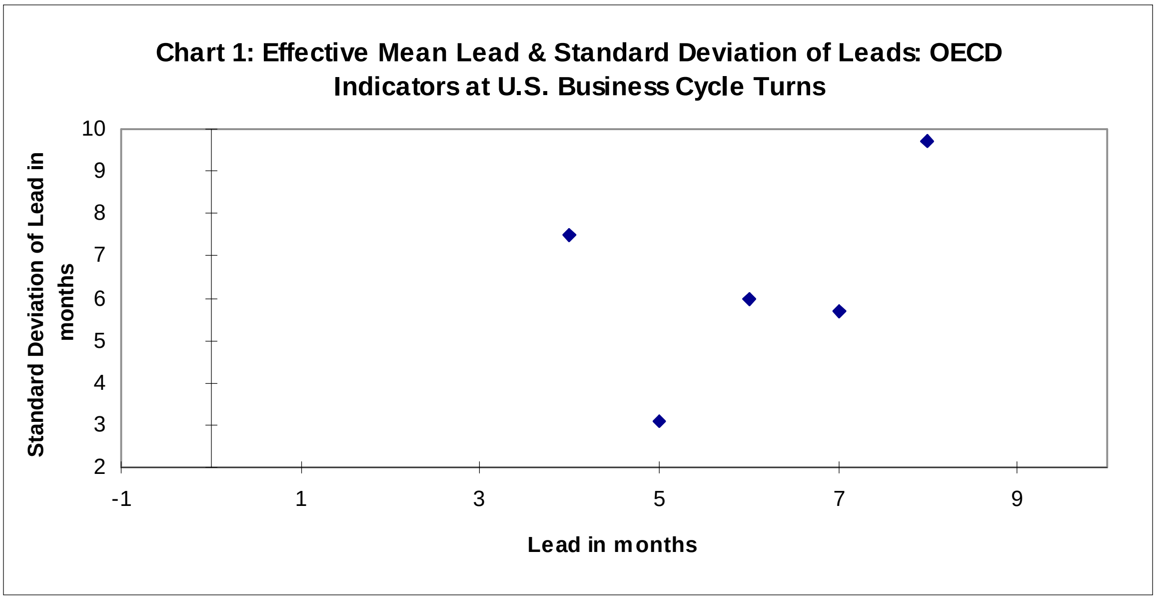
Chart 1: Effective Mean Lead & Standard Deviation of Leads: OECD Indicators at U.S. Business Cycle Turns
Standard Deviation of Lead in months
10
9
8
7
6
5
4
3
2
-1
1
3
5
7
9
Lead in months

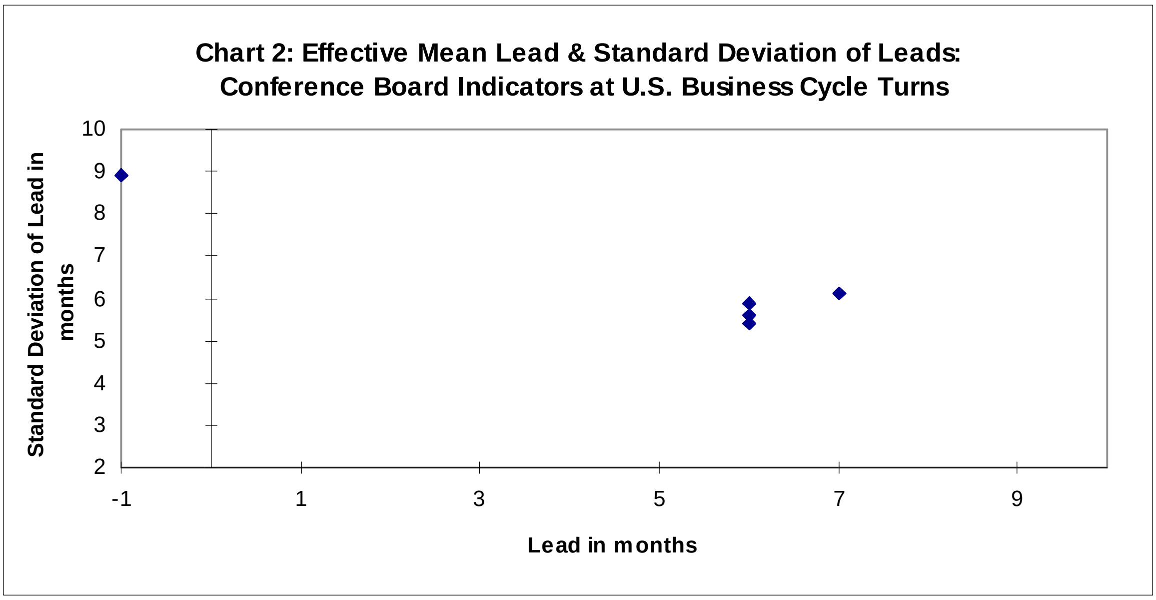
Chart 2: Effective Mean Lead & Standard Deviation of Leads: Conference Board Indicators at U.S. Business Cycle Turns
Standard Deviation of Lead in months
10
9
8
7
6
5
4
3
2
-1
1
3
5
7
9
Lead in months

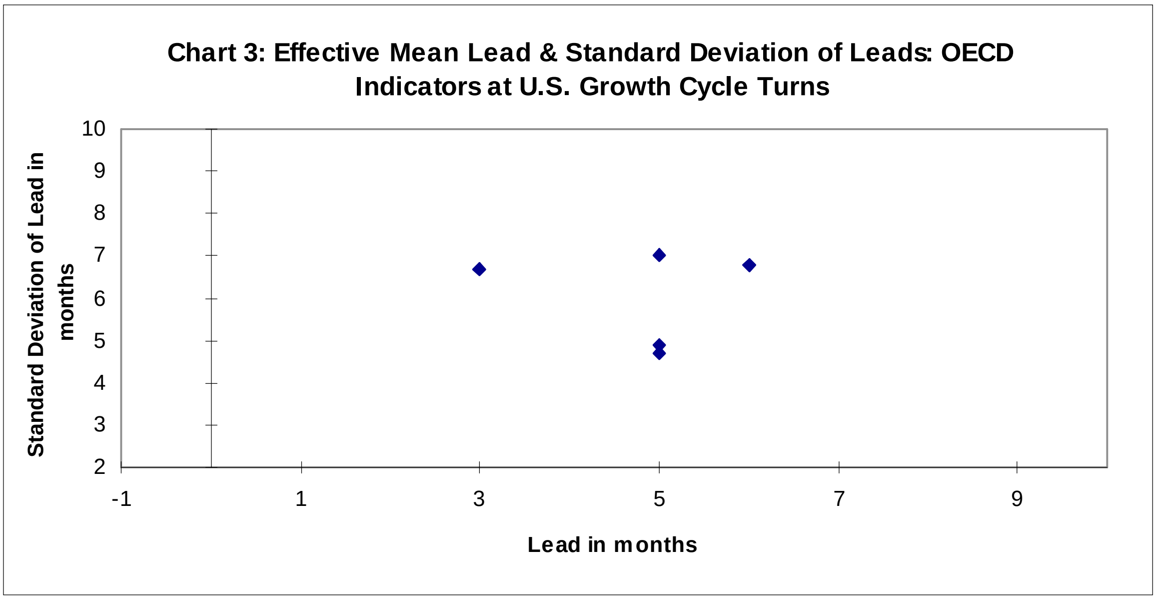
Chart 3: Effective Mean Lead & Standard Deviation of Leads: OECD Indicators at U.S. Growth Cycle Turns
Standard Deviation of Lead in months
Lead in months
10
9
8
7
6
5
4
3
2
-1
1
3
5
7
9

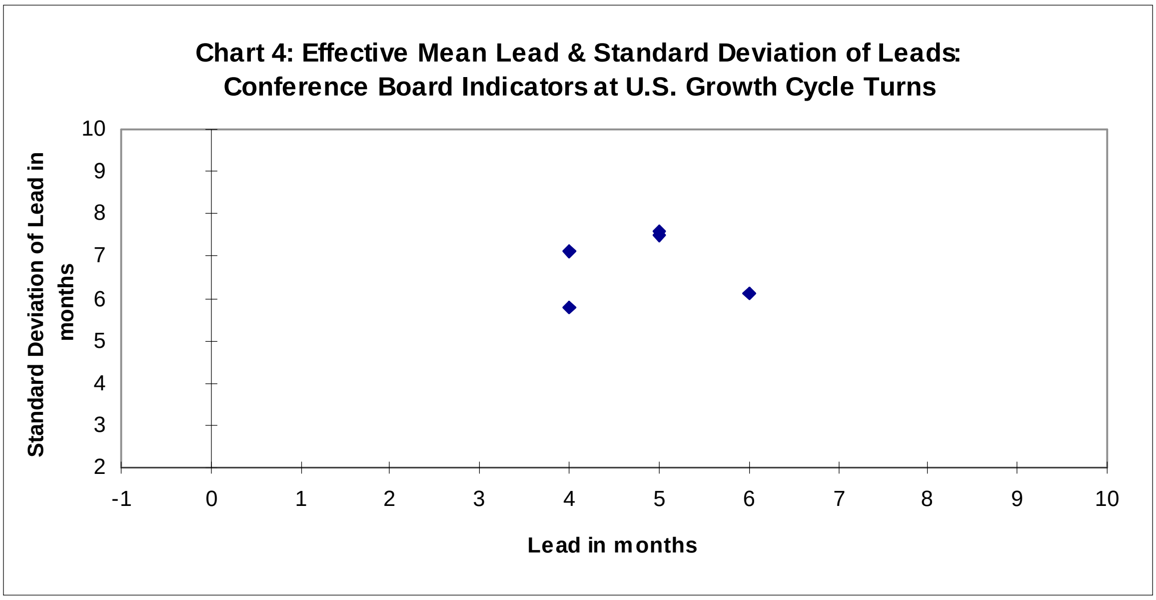
Chart 4: Effective Mean Lead & Standard Deviation of Leads: Conference Board Indicators at U.S. Growth Cycle Turns
Standard Deviation of Lead in months
Lead in months
10
9
8
7
6
5
4
3
2
-1
0
1
2
3
4
5
6
7
8
9
10