Volume Title: Monitoring Growth Cycles in Market-Oriented Countries: Developing and Using International Economic Indicators

Volume Author/Editor: Klein, Philip A. and Geoffrey H. Moore

Volume Publisher: Ballinger

Volume ISBN: 0-887-30041-3

Volume URL: http://www.nber.org/books/klei85-1

Publication Date: 1985

Chapter Title: Summary Measures of Leading, Coincident, and Lagging Indicators in Ten Countries

Chapter Author: Philip A. Klein, Geoffrey H. Moore

Chapter URL: http://www.nber.org/chapters/c4166

Chapter pages in book: (p. 71 - 105)

Chapter 3

SUMMARY MEASURES OF LEADING, COINCIDENT, AND LAGGING INDICATORS IN TEN COUNTRIES

COMPOSITE INDEXES

By utilizing composite indexes of economic indicators it is possible to observe how rough equivalents to U.S. indicators behave with respect to growth cycle turning points in other countries. Figure 3-1 enlarges the picture presented in Figure 2-4 by including the composite leading index and the composite lagging index for each of the ten countries under study. One further addition is the lagging index on an inverted basis, which we have found usually precedes the leading index. These composite indicators are also related to the national growth cycle chronologies shown in Table 2-2.[1] Each index displays clearly defined cycles, testifying to the pervasiveness and persistence of short-run fluctuations around national growth trends. (See pp. 73-77.)

Figure 3-1 can best be understood in connection with Table 3-1, which summarizes the timing comparisons shown in the figure. The first point to be noted is that the composite indexes confirm that the United States continues to have more business cycles than other countries. Thus, since World War II the United States has exhibited more peaks and troughs than any other country, including Canada, whose economic patterns customarily are most like those of the United States.[2] For much of the 1970s, growth cycles were roughly synchronous in most of the countries under review. This is especially true during the 1973-75 period when a conventional classical recession was experienced in all these economies. Only toward the end

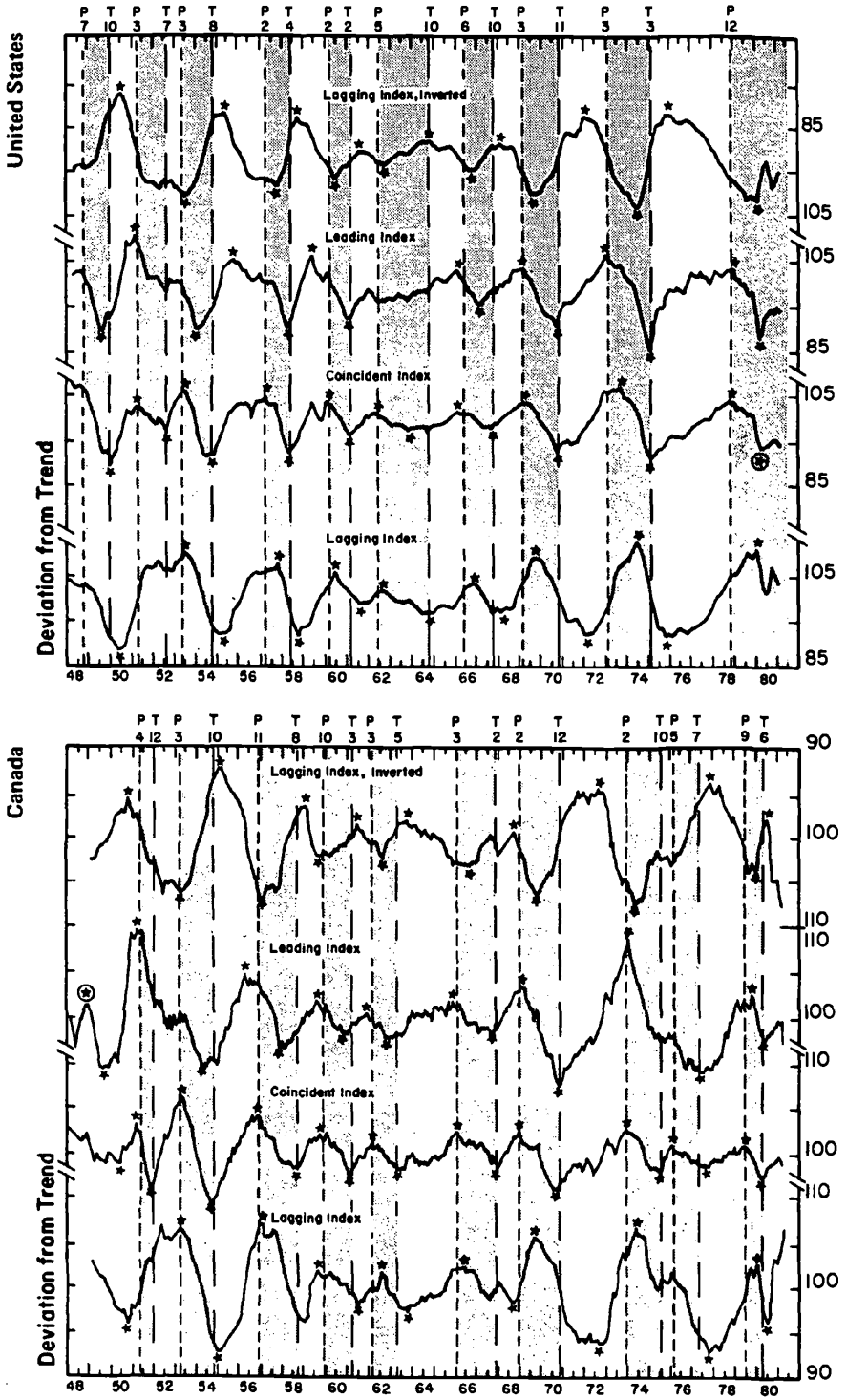
of the decade did the United States tend to diverge significantly from this pattern. By the 1980s a continuation of this historical tendency toward synchronism seemed a reasonable, if yet to be tested, assumption.

Overall, the behavior of the composite indexes confirms that the U.S. classification of indicators for classical turning points is appropriate for growth cycle turning points in the United States and in the other nine countries as well. It is, of course, not surprising that the roughly coincident indexes, with few exceptions, exhibit median lead-lag measures of zero months at the peaks and troughs, because these indicators figure so prominently in the selection of growth cycle chronologies in the first place. Far more impressive is the discovery that the timing relationship within each country, among the three composite indexes, is almost invariably what one would expect from the timing classification itself. That classification was based solely on U.S. information. There is also considerable similarity in the length of the median leads or lags, most of them falling within a range of four to six months. In every country a turn in the growth cycle is typically spread over a considerable range of months—usually from eight to thirteen or fourteen months, counting from the turn in the leading index to the subsequent turn in the lagging index. For all ten countries the interval between the average of the medians for the leading and lagging indexes is ten months.

None of the leading composite indexes fails to show median leads. Among the roughly coincident indexes, only in Belgium does the median differ from zero. The lagging indexes turn in a perfect record—median lags in every instance. Moreover, on an inverted basis the median leads in the lagging indexes always exceed those in the leading indexes.

In most of the countries the indexes exhibit few extra or skipped cycles. (See Table 3-2.) In Canada the computer discerned an extra cycle in the lagging index during the 1952-53 period. In the United Kingdom there may be an extra cycle in all three indexes before the reference dates begin (in the late 1940s), but this may simply reflect a paucity of data and an inability to start the reference chronology earlier. An extra cycle in the Japanese leading index in the early 1960s—as well as an extra cycle in the Japanese lagging index in 1968-69—is reflected in a rather high plateau in the leading index (1966-68) but does not show up in the coincident index. There is an extra cycle in the roughly coincident index for West Germany in 1972-73. Our judgmental review eliminated an extra cycle in the West German leading index (1973-74) and in the lagging index (1968-69).

Figure 3-1. Composite Indexes for Ten Countries.



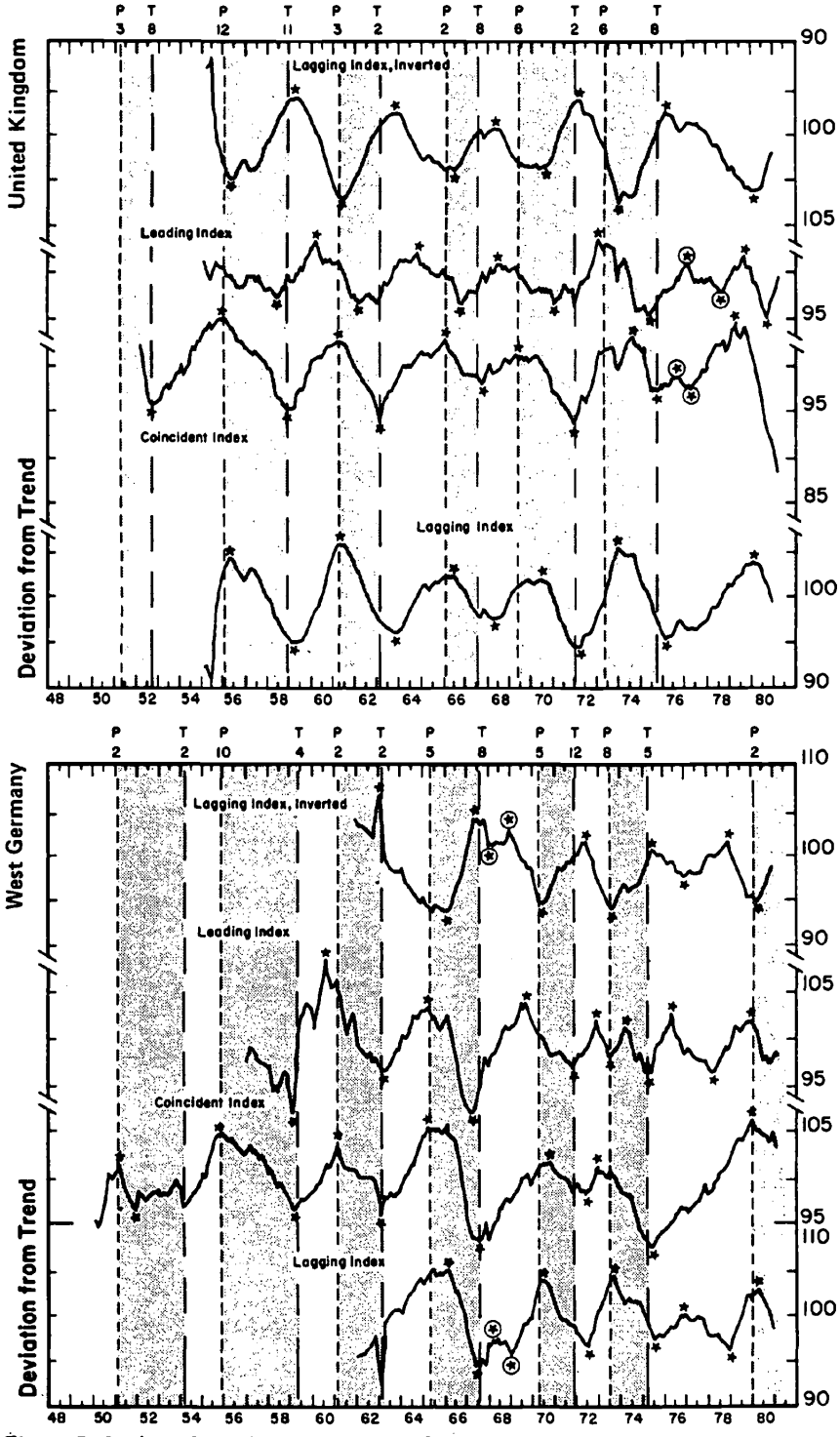


Figure 3-1. *(continued)*

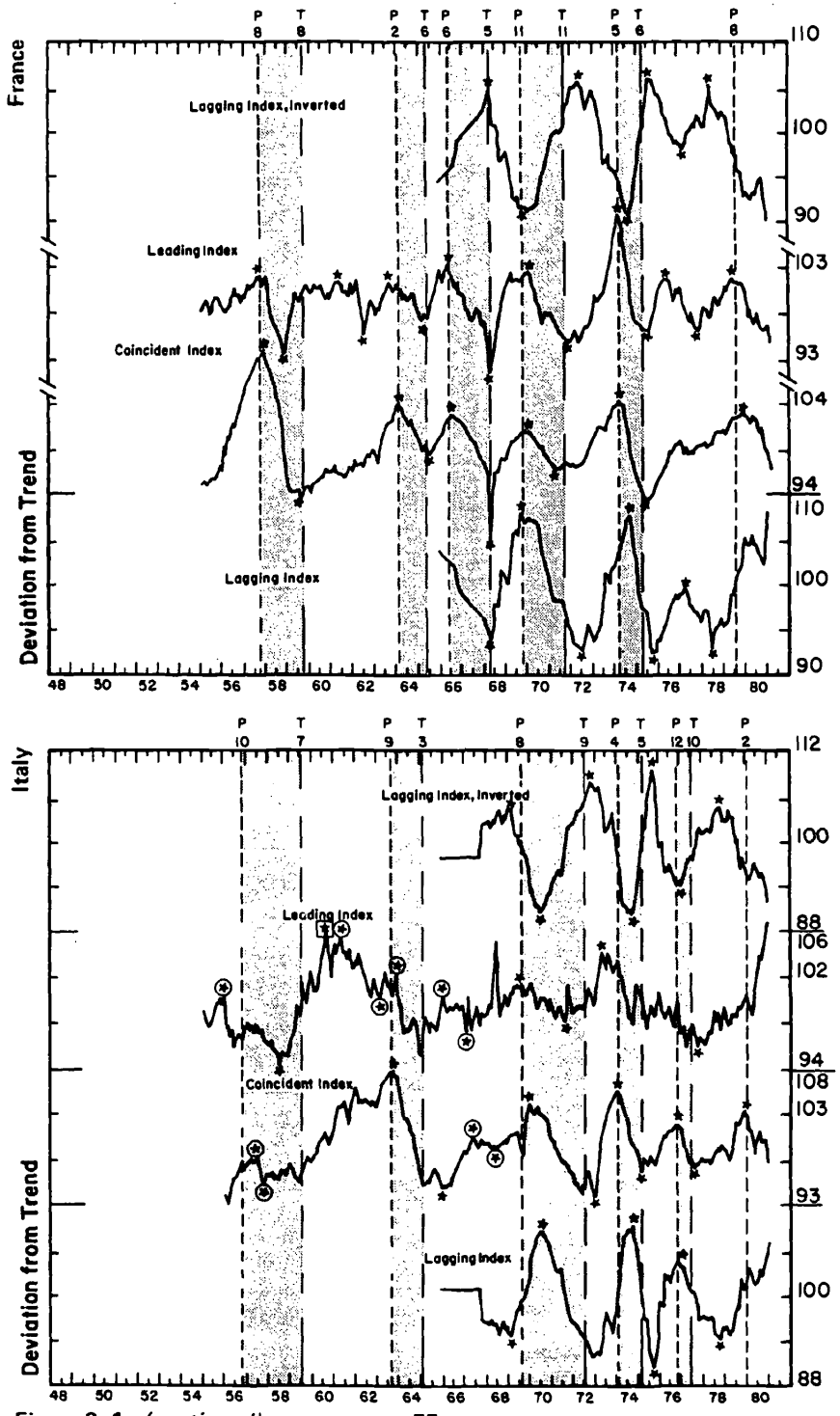


Figure 3-1. *(continued)*

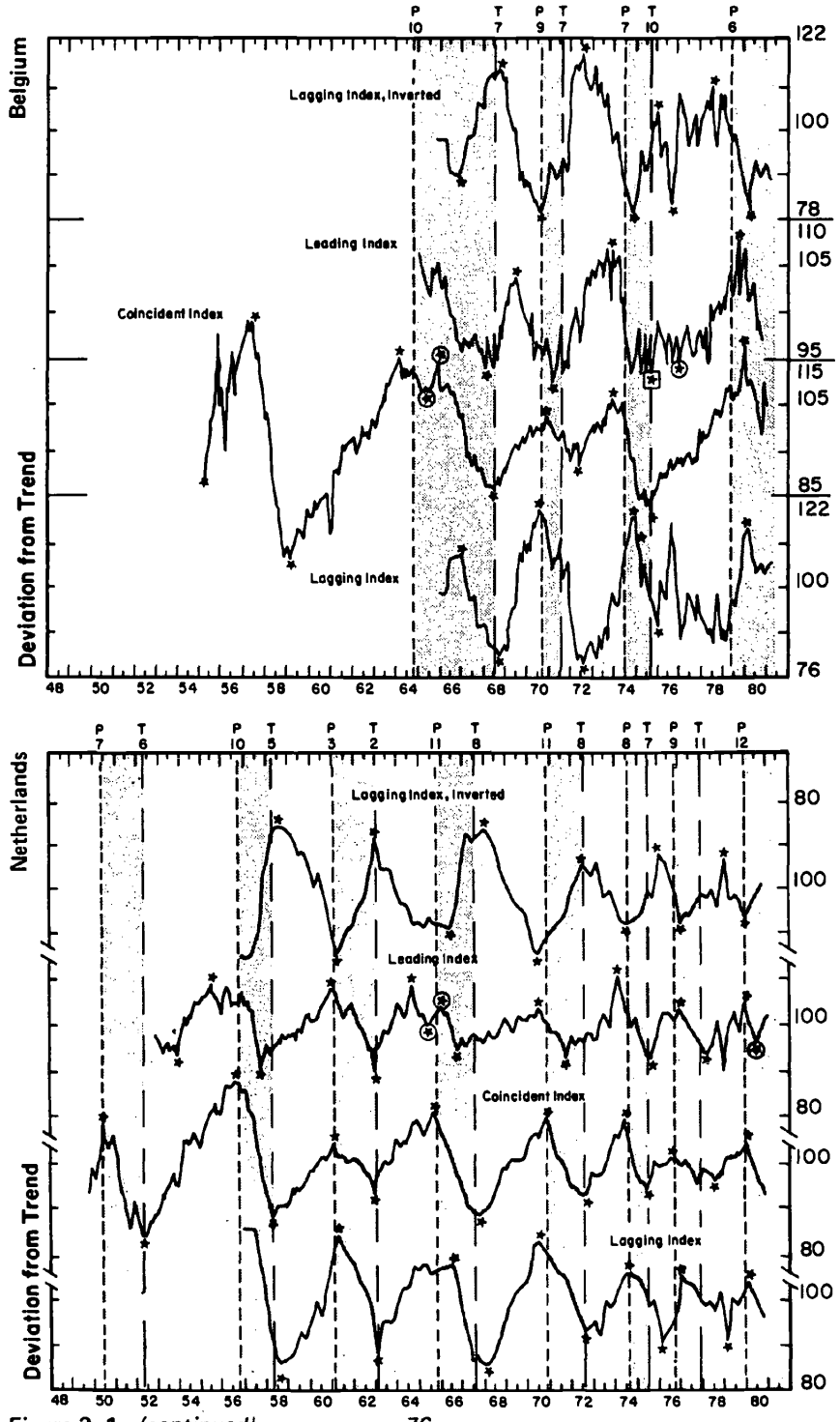


Figure 3-1. *(continued)*

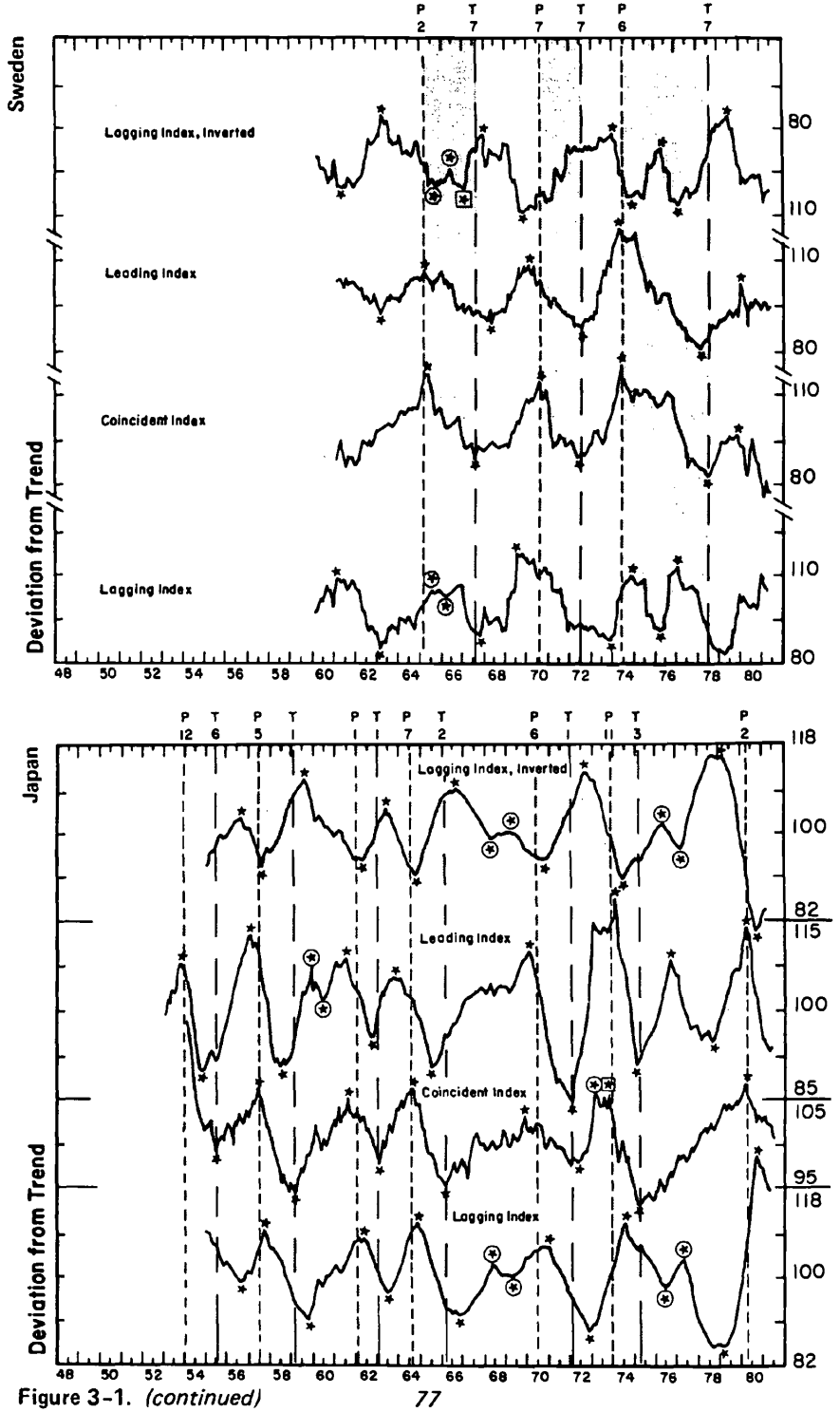


Figure 3-1. *(continued)*

Table 3-1. Median Lead or Lag of Composite Indexes at Growth Cycle Peaks and Troughs, Ten Market-Oriented Economies, 1948-81.

SECTION A

Country	*Number of Timing Comparisons*	*Median Lead (-) or Lag (+), in Months, at*		
	P & T	P	T	P & T
Lagging Indexes, Inverted				
United States	17	-15	-11	-12
Canada	20	-15	-16	-15
United Kingdom	11	-24	-19	-22
West Germany	6	-12	-18	-18
France	5	-18	-14	-18
Italy	7	-14	-7	-13
Belgium	5	-26	-14	-20
Netherlands	11	-13	-11	-12
Sweden	6	-18	-24	-22
Japan	11	-14	-14	-14
Mean Timing, Ten Countries	—	-14	-15	-17
Leading Indexes				
United States	18	-2	-2	-2
Canada	20	-2	-4	-2
United Kingdom	10	-10	-9	-10
West Germany	10	-7	-2	-5
France	11	-3	-4	-4
Italy	10	-9	-6	-9
Belgium	7	-2	-2	-2
Netherlands	14	-2	-1	-1
Sweden	6	-3	0	-2
Japan	13	-4	-4	-4
Mean Timing, Ten Countries	—	-4	-3	-4

Roughly Coincident Indexes				
United States	18	0	0	0
Canada	20	0	0	0
United Kingdom	12	0	0	0
West Germany	13	0	0	0
France	11	0	0	0
Italy	9	0	+3	0
Belgium	7	-2	-1	-1
Netherlands	15	0	0	0
Sweden	6	0	-1	0
Japan	12	0	0	0
Mean Timing, Ten Countries	—	0	0	0
Lagging Indexes				
United States	18	+6	+6	+6
Canada	20	+5	+4	+4
United Kingdom	11	+6	+8	+8
West Germany	7	+3	+4	+3
France	5	+5	+6	+6
Italy	8	+8	+10	+8
Belgium	6	+6	+10	+10
Netherlands	12	+3	+8	+6
Sweden	6	+1	+10	+8
Japan	12	+4	+8	+6
Mean Timing, Ten Countries	—	+5	+7	+7

(*Table 3-1. continued overleaf*)

Table 3-1. continued

SECTION B Median Lead (-) or Lag (+), in Months

		Lagging Index, Inverted			*Leading Index*			*Roughly Coincident Index*			*Lagging Indexes*		
		P	T	P & T	P	T	P & T	P	T	P & T	P	T	P & T
United States	P	-15			-2			0			+6		
	T		-11			-2			0			+5	
	P & T			-12			-2			0			+5
Canada	P	-15			-2			0			+5		
	T		-16			-3			0			+4	
	P & T			-15			-2			0			+4
United Kingdom	P	-24			-10			0			+6		
	T		-19			-9			0			+8	
	P & T			-22			-10			0			+8
West Germany	P	-12			-7			0			+3		
	T		-18			-2			0			+4	
	P & T			-15			-5			0			+3
France	P	-18			-3			0			+5		
	T		-14			-4			0			+6	
	P & T			-18			-4			0			+6
Italy	P	-13			-9			0			+8		
	T		-7			-6			+3			+10	
	P & T			-13			-9			0			+8
Belgium	P	-26			-2			-2			+6		
	T		-14			-2			-1			+10	
	P & T			-20			-2			-1			+8
Netherlands	P	-13			-2			0			+3		
	T		-11			-1			0			+8	
	P & T			-12			-1			0			+6
Sweden	P	-18			-3			0			+1		
	T		-24			0			-1			+10	
	P & T			-22			-2			0			+10
Japan	P	-16			-4			0			+5		
	T		-14			-4			0			+6	
	P & T			-15			-4			0			+6

Table 3-2. Extra and Skipped Growth Cycles in the Composite Indexes.

	Leading		*Coincident*		*Lagging*	
	Extra	*Skipped*	*Extra*	*Skipped*	*Extra*	*Skipped*
United States		2				1
Canada		2				1
United Kingdom						
West Germany	2				1	
France	2				1	
Italy		1		1		
Belgium					1	
Netherlands						
Sweden					1	
Japan	1					
Ten Countries	5	5	0	1	4	2

Source: Figure 3-1.

An extra cycle in both the leading and coincident indexes for France showed amplitudes too small to survive our review. This situation provided the basis for eliminating two otherwise extra cycles in the leading index for the Netherlands, and an extra cycle in both the leading and the coincident indexes for Italy. Since these were the only cases of extra cycles, we may say that, after review of the computer-selected turns, no extra cycles existed among the composite indexes for any country except in the German coincident index. One is tempted to conclude that the U.S.-derived indicators on the basis of the summary examination undertaken with this evidence, have behaved somewhat better in a number of foreign countries than in the country where they were developed, at least in recent years!

According to our data, the usual sequence in the growth cycle consists of a turn in the inverted laggers, followed by a turn in the leading index, then in the coincident index, and then the lagging index, which starts another round. Section B of Table 3-1 enables one to see the sequence more clearly. This way of organizing the data reveals the strong tendency for indexes to turn in the order expected at peaks and at troughs. The only exceptions to this expected order involve the Belgian and Swedish leading and coincident indexes at peaks. Hence, in fifty-two out of the fifty-four sequences (six for each of the nine countries) the turns in the composite indexes occurred in the order experienced at U.S. classical turns—a 96 percent success record. The details of the performance, considered in

Table 3-3. Summary of Sequence of Turns in Composite Indexes at Growth Cycle Turns in Ten Countries.

	Inverted Lagging Index to Leading Index			*Leading Index to Coincident Index*			*Coincident Index to Lagging Index*			*Total*		
	P	T	P & T	P	T	P & T	P	T	P & T	P	T	P & T
United States	100[a]	89	94	90	89	90	100	89	95	97	89	93
Canada	100	100	100	80	80	80	89	78	83	89	86	87
United Kingdom	83	100	92	71	100	85	100	100	100	85	100	92
West Germany	100	100	100	67	80	73	100	100	100	85	92	88
France	100	100	100	100	80	91	100	100	100	100	90	95
Italy	67	100	83	83	100	91	67	100	83	75	100	87
Belgium	100	100	100	75	67	71	100	100	100	90	88	89
Netherlands	100	100	100	50	57	53	71	100	85	71	84	78
Sweden	100	100	100	100	67	83	67	100	83	88	89	88
Japan	100	80	91	86	100	92	83	100	92	90	82	92

Note:

a. In the table 100 means that in all the possible comparisons the inverted lagging index turned before the leading index, excluding cases where both indexes turned in the same month. Fifty would mean that the indexes turned in the expected order half the time. As the text makes clear, the inverted lagging index is expected to turn first, the leading index next, the coincident index third, and the lagging index last. The higher the percentages for a given country the more consistently its indicator system conforms to the expected behavior.

Source: Appendix 3B.

the next section of this chapter, will reveal a number of discrepancies among individual indicators. But the overall pattern of sequential behavior outside the United States (summarized in Table 3-3) is certainly in line with what U.S. experience with the indicators underlying these composites at classical cycles has led us to expect.

Turning again to the evidence in Figure 3-1, three additions to U.S. classical cycle history are revealed in growth cycle analysis—the slowdowns of 1950-51, 1962-64, and 1966-67. Though smaller in terms of amplitude, these slowdowns are clearly reflected in the behavior of the coincident index. Most, though not all, of the reference turns for the United States are confirmed by the appearance of related turns in the composite indexes of the leaders and laggers. There are two skipped cycles in the leading index (1952-53 and 1962-64) and one in the lagging index (1951-52). The skipped cycles are visible but much smaller than the rest. In the other countries there are a few extra or skipped cycles in the leading or lagging indexes (as well as one skipped cycle in the coincident index for France), but for the most part one-to-one correspondence is the rule. The evidence on skipped and extra cycles in the composite index has been summarized in Table 3-2.

The high degree of conformity between the growth cycle chronologies and the behavior of the composite indexes in the countries under study speaks well for the indicator method as adapted to growth cycle measurement and for the objective criteria used for dating turning points. The judgmental screening to which the computer-selected turns were subjected did not affect many of the choices. The results also speak well for the consistent overall behavior of the economic activities embodied in the indicators included in the composite indexes and for the similarity in the timing behavior of each type of indicator. In order to carry the analysis further, however, it is necessary to look at the individual indicators in each timing classification.

MEDIAN TIMING OF INDICATORS

We shall now examine the international record of the twelve leading indicators, six roughly coincident indicators, and six lagging indicators included in the 1966 U.S. list of "most reliable indicators." The median behavior is summarized in Table 3-4. Is the median timing pattern in the nine foreign countries in our study similar to that found in the United States?

Based on Table 3-4 we find that among the leading indicators at peaks the medians fail to lead in nineteen out of seventy-four in-

Table 3-4. Lengths of Median Lead or Lag of Individual Indicators at Growth Cycle Peaks for Ten Countries.

Indicators: U.S. Classification and U.S. Titles[a]	*United States*	*Canada*	*United Kingdom*	*West Germany*	*France*
	Lead (-) or Lag (+), in Months				
Leading Indicators					
Average workweek, mfg.	-3	-3	0	-8	-4
New unemployment claims[c]	-1	-1	n.a.	+2	n.a.
New orders, consumer goods[d]	-2	-2	n.a.	n.a.	-11
Formation of bus. enterprises	-11	n.a.	-8	-8	n.a.
Contracts & orders, plant & equipment[d]	+1	+3	-3	-6	n.a.
Building permits, housing	-6	-3	-11	-16	-9
Change in bus. inventories[d]	0	0	-4	-4	n.a.
Industrial materials prices	-1	+2	+5	n.a.	+1
Stock price index	-4	-3	-5	-6	-3
Profits[d]	-4	-5	-4	-8	n.a.
Ratio, price to labor cost	-8	+1	-14	-9	-4
Change in consumer debt[d]	-6	-2	-16	-21	n.a.
Median or Total	-4	-2	-4	-8	-4
Coincident Indicators					
Nonfarm employment	+1	+2	+2	+3	+6
Unemployment rate[c]	0	+1	+2	+3	0
Gross national product[d]	0	0	-13	0	-1
Industrial production	+3	0	0	0	0
Personal income[d]	-1	+1	-4	-6	n.a.
Mfg. & trade sales[d]	-1	-2	-3	-3	-2
Median or Total	0	0	-2	0	0
Lagging Indicators					
Long-duration unemployment[c]	+6	+1	+6	n.a.	n.a.
Plant & equipment investment[d]	+5	+4	+5	-2	n.a.
Business inventories[d]	+6	+9	+10	+15	+8
Productivity change, nonfarm[c]	+11	+15	+8	+11	n.a.
Business loans outstanding[d]	+6	+3	+4	n.a.	n.a.
Interest rates, bus. loans	+7	+5	+5	+2	+6
Median or Total	+6	+4	+6	+6	+7

Notes:

a. The series available for each country are sometimes only roughly equivalent in content to the U.S. series. In some cases two series are used to match the U.S. series and the median includes all observations for both series. The periods covered vary for each indicator and each country, but all are within the years 1948-1981.

b. Matching means that for leading indicators the median is a lead, for lagging indicators the median is a lag, and for coincident indicators the median is a lead or lag of three months or less.

Table 3-4. continued

Italy	*Belgium*	*Netherlands*	*Sweden*	*Japan*	*All Countries*	*Number of Countries in Which*	
						Median Matches U.S.[b]	*Median Does Not Match U.S.*[b]
	Lead (-) or Lag (+), in Months (continued)						
0	-4	-1	0	-4	-3	6	3
n.a.	n.a.	n.a.	+4	n.a.	0	1	2
-8	+1	-5	-4	n.a.	-4	5	1
-4	0	-11	n.a.	-10	-8	5	1
n.a.	-4	-3	n.a.	-5	-4	5	1
-2	-7	-1	n.a.	-12	-6	7	1
n.a.	n.a.	+2	n.a.	-1	0	3	2
n.a.	-11	-4	+1	0	0	2	5
-6	n.a.	-13	-14	-8	-6	8	0
n.a.	n.a.	n.a.	n.a.	-10	-5	4	0
n.a.	n.a.	-2	+7	-2	-2	5	2
n.a.	n.a.	n.a.	+8	-9	-7	4	1
-4	-4	-3	+1	-5	-4	55	19
+6	n.a.	+4	+5	+2	+3	4	4
+1	-1	0	0	0	0	9	0
+1	0	n.a.	0	-5	0	6	2
0	-4	-2	0	0	0	8	1
n.a.	n.a.	n.a.	0	-9	-2	2	3
-1	-17	0	+3	-8	-2	7	2
+1	-2	0	0	-2	0	36	12
n.a.	n.a.	+5	+4	n.a.	+5	4	0
n.a.	n.a.	+2	n.a.	0	+3	3	2
+6	+15	+6	n.a.	+4	+8	8	0
n.a.	n.a.	n.a.	-3	+8	+9	4	1
n.a.	n.a.	n.a.	0	-6	+3	2	2
+3	+5	n.a.	+7	+7	+5	8	0
+4	+10	+5	+2	+4	+5	29	5

c. Inverted.
d. In constant prices.
Source: Appendix Tables 5-1 to 5-10.

Table 3-4. continued. Lengths of Median Lead or Lag of Individual Indicators at Growth Cycle Troughs for Ten Countries.

Indicators: U.S. Classification and U.S. Titles[a]	*United States*	*Canada*	*United Kingdom*	*West Germany*	*France*
		Lead (-) or Lag (+), in Months			
Leading Indicators					
Average workweek, mfg.	-2	-5	-2	-1	-3
New unemployment claims[c]	-5	-2	n.a.	-3	n.a.
New orders, consumer goods[d]	-2	0	n.a.	n.a.	-12
Formation of bus. enterprises	-1	n.a.	-10	-4	n.a.
Contracts & orders, plant & equipment[d]	-5	0	0	0	n.a.
Building permits, housing	-9	-9	-10	+2	-7
Change in bus. inventories[d]	-2	0	-6	-1	n.a.
Industrial materials prices	-1	-2	+4	n.a.	+4
Stock price index	-4	-6	-8	-8	-9
Profits[d]	-2	-2	-3	-12	n.a.
Ratio, price to labor costs	-7	0	-9	-6	-3
Change in consumer debt[d]	-4	-11	-15	-18	n.a.
Median or Total	-3	-2	-7	-3	-5
Coincident Indicators					
Nonfarm employment	+1	0	+2	+6	+7
Unemployment rate[c]	+1	+2	+1	0	+1
Gross national product[d]	-1	-1	0	0	-4
Industrial production	0	0	0	0	-3
Personal income[d]	0	0	-3	+6	n.a.
Mfg. & trade sales[d]	0	0	-1	0	0
Median or Total	0	0	0	0	0
Lagging Indicators					
Long-duration unemployment[c]	+4	+2	+3	n.a.	n.a.
Plant & equipment investment[d]	+7	+6	+8	0	n.a.
Business inventories[d]	+6	+8	+6	+16	+4
Productivity change, nonfarm[c]	+10	+8	+12	+3	n.a.
Business loans outstanding[d]	+6	+3	+6	n.a.	n.a.
Interest rates, bus. loans	+11	+5	-1	+18	+8
Median or Total	+6	+6	+6	+10	+6

Notes:

a. The series available for each country are sometimes only roughly equivalent in content to the U.S. series. In some cases two series are used to match the U.S. series and the median includes all observations for both series. The periods covered vary for each indicator and each country, but all are within the years 1948-1981.

b. Matching means that for leading indicators the median is a lead, for lagging indicators the median is a lag, and for coincident indicators the median is a lead or lag of three months or less.

Table 3-4. continued.

Italy	Belgium	Netherlands	Sweden	Japan	All Countries	Number of Countries in Which: Median Matches U.S.[b]	Number of Countries in Which: Median Does Not Match U.S.[b]
Lead (-) or Lag (+), in Months (continued)							
+4	-1	-2	0	-4	-2	7	2
n.a.	n.a.	n.a.	-5	n.a.	-4	3	0
-9	+5	-13	0	n.a.	-2	3	3
-7	-3	0	n.a.	-14	-4	5	1
n.a.	-2	-3	n.a.	0	0	2	4
-2	-5	-9	n.a.	-6	-7	7	1
n.a.	n.a.	+3	n.a.	-4	-2	3	2
n.a.	-14	-13	+1	+6	+1	3	4
-8	n.a.	-8	-7	-4	-7	8	0
n.a.	n.a.	n.a.	n.a.	-10	-3	4	0
n.a.	n.a.	+6	-2	-2	-2	5	2
n.a.	n.a.	n.a.	-5	-6	-8	5	0
-7	-2	-2	-2	-4	-2	55	19
+8	n.a.	+4	+1	+2	+2	4	4
+7	-1	0	0	+2	+1	8	1
-1	0	n.a.	-8	-2	-1	6	2
0	-6	0	0	0	0	8	1
n.a.	n.a.	n.a.	-4	+1	0	3	2
-7	-11	0	+4	-1	0	6	3
0	-4	0	0	0	0	35	13
n.a.	n.a.	+3	+4	n.a.	+3	4	0
n.a.	n.a.	0	n.a.	+4	+5	3	2
+5	+16	+10	n.a.	+5	+6	8	0
n.a.	n.a.	n.a.	+11	+8	+9	5	0
n.a.	n.a.	n.a.	+6	0	+6	3	1
+9	+4	n.a.	+18	+18	+9	7	1
+7	+10	+3	+8	+5	+6	30	4

c. Inverted.
d. In constant prices.

Table 3-4. continued. Median Lead or Lag of Individual Indicators at Growth Cycle Peaks and Troughs for Ten Countries.

Indicators: U.S. Classification and U.S. Titles[a]	*United States*	*Canada*	*United Kingdom*	*West Germany*	*France*
		Lead (-) or Lag (+), in Months			
Leading Indicators					
Average workweek, mfg.	-2	-4	-2	-2	-3
New unemployment claims[c]	-2	-2	n.a.	-2	n.a.
New orders, consumer goods[d]	-2	-1	n.a.	n.a.	-11
Formation of bus. enterprises	-4	n.a.	-8	-8	n.a.
Contracts & orders, plant & equipment[d]	-2	+2	-3	-4	n.a.
Building permits, housing	-7	-5	-11	+8	-8
Change in bus. inventories[d]	-1	0	-5	-4	n.a.
Industrial materials prices	-1	-2	+5	n.a.	+3
Stock price index	-4	-4	-8	-7	-8
Profits[d]	-2	-3	-3	-9	n.a.
Ratio, price to labor cost	-7	0	-12	-9	-4
Change in consumer debt[d]	-6	-7	-16	-18	n.a.
Median or Total	-2	-2	-6	-5	-6
Coincident Indicators					
Nonfarm employment	+1	0	+2	+3	+7
Unemployment rate[c]	+1	+2	+1	+2	0
Gross national product[d]	-1	-1	-2	0	-4
Industrial production	0	0	0	0	-1
Personal income[d]	0	0	-3	0	n.a.
Mfg. & trade sales[d]	0	0	-2	+1	0
Median or Total	0	0	-1	0	0
Lagging Indicators					
Long-duration unemployment[c]	+4	+1	+5	n.a.	n.a.
Plant & equipment investment[d]	+6	+5	+6	0	n.a.
Business inventories[d]	+6	+9	+6	+16	+6
Productivity change, nonfarm[c]	+10	+9	+10	+4	n.a.
Business loans outstanding[d]	+4	+3	+4	+4	n.a.
Interest rates, bus. loans	+7	+5	+3	+8	+6
Median or Total	+6	+5	+6	+6	+6

Notes:

a. The series available for each country are sometimes only roughly equivalent in content to the U.S. series. In some cases two series are used to match the U.S. series and the median includes all observations for both series. The periods covered vary for each indicator and each country, but all are within the years 1948-1981.

b. Matching means that for leading indicators the median is a lead, for lagging indicators the median is a lag, and for coincident indicators the median is a lead or lag of three months or less.

Table 3-4. continued.

Italy	*Belgium*	*Netherlands*	*Sweden*	*Japan*	*All Countries*	*Number of Countries in Which*	
						Median Matches U.S.[b]	*Median Does Not Match U.S.*[b]
	Lead (-) or Lag (+), in Months (continued)						
+2	-2	-1	0	-4	-2	7	2
n.a.	n.a.	n.a.	0	n.a.	-2	2	1
-8	+4	-7	-4	n.a.	-4	5	1
-6	-1	-5	n.a.	-13	-6	6	0
n.a.	-2	-4	n.a.	-4	-3	5	1
-2	-5	-9	n.a.	-9	-7	7	1
n.a.	n.a.	+3	n.a.	-2	-2	3	2
n.a.	-14	+7	+1	0	+1	2	5
-8	n.a.	-8	-10	-6	-8	8	0
n.a.	n.a.	n.a.	n.a.	-10	-3	4	0
n.a.	n.a.	+2	-2	-2	-3	5	2
n.a.	n.a.	n.a.	+4	-9	-8	4	1
-7	-2	-4	0	-5	-3	58	16
+6	n.a.	+4	+5	+2	+3	4	4
+4	-2	0	0	+1	+1	8	1
0	0	n.a.	0	-2	-1	7	1
0	-6	0	0	0	0	8	1
n.a.	n.a.	n.a.	0	-5	0	4	1
-2	-11	0	+4	0	0	7	2
0	-4	0	0	0	0	38	10
n.a.	n.a.	+4	+4	n.a.	+4	4	0
n.a.	n.a.	+2	n.a.	0	+4	3	2
+6	+16	+9	n.a.	+4	+6	8	0
n.a.	n.a.	n.a.	+6	+8	+8	5	0
n.a.	n.a.	n.a.	+4	-4	+4	3	1
+9	+4	n.a.	+14	+9	+7	8	0
+8	+10	+4	+5	+4	+5	31	3

c. Inverted.
d. In constant prices.

Table 3-5. Consistency of Timing of Indicators in Ten Countries, 1948-80.

	Number of Indicators for which Median Timings were "Right" (R) or "Wrong" (W)[a]								
	At Peaks			*At Troughs*			*At Peaks and Troughs*		
	Number		*Percent Wrong*	*Number*		*Percent Wrong*	*Number*		*Percent Wrong*
	R	*W*		*R*	*W*		*R*	*W*	
				Leading Indicators					
United States	10	2	17%	12	0	0%	12	0	0%
Canada	7	4	57	7	4	36	8	3	27
United Kingdom	8	2	20	9	1	10	9	1	10
West Germany	8	2	20	8	2	20	9	1	10
France	5	1	20	5	1	17	5	1	17
Italy	4	1	20	4	1	20	4	1	20
Belgium	4	2	33	5	1	17	5	1	17
Netherlands	8	1	11	6	3	33	6	3	33
Sweden	2	5	71	4	3	43	3	4	57
Japan	9	1	10	8	2	20	9	1	10
All except U.S.	55	19	26	56	18	24	56	16	22
				Roughly Coincident Indicators					
United States	6	0	0	6	0	0	6	0	0
Canada	6	0	0	6	0	0	6	0	0
United Kingdom	4	2	33	6	0	0	6	0	0
West Germany	5	1	17	4	2	33	6	0	0
France	4	1	20	3	2	40	3	2	40
Italy	4	1	20	2	3	60	3	2	40
Belgium	2	2	50	2	2	50	2	2	50
Netherlands	3	1	25	3	1	25	3	1	25
Sweden	5	1	17	3	3	50	4	2	33
Japan	3	3	50	6	0	0	5	1	17
All except U.S.	36	12	25	35	13	27	38	10	21

				Lagging Indicators					
United States	6	0	0	6	0	0	6	0	0
Canada	6	0	0	6	0	0	6	0	0
United Kingdom	6	0	0	5	1	17	6	0	0
West Germany	3	1	25	3	1	25	3	1	25
France	2	0	0	2	0	0	2	0	0
Italy	2	0	0	2	0	0	2	0	0
Belgium	2	0	0	2	2	50	2	0	0
Netherlands	3	0	0	2	1	33	3	0	0
Sweden	2	2	50	4	0	0	4	0	0
Japan	3	2	40	4	1	20	3	2	40
All except U.S.	29	5	15	30	5	14	31	3	9
				All Indicators					
United States	22	2	8	24	0	0	24	0	0
Canada	19	4	17	19	4	17	20	3	13
United Kingdom	18	4	18	20	2	9	21	1	5
West Germany	16	4	20	14	4	22	18	2	1
France	11	2	15	10	3	23	10	3	23
Italy	10	2	17	8	4	33	9	3	25
Belgium	8	4	33	8	4	33	9	3	25
Netherlands	14	2	13	11	4	27	12	4	25
Sweden	9	7	44	11	6	35	11	6	35
Japan	15	6	29	18	3	14	17	4	19
All except U.S.	120	35	23	121	36	23	127	29	19

Note:
a. "Wrong" median timing is defined as follows: leading indicator (exact coincidence or lag); lagging indicator (exact coincidence or lead); roughly coincident indicator (lead or lag greater than three months).
Source: Center for International Business Cycle Research.

stances, or about a quarter of the time. At troughs the medians fail to lead about 24 percent of the time. The best overview, perhaps, is provided by the median timing for peaks and troughs together. Here, the medians fail to lead in sixteen out of seventy-four cases or 22 percent of the time. The exceptions are widely scattered among the nine countries and among the indicators. There is no country without at least one indicator that failed to show a median lead. Only three indicators, the formation of business enterprises, stock prices, and profits, exhibit median leads at peaks and troughs in all countries.

For the roughly coincident indicators, at peaks there are twelve failures out of forty-eight comparisons, a failure rate of 25 percent. There are a number of medians of zero, and the exceptions are widely dispersed. The same situation is found at troughs, where there are thirteen failures out of forty-eight comparisons, a failure rate of 27 percent. Again the exceptions are dispersed. Viewing the peaks and troughs together, among the roughly coincident indicators the medians for the nine countries fail to match the U.S. behavior 21 percent of the time. There are no exceptions in Canada, the United Kingdom, or West Germany, and as noted, the exceptions are widely dispersed among the indicators as well. As for the lagging indicators, at peaks they fail to lag five out of thirty-four times (a failure rate of 15%), and at troughs the medians fail to match five of thirty-five times (a failure rate of 14%). At both peaks and troughs together, for the lagging indicators, only 9 percent of the medians for other countries fail to match the U.S. pattern, and once more there is no particular pattern either by country or by indicator.

Another way of summarizing this information is shown in Table 3-5, where for each country the number of indicators with medians consistent with ("right") or inconsistent with ("wrong") the U.S. classification is shown. For the United States, taking the results for peaks and troughs combined, the indicators behaved as postulated. This is not unexpected, of course, since the original classification, made in 1966, was based on the U.S. record, albeit at classical cycle turns rather than growth cycle turns and for a period that ended with the business cycle trough in 1961. For the other countries combined, 29 of the 156 indicators, or about 1 of 5, failed to behave in the expected manner—that is, in the manner suggested by U.S. experience. The "failure rate" for each country at both peaks and troughs is shown in the extreme left-hand column of the table. This rate varies from a high of 35 percent in Sweden to a low of 5 percent in the United Kingdom. In the rest of the countries the behavior of most of the indicators—between three-fourths and nine-tenths—corresponded to their behavior in the United States.

In general the lagging indicators deviated less often from their U.S. counterparts than the other indicators did. For the leading group, 22 percent of the indicators in the other nine countries (at peaks and troughs combined) deviated from U.S. experience. For the coincident indicators, 21 percent failed to exhibit roughly coincident performance. For the lagging group, only 9 percent failed to lag.

If we consider peak and trough behavior separately, relatively few substantial differences appear. The similarity in results is probably a consequence of the trend adjustment involved in growth cycle analysis. In the United States, we have found that when no trend adjustment is made, differences in the timing behavior of different indicators are more pronounced at peaks than at troughs. While growth cycle analysis may make the distinction between peak and trough behavior less consequential, there is clear confirmation from the foreign record that indicators that lead, coincide, or lag at peaks also tend to perform the same way at troughs.

NOTES TO CHAPTER 3

1. Measures of smoothness and cyclical amplitude are given in Appendix 3A.
2. Where the number of turning point comparisons in Table 3-1 differs from the number of growth cycle turns in Figure 3-1, this is due to turns at which one or more of the composite indicators could not be matched with the reference chronology.

APPENDIX 3A

SUMMARY MEASURES OF SMOOTHNESS AND AMPLITUDE FOR COMPOSITE INDEXES, TEN COUNTRIES

	U.S.	*Canada*	*U.K.*	*West Germany*	*France*	*Italy*	*Belgium*	*Netherlands*	*Sweden*	*Japan*
A. *Leading Indexes*										
$\overline{CI}$ (one month span)	0.80	0.62	0.46	0.60	0.72	0.76	2.03	0.71	2.19	1.11
$\overline{I}$ (one month span)	0.48	0.45	0.36	0.40	0.56	0.67	1.88	0.53	2.03	0.61
$\overline{C}$ (one month span)	0.60	0.40	0.23	0.38	0.41	0.31	0.70	0.37	0.73	0.87
I/C Ratio (one month span)	0.79	1.14	1.55	1.06	1.36	2.18	2.69	1.41	2.78	0.70
Months for Cyclical Dominance	1	2	2	2	2	3	3	2	3	1
Average Duration of Run (months)										
CI	3.0	2.3	2.2	3.0	2.5	2.0	1.7	2.7	1.8	3.6
I	1.7	1.6	1.7	1.8	1.7	1.7	1.4	1.8	1.5	1.8
C	12.6	13.8	8.8	10.6	9.6	9.9	7.0	7.7	8.0	13.0
MCD	3.0	4.0	3.2	4.0	3.7	3.3	3.7	3.7	3.5	3.6
B. *Roughly Coincident Indexes*										
$\overline{CI}$ (one month span)	0.75	0.53	0.47	0.62	0.61	0.80	2.08	0.72	1.95	1.05
$\overline{I}$ (one month span)	0.35	0.28	0.29	0.44	0.43	0.57	1.81	0.48	1.43	0.59
$\overline{C}$ (one month span)	0.64	0.45	0.32	0.47	0.44	0.55	0.94	0.52	1.18	0.86
I/C Ratio (one month span)	0.55	0.64	0.90	0.94	0.99	1.03	1.92	0.92	1.22	0.69
Months for Cyclical Dominance	1	1	1	1	1	2	3	1	2	1

Average Duration of Run (months)										
CI	4.6	3.9	3.1	2.8	2.9	3.1	1.9	3.0	2.8	3.6
I	1.7	1.6	1.7	1.6	1.6	1.8	1.5	1.7	1.7	1.6
C	19.1	20.0	11.6	20.9	16.8	14.2	10.5	14.3	12.8	35.4
MCD	4.6	3.9	3.1	2.8	2.9	4.9	3.9	3.0	4.5	3.6
C. *Lagging Indexes*										
$\overline{CI}$ (one month span)	0.70	0.36	0.41	1.09	0.55	0.81	2.45	0.70	1.93	1.05
$\overline{I}$ (one month span)	0.31	0.34	0.14	0.37	0.37	0.52	2.10	0.35	1.82	0.42
$\overline{C}$ (one month span)	0.63	0.46	0.38	0.96	0.33	0.71	1.45	0.56	1.10	0.93
I/C Ratio (one month span)	0.49	0.74	0.36	0.38	1.12	0.72	1.45	0.62	1.65	0.46
Months for Cyclical Dominance	1	1	1	1	2	1	2	1	2	1
Average Duration of Run (months)										
CI	5.5	3.2	8.3	5.2	4.7	6.4	2.8	7.9	1.8	4.6
I	1.8	1.7	2.1	1.9	1.9	2.1	1.8	2.3	1.6	1.7
C	18.0	16.4	16.3	21.1	14.6	9.6	10.8	11.0	10.7	21.0
MCD	5.5	3.2	8.3	5.2	5.5	6.4	3.6	7.9	3.2	4.6

APPENDIX 3B
NUMERICAL ANALYSIS OF SEQUENCE OF TURNS IN COMPOSITE INDEXES, TEN COUNTRIES

Table 3B-1. United States, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	9	10	10	29
Number of Successes				
Including Ties	9	10	10	29
Excluding Ties	9	9	10	28
Percent of Successes				
Including Ties	100	100	100	100
Excluding Ties	100	90	100	97
Troughs				
Number of Timings	9	9	9	27
Number of Successes				
Including Ties	8	9	8	25
Excluding Ties	8	8	8	24
Percent of Successes				
Including Ties	89	100	89	93
Excluding Ties	89	89	89	89
Total (P + T)				
Number of Timings	18	19	19	56
Number of Successes				
Including Ties	17	19	18	54
Excluding Ties	17	17	18	52
Percent of Successes				
Including Ties	94	100	95	96
Excluding Ties	94	90	95	93

Table 3B-2. Canada, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	8	10	9	27
Number of Successes				
Including Ties	8	8	8	24
Excluding Ties	8	8	8	24
Percent of Successes				
Including Ties	100	80	89	89
Excluding Ties	100	80	89	89
Troughs				
Number of Timings	9	10	9	28
Number of Successes				
Including Ties	9	8	8	25
Excluding Ties	9	8	7	24
Percent of Successes				
Including Ties	100	80	89	89
Excluding Ties	100	80	78	86
Total (P + T)				
Number of Timings	17	20	18	55
Number of Successes				
Including Ties	17	16	16	49
Excluding Ties	17	16	15	48
Percent of Successes				
Including Ties	100	80	89	89
Excluding Ties	100	80	83	87

Table 3B-3. United Kingdom, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	6	7	7	20
Number of Successes				
Including Ties	5	5	7	17
Excluding Ties	5	5	7	17
Percent of Successes				
Including Ties	83	71	100	85
Excluding Ties	83	71	100	85
Troughs				
Number of Timings	6	6	6	18
Number of Successes				
Including Ties	6	6	6	18
Excluding Ties	6	6	6	18
Percent of Successes				
Including Ties	100	100	100	100
Excluding Ties	100	100	100	100
Total (P + T)				
Number of Timings	12	13	13	38
Number of Successes				
Including Ties	11	11	13	35
Excluding Ties	11	11	13	35
Percent of Successes				
Including Ties	92	85	100	92
Excluding Ties	92	85	100	92

Table 3B-4. West Germany, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	4	6	3	13
Number of Successes				
Including Ties	4	5	3	12
Excluding Ties	4	4	3	11
Percent of Successes				
Including Ties	100	83	100	92
Excluding Ties	100	67	100	85
Troughs				
Number of Timings	3	5	4	12
Number of Successes				
Including Ties	3	4	4	11
Excluding Ties	3	4	4	11
Percent of Successes				
Including Ties	100	80	100	92
Excluding Ties	100	80	100	92
Total (P + T)				
Number of Timings	7	11	7	25
Number of Successes				
Including Ties	7	9	7	23
Excluding Ties	7	8	7	22
Percent of Successes				
Including Ties	100	82	100	92
Excluding Ties	100	73	100	88

Table 3B-5. France, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	3	6	2	11
Number of Successes				
Including Ties	3	6	2	11
Excluding Ties	3	6	2	11
Percent of Successes				
Including Ties	100	100	100	100
Excluding Ties	100	100	100	100
Troughs				
Number of Timings	2	5	3	10
Number of Successes				
Including Ties	2	4	3	9
Excluding Ties	2	4	3	9
Percent of Successes				
Including Ties	100	80	100	90
Excluding Ties	100	80	100	90
Total (P + T)				
Number of Timings	5	11	5	21
Number of Successes				
Including Ties	5	10	5	20
Excluding Ties	5	10	5	20
Percent of Successes				
Including Ties	100	91	100	95
Excluding Ties	100	91	100	95

Table 3B-6. Italy, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	3	6	3	12
Number of Successes				
Including Ties	3	5	3	11
Excluding Ties	2	5	2	9
Percent of Successes				
Including Ties	100	83	100	92
Excluding Ties	67	83	67	75
Troughs				
Number of Timings	3	5	3	11
Number of Successes				
Including Ties	3	5	3	11
Excluding Ties	3	5	3	11
Percent of Successes				
Including Ties	100	100	100	100
Excluding Ties	100	100	100	100
Total (P + T)				
Number of Timings	6	11	6	23
Number of Successes				
Including Ties	6	10	6	22
Excluding Ties	5	10	5	20
Percent of Successes				
Including Ties	100	91	100	96
Excluding Ties	83	91	83	87

Table 3B-7. Belgium, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	3	4	3	10
Number of Successes				
Including Ties	3	3	3	9
Excluding Ties	3	3	3	9
Percent of Successes				
Including Ties	100	75	100	90
Excluding Ties	100	75	100	90
Troughs				
Number of Timings	2	3	3	8
Number of Successes				
Including Ties	2	3	3	8
Excluding Ties	2	2	3	7
Percent of Successes				
Including Ties	100	100	100	100
Excluding Ties	100	67	100	88
Total (P + T)				
Number of Timings	5	7	6	18
Number of Successes				
Including Ties	5	6	6	17
Excluding Ties	5	5	6	16
Percent of Successes				
Including Ties	100	86	100	94
Excluding Ties	100	71	100	89

Table 3B-8. Netherlands, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	6	8	7	21
Number of Successes				
Including Ties	6	5	7	18
Excluding Ties	6	4	5	15
Percent of Successes				
Including Ties	100	63	100	86
Excluding Ties	100	50	71	71
Troughs				
Number of Timings	6	7	6	19
Number of Successes				
Including Ties	6	5	6	17
Excluding Ties	6	4	6	16
Percent of Successes				
Including Ties	100	71	100	90
Excluding Ties	100	57	100	84
Total (P + T)				
Number of Timings	12	15	13	40
Number of Successes				
Including Ties	12	10	13	35
Excluding Ties	12	8	11	31
Percent of Successes				
Including Ties	100	67	100	88
Excluding Ties	100	53	85	78

Table 3B-9. Sweden, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	2	3	3	8
Number of Successes				
Including Ties	2	3	2	7
Excluding Ties	2	3	2	7
Percent of Successes				
Including Ties	100	100	67	88
Excluding Ties	100	100	67	88
Troughs				
Number of Timings	3	3	3	9
Number of Successes				
Including Ties	3	2	3	8
Excluding Ties	3	2	3	8
Percent of Successes				
Including Ties	100	67	100	89
Excluding Ties	100	67	100	89
Total (P + T)				
Number of Timings	5	6	6	17
Number of Successes				
Including Ties	5	5	5	15
Excluding Ties	5	5	5	15
Percent of Successes				
Including Ties	100	83	83	88
Excluding Ties	100	83	83	88

Table 3B-10. Japan, Analysis of Sequence of Turns in Composite Indexes, at Growth Cycle Turns.

	Comparison of			
	Inverted Lagging Index to Leading Index	*Leading Index to Coincident Index*	*Coincident Index to Lagging Index*	*Total*
Peaks				
Number of Timings	6	7	6	19
Number of Successes				
Including Ties	6	6	5	17
Excluding Ties	6	5	5	17
Percent of Successes				
Including Ties	100	86	83	90
Excluding Ties	100	86	83	90
Troughs				
Number of Timings	5	6	6	17
Number of Successes				
Including Ties	5	6	6	17
Excluding Ties	4	6	6	14
Percent of Successes				
Including Ties	100	100	100	100
Excluding Ties	80	100	100	82
Total (P + T)				
Number of Timings	11	13	12	36
Number of Successes				
Including Ties	11	12	11	34
Excluding Ties	10	12	11	33
Percent of Successes				
Including Ties	100	92	92	94
Excluding Ties	91	92	92	92