

The 1994 Mexican crisis: were signals inadequate?

Pierre Beziz - Gérald Petit
Organisation for Economic Co-operation and Development (OECD)
Statistics Directorate, May 1997
E-mail: pierre.beziz@oecd.org

“Are economists tempted to sit overmuch in offices and think, supported by basic principles, rather than trudge the often privately unrewarding empirical highways and byways?”. This question raised in a general context by Theodore Morgan (see [1]) is worth examining in the particular case of the 1994 Mexican crisis. The purpose of this article is to show that statistical data available at that time would have given discerning economists early signals of the crisis. More precisely, using a practical forecasting tool called “leading indicators”, we show that such signals existed in a number of forms.

0. Introduction

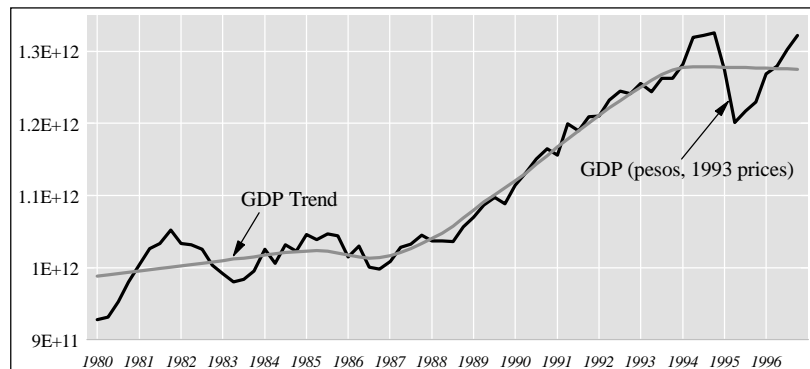
Composite leading indicators are aggregate time series which show a leading relationship with the growth cycles of key macro-economic indicators. Typically, they are constructed to anticipate the cycles of Total industrial production or Gross domestic product (GDP), which are chosen as reference series for the aggregate economy. Composite leading indicators are calculated by combining component time series. Component series cover a wide range of short-term indicators such as observations or opinions about economic activity, housing permits, financial and monetary data, etc. Composite leading indicators are considered a reliable guide of the cyclical behaviour of the economy, and they are available with a shorter delay than direct measures. Composite leading indicators are computed each month for 22 OECD Member countries (see [2], [3]) and four aggregate geographical zones. Data are published in the monthly *Main Economic Indicators* (MEI), see [4].

The recent economic history of Mexico is marked by the severe recession that started in the fall of 1994, as is shown in Figure 1. The recession deepened even further following the 15% devaluation of the national currency, the peso on December 20th. By the end of December the peso had fallen by 30%, stock prices collapsed and interest rates increased sharply. As a consequence of this crisis, GDP fell by 6.2% in 1995, the rate of inflation on a 12-month basis climbed to 52% in December 1995 and short-term interest rates¹ reached a level of 71.5% in April 1995 (see [5]).

On the occasion of a meeting on Leading Indicators organised at OECD in October 1996², a composite leading indicator was created for Mexico³. This indicator was calculated using a posteriori information about the 1994 crisis, that is with component series available up to the end of 1996 (see [7]). In order to test the ability of this composite leading indicator to signal the 1994 crisis, a second indicator was created using a priori information about the 1994 crisis. This second indicator was calculated with component series as they existed through the summer of 1994⁴. Both indicators clearly signal with a 6-month lead the subsequent recession.

The seriousness of the 1994 Mexican crisis, pushed the International Monetary Fund (IMF) to establish Special Data Dissemination Standards, which provide countries guidelines on the quality, timeliness and dissemination of economic and financial data. This IMF exercise was triggered by an apparent lack of adequate information to forecast the Mexico crisis. However, as it is shown in this article, signals of the Mexican crisis clearly existed in the available data and are summarised in the composite leading indicator. Empirical analysis of concrete and detailed statistical data provide a pertinent and timely information and can give a good overview of the states of the current economic situation. Perhaps the need is to encourage a review of the manner in which available data series are utilised by economists and analysts.

Figure 1: Gross Domestic Product 1980-1996



This paper briefly describes the methodology of the computation of OECD leading indicators and the cyclical behaviour of the Mexican economy (sections 1 and 2). The predictive performance of both a posteriori and a priori composite leading indicators are presented in section 3.

1. The OECD system of leading indicators

1.1 Growth cycles

The OECD system of leading indicators is based on the “growth cycle” approach, which measures deviations from the long-term trend (see [8]). A contractionary phase signals a decline in the rate of growth of the economy but does not necessarily indicate an absolute decline in economic activity as for classical cycles. Peaks and troughs of growth cycles tend to appear earlier in time than those of classical cycles. Trends in time series are estimated using the PAT (Phase Average Trend) method⁵, developed by the US National Bureau of Economic Research (see [9], [10]).

Leading indicators are constructed to relate to a reference series for the aggregate economy. In the case of Mexico, as for the majority of OECD Member countries, the reference series is monthly total industrial production (IIP). Cyclical behaviour of the reference series and comparisons with GDP data are described in detail in the next section.

1.2 Composite leading indicators

Composite leading indicators⁶ are constructed from several component series, which are selected in the OECD system of leading indicators according to the following criteria:

- Economic significance: there has to be an economic reason for a leading relationship with the reference series. There are various reasons why series could be suitable components of a composite leading indicator:
 - (i) As causes of the fluctuations of economic activity (e.g. economic policy instruments such as short-term interest rates);
 - (ii) As indicators expressing the expectations of economic agents (e.g. business or consumer surveys, share prices);
 - (iii) As measures of economic activity at an early stage of the production process (e.g. housing starts, output of intermediate goods); or,
 - (iv) As indicators which adjust quickly to changes in economic activity (e.g. overtime work).

- Cyclical behaviour: cycles should lead those of the reference series, there should be no missing or extra cycles;
- Data quality: statistical coverage of the series should be broad, series should be compiled on a monthly basis (rather than on a quarterly basis), series should be timely and easily available.

Additional statistical tests are carried out to determine which component series will be included in the calculation of the composite leading indicator. These are: peak-trough analysis and examination of cross-correlation with the reference series.

2. The Mexican economy: shorter cycles with larger amplitude than for total OECD

Over the period 1980-1996, all cycles detected by PAT in the total industrial production series were also found in the Gross Domestic Product series, except for a cycle of minor amplitude between August 1990 and July 1992, (see Table 1). Industrial production cycles generally lead or are coincident with those of GDP. Thus they reflect GDP trends but are compiled on a monthly basis, in contrast to GDP, which is only available on a quarterly basis.

Table 1: Cyclical characteristics of the Mexican economy and total OECD area over the period 1980 - 1996

MEXICO							Total OECD area ¹			
	Gross Domestic Product			Total industrial production			Total industrial production			
	Turning point date, duration (quarters)		Amplitude % of trend	Turning point date ² , duration (months)		Amplitude % of trend ³	Turning point date ² , duration (months)		Amplitude % of trend ³	
Peak							Feb 80			
Trough	Q1 80			Feb 80			(Sep 80)		- 5.7	
Peak	Q4 81			Sep 81			(Jul 81)		+ 3.2	+ 11.2
Trough	Q2 83	7	- 8.2	Mar 83	37	-15.4	Dec 82		- 8.9	
Peak	Q3 85	7	+ 5.4	Jul 85	46	+13.0	May 85	63	+ 7.3	
Trough	Q4 86	8	- 3.9	Dec 86	41	-10.9	Jan 87	49	- 3.9	
Peak	Q4 87	9	+ 2.7	Dec 87	29	+8.7				
Trough	Q3 88	9	- 3.2	Jul 88	19	- 6.9				
Peak				(Aug 90)		+ 5.9	Aug 90	63	+ 4.4	
Trough				(Jan 92)		- 4.5				+ 6.9
Peak	Q3 92	18	+ 3.1	Jul 92	55	+5.6				
Trough	Q2 93	5	- 2.3	Jun 93	48	-5.0	Jun 93	60	- 4.6	
Peak	Q4 94	19	+ 4.9	Aug 94	25	+ 9.4	Dec 94	52	+ 4.7	
Trough	Q2 95	4	- 9.6	Jun 95	25	-14.5		(Mar 96)		
Cycle average⁴										
Peak to peak		11 (qtr)			34 (mth)			59 (mth)		
Trough to trough		12 (qtr)			35 (mth)			55 (mth)		
Expansion phases			+ 4.0			+ 9.5			+ 6.9	
Contraction phases			- 5.4			- 10.5			- 5.8	

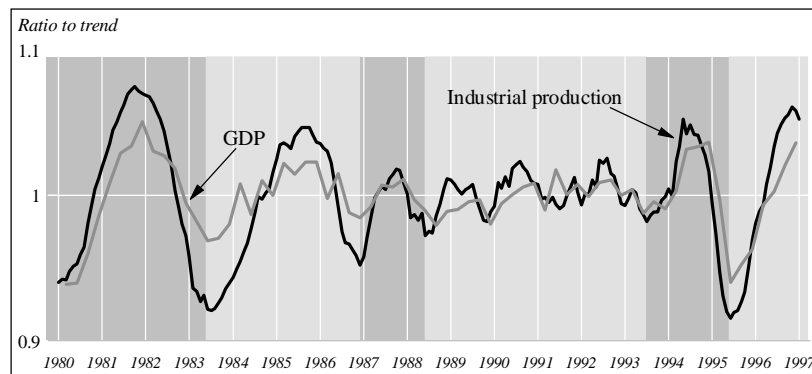
1. Excluding Mexico.
2. Minor cycles are given in brackets.
3. The amplitude is calculated as the percentage above trend at peak *plus* the percentage below trend at trough. A major cyclical phase interrupted by minor cycle (s) is shown by grouping the amplitudes together.
4. Calculated at major turning points, that is excluding the minor cycle between August 1990-July 1992.

The average duration of the cycles of industrial production from peak to peak is 34 months as shown in Table 1. This is lower than for the total OECD area: 59 months from peak to peak. When measured from trough to trough, the cycle length for Mexico is of 35 months which is also less than for the total OECD area, 55 months. The average amplitude of the expansion and contraction phases for Mexico is respectively of 9.5 per cent and -10.5 per cent of trend measured, at peaks and at troughs. This is considerably higher than the OECD averages of 6.9 per cent and -5.8 per cent, respectively.

The cyclical characteristics of the Mexican economy (duration and amplitude of the cycles) over the period 1980-1996 can be compared to those of the total OECD area for the period 1969- 1985. This period of the world economy is marked by two oil crises in 1973 and 1982. Similarities can also be observed with economic cycles of Spain, over the period 1963-1985. See ([3]).

The five major cycles, measured from trough to trough, of the reference series reflect the movements of the Mexican economy (Figure 2).

Figure 2: Total industrial production and GDP in Mexico ratio to trend



The 1982 crisis known as the “debt crisis”, was triggered by foreign creditors’ refusal to provide additional loans to Mexico which resulted in the country’s involuntary interruption of debt service. This is reflected on the first cycle of industrial production by a contraction phase which culminated in March 1983 with a high amplitude of -15.4 per cent.

The period between 1983 and 1985 is the second major cycle of the Mexican economy. This period is marked by the effects of the “Programme for Immediate Economic Reordering” (PIRE) adopted to stabilise the economy and restore the confidence of the private sector. This is reflected by an expansion phase with an amplitude of 13 per cent.

The years 1986 and 1987 are marked by general economic instability and a confidence crisis following the 1986 oil price collapse and the major earthquake which hit Mexico City in September 1985. This reflected by a short third cycle (2 years) with low amplitude.

Between August 1988 and mid-1993, the fourth cyclical pattern is not very pronounced and had a relative low amplitude. This resulted, to some extent, from the government's economic policy, which combined a tight rein on public finances with strict monetary policy in order to reduce inflation to a level near that of Mexico's main economic partners.

At the end of 1993, elimination of uncertainty about the ratification of the NAFTA treaty by the US congress was followed by a period of expansion. This is reflected by a fifth cycle with an ascending phase clearly pronounced between June 1993 and August 1994. A turning point (peak) appears in August 1994 for the reference series, with a phase of amplitude equal to 9.4 per cent. Finally the recession that followed the devaluation of the peso on 20th December 1994 was reflected in the total industrial production series by a short phase (10 months) with high amplitude (-14.5 per cent). An amplitude of this size over such a short cycle had never been observed over the period 1980-1994.

3. Composite leading indicators forecasting the 1994 crisis

3.1 Description of the indicators and their component series

Two different composite leading indicators for Mexico have been calculated.

- i) LI96: This indicator was created in October 1996. It uses a posteriori information about the 1994 crisis, examining the cyclical behaviour of the Mexican economy over the period 1985-1996.
- ii) LI94: This a priori indicator uses only information available in July 1994⁴, one month before the peak of the cycle in which the Mexican crisis occurred. It is calculated ignoring subsequent knowledge about which component series would work over the entire period 1985-1996.

The two composite leading indicators were computed in order to present the best performance over each period investigated. Thus, they were calculated using different component series. These component series were selected after an examination of more than 70 different time series, drawn primarily from the *Main Economic Indicators* database (see [11]), but also from INEGI's *Banco de datos* database and the Bank of Mexico's *SINIEE* database.

Most of these series were rejected because they lacked a relevant cyclical profile. Moreover, it was impossible to test the cyclical behaviour of various other series, either because data were not available over a long enough period (e.g. the yield on "tesobonos") or because they were calculated on an annual basis only (e.g. foreign investment in Mexico). The rejected series were either directly related to the real economy such as components of industrial production, wages, prices, construction costs, etc. (expressed in level form or as first differences) or were financial data (the money supply, official reserves, peso/US dollar exchange rates, federal government deficits, etc.).

Table 2 gives details of the component series which were selected to calculate the composite leading indicators and summarises the performance of these indicators.

Table 2: Characteristics of the component series and composite leading indicators

	Delay in release (months)	Missing (m) extra (x) cycles	Average leads (months)			Median leads (months)		
			peaks and troughs	peaks	troughs	peaks and troughs	peaks	troughs
LI 96 (1985-1996) ¹	2		4.4	4.0	4.8	4	3	5
Component series								
Production: tendency (business survey)	2		5.3	5.6	5.0	4	4	1
Stocks of finished goods: tendency (business survey) ²	2	2m	2.8	4.5	1.0	4	4	1
Employment: tendency (business survey)	3		5.4	5.7	5.3	4	4	5
Changes in manufacturing employment	3		4.6	5.3	4.0	5	5	5
Average cost to banks of managing deposits in national currency - CPP - (since 1985) ²	1	1m, 1x	3.8	4.3	3.3	5	5	4
Real effective exchange rate ³	2	2m	4.8	5.0	4.5	5	5	3
US long-term interest rate (since 1990) ²	1	1m	10.7	10.0	11.0	10	10	11
LI 94 (1980-1994)	2		4.0	3.8	4.3	4	4	5
Component series								
Total IIP for United States	2	2m	9.5	12.7	6.3	10	12	6
IIP for construction	2	1/2m	1.9	2.4	1.3	2	2	1
Employment: tendency (business survey)	3		4.9	3	6.4	5	5	6
Production: tendency (business survey)	2		7.1	6.8	7.4	7	6	7
Changes in manufacturing employment	3		9.7	9.4	10.0	6	7	6
Share prices (since 1987)			6.5	6.3	6.7	8	5	12
Average cost to banks of managing deposits in national currency - CPP- (since 1985) ²	1	1m	11.3	11	11.7	7	5	9
Real effective exchange rate ³	2	2m	7.4	8.3	6.3	3	9	2
Total imports from USA	3	1m	4.8	5.8	3.8	3	3	3

1. Calculated at major turning points, that is excluding the minor cycle between August 1990-July 1992.
2. Inverse relationship.
3. Indicator of competitiveness which takes into account both import and export competitiveness. A fall indicates improvement in competitive position. For more details refer to "OECD's Indicators of International Trade and Competitiveness" OECD Economics Department Working Papers, No. 120, Martine Durand, Jacques Simon and Colin Webb.

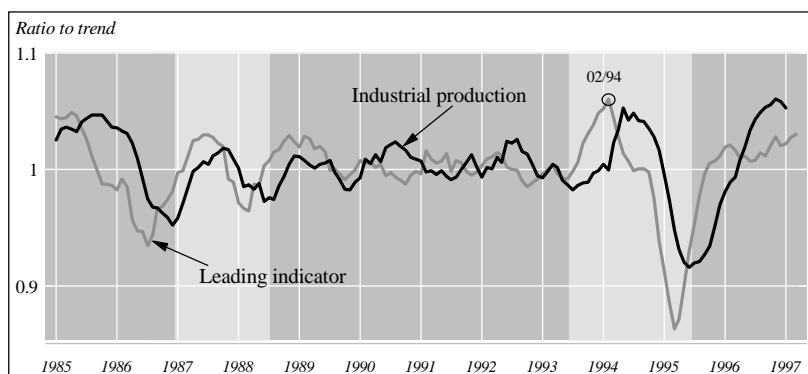
Component series selected in the calculation of the composite leading indicators LI96 and LI94 cover business surveys⁷, financial statistics, employment, foreign trade and production data, for Mexico and the United States. Leading indicator LI96 is calculated from seven component series, while LI94 is calculated from nine component series. Five component series are common to the calculation of both leading indicators. These are: *Employment tendency* and *Production tendency* (derived from business surveys), *Changes in manufacturing employment*, *CPP* and the *Real effective exchange rate*.

In addition, LI96 uses *US long-term interest rate* and *Stocks of finished goods tendency* (obtained from business surveys); while *Total industrial production for the United States*, *Construction* (as a component of Industrial production), *Total Imports from United States* and *Share prices* are component series unique to LI94.

3.2 A simulation showing signals of the 1994 crisis

The performance of both composite leading indicators and their ability to signal the 1994 recession are described below:

Figure 3: Composite leading indicator (LI96) and reference series

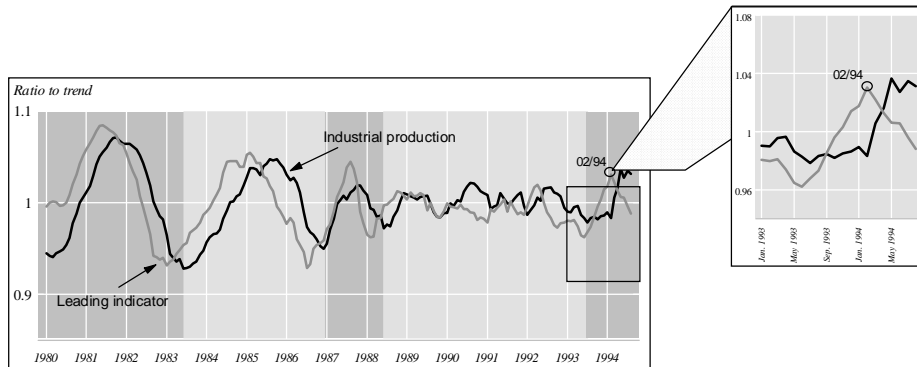


- LI96: The composite leading indicator of industrial activity has been calculated for the period beginning in 1985 (Figure 3). All cycles correspond to the major cycles of the reference series with an average lead of 4.4 months. The composite leading indicator LI96 announces clearly the recession with a lead of six months: its turning point is in February 1994. The indicator's deviation from trend fell continuously from February 1994, dipping from 6.02 per cent in February to - 0.01 per cent in July 1994 (Figure 4). A difference of that amplitude in so short a time had never before been observed over the period 1985-1994.

This movement (see Table 3) was reflected primarily in the financial components⁸: *US ten-year interest rate*⁹ (the deviation from trend went up sharply from the trough of October 1993: from -19.5 per cent to 7.9 per cent in July 1994), *Real effective exchange rate* (deviation from trend 23.4 per cent in January 1994 and 12.5 per cent in July 1994) and *CPP*⁹ (deviation from trend -37.0 per cent in February 1994 and -14.2 per cent in July 1994). Signals of the crisis were also visible in the business surveys series: *Employment tendency* (-2 % balance in April 1994 and -11 % balance in July 1994), *Production tendency* (39 % balance in April 1994, 3 % balance in July 1994), *Stocks of finished goods tendency*⁹ (-6 % balance in February 1994, 14.% balance in July 1994), as well as in the *Change in manufacturing employment* (deviation from trend 16.3 per cent in January 1994 to 0.17 per cent in July 1994). The indicator therefore correctly signals the recession which reached its trough in May 1995.

Additional simulations were carried out to test the robustness of the signal given by this composite leading indicator¹⁰. The indicator was recalculated using the same component series, taking into account updates only up to July 1994. Here again, there is a clear signal of the recession with a six month lead (turning point in February). Detailed results of this simulation were published in [7].

Figure 4: Composite leading indicator (LI94) and reference series



- LI94: The composite leading indicator has been calculated from 1980. It gives clear signals of all the turning points of the reference series with an average lead of 4 months (Figure 4). The lead is uniform over the whole period. There are no missing or extra cycles. This leading indicator again clearly signals the 1994 recession with a six months lead: the deviation from trend has been falling continuously from February 1994, dipping from 3.04 per cent to -0.03 per cent in July. A difference of that amplitude, while the deviation from trend of industrial production was still increasing, would have given analysts clear and repeated advance warnings of a turning point for the reference series.

Six of the nine component series used in the calculation of LI94 give an early signal of the 1994 recession, see Table 3. These are the financial series (namely: *CPP*, *Share prices*, *Real effective exchange rate*), the two business surveys series (*Production tendency*, *Employment tendency*) and the series of *Changes in manufacturing employment*. All these series, except *Share prices* (deviation from trend from 32.4 per cent in January 1994 to 6.4 per cent in July 1994) are also component series of LI96. The series *Industrial production for construction* gives a signal of the recession in June 1994 (with only a two months lead); while the turning point of the series *Total imports from US* is coincident with that of the industrial production (August 1994). The series *US Total industrial production* does not give early signal of the recession.

Table 3 contains details about which component series used in the calculation of both composite leading indicators give signals of the 1994 crisis.

Table 3: Component series giving signals of the 1994 crisis

	Turning point date	Lead with reference series (months)
Reference series and composite leading indicators		
Total industrial production	Aug 1994	
LI 96	Feb 1994	6
LI 94	Feb 1994	6
Component series		
Production: tendency (business survey)	Apr 94	4
Stocks of finished goods: tendency (business survey)	Feb 94	6
Employment: tendency (business survey)	Apr 94	4
Changes in manufacturing employment	Jan 94	7
Average cost to banks of managing deposits in national currency - CPP - (since 1985)	Mar 94	4
Real effective exchange rate	Jan 94	7
US long-term interest rate (since 1990)	Oct 93	11
Total IIP for United States	None	
IIP for construction	Jun 94	2
Share prices (since 1987)	Jan 94	7
Total imports from USA	Aug 94	0

4. Conclusion

Both composite leading indicators thus constructed signal the 1994 recession with a six months lead, and anticipate the turning points of the economy for the period investigated. Early signals of the Mexican crisis were present in several individual short-term indicators which are: the financial series⁸ (*CPP, US long-term interest rate, Share prices, Real effective exchange rate*), results from business surveys (*Production tendency, Stocks of finished goods tendency, Employment tendency*) and employment (*Changes in manufacturing employment*). All these indicators are published on a monthly basis by the national sources, and are available no more than three months after the end of the reference period. In addition these indicators are by construction, not subject to revision (except for the series *Changes in manufacturing employment*, which in practice, is very slightly revised, when it is). Thereby, the signal of the 1994 crisis given by both composite leading indicators is reliable.

The straightforward and empirical analysis of readily available Mexican data, described in this article, would have given clear and reliable warnings of a severe recession that the usual methods of economic analysis do not appear to have signalled. These conclusions may encourage economists and analysts to develop and use empirical analysis based on available statistical data.

NOTES

- 1 3-month Cetes treasury bills.
- 2 All papers presented during the meeting and the list of participants are available on Internet at the following address: <http://www.oecd.org/std>.
- 3 Previously, the Mexican National Statistics Institute (*Instituto Nacional de Estadística, Geografía e Informática*, INEGI) had carried out a study on the topic, the findings of which were published in 1992 (see [6]).
- 4 The a priori indicator was calculated using the July 1994 data as available in 1996. Thus, data include subsequent revisions.
- 5 The trend is first estimated by splitting the series into cyclical phases using a preliminary estimation of peaks and troughs (Bry-Boschan routine). Averages of the data over each phase (phase averages) are calculated and a three month moving average of the phase averages is computed. The obtained values are located at the midpoint of the three-phase period, called "triplets". A second approximation of the trend is calculated by connecting midpoints of the triplets. The level of the final trend is then adjusted to match the level of the original data.
The trend is extrapolated to the end of the series by computing the slope from the last triplet mid-point. The level of the trend of the last segment is finally adjusted to match the level of the original data. See ([9],[10]).
- 6 Composite leading indicators are usually calculated as the simple average of the component series which have been detrended, smoothed according to their Monthly Cyclical Dominance (MCD) and normalised to ensure that cyclical movements of all series have the same amplitude.
- 7 Business surveys in manufacturing sector. Business surveys collect qualitative information. Results are summarised into one figure, the percent balance calculated as the difference between the weighted proportion of respondents giving favourable answer and unfavourable answers.
- 8 The CPP and share prices developments were probably dominated by the assassination in March 1994 of Luís Donaldo Colosio, presidential candidate. They may therefore have been partly disregarded as early signal of future economic activity.
- 9 Inverse relationship with the reference series.
- 10 End of period trend estimates, using the PAT method, may be fairly substantially revised when new data become available.

REFERENCES

- [1] Theory versus Empiricism in Academic Economics: Update and Comparisons (Theodore Morgan, University of Wisconsin, 1988).
- [2] OECD Leading Indicators (Nilsson, Economic Studies, No. 9, Autumn 1987).
- [3] OECD System of Leading indicators and Business Cycles in Member countries (January 1987).
- [4] Main Economic Indicators (OECD, monthly publication).
- [5] OECD Economic Surveys: Mexico (September 1995).
- [6] Sistema de indicadores adelantados para la economía Mexicana (INEGI, 1992).
- [7] An update of the OECD system of Leading indicators (G. Petit, G. Salou, P. Beziz, C. Degain, OECD, 1996). This paper was presented at the October 1996 meeting on Leading indicators at OECD.
- [8] Measuring Business Cycles (Burns, Mitchell, National Bureau of Economic Research, 1946).
- [9] The Phase Average Trend: a New Way of Measuring Economic Growth (G. Bry and C. Boschan, National Bureau of Economic Research, 1978).
- [10] "Programmed turning point determination" in Cyclical Analysis of Time Series: selected procedures and computer programmes (G. Bry and C. Boschan, National Bureau of Economic Research, 1971).
- [11] Main Economic Indicators, Sources and Methods: Mexico (OECD, December 1996).