CYCLICAL INDICATORS IN POLAND AND HUNGARY

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This paper was prepared by the OECD Secretariat and contains two separate papers on cyclical indicator projects in Poland and Hungary.

Technical assistance to the projects was supplied by the Secretariat within the framework of the work programme of the Centre for Co-operation with Economies in Transition at the OECD.

The first paper on cyclical indicators in Poland was prepared in co-operation with Izabella Kudrycka, Research Centre for Economic and Statistical Studies, Poland.

The second paper on cyclical indicators in Hungary was prepared in co-operation with Janos Hoos and Gyorgy Muszely, Ministry of Finance, Hungary.

Both papers complement a companion document published by the OECD, *Cyclical Indicators and Business Tendenct Surveys*. This document contains a more detailed discussion of the underlying concepts used in the formulation of cyclical indicators in Poland and Hungary. These include cycles, turning point and trend estimation, composite indicators, etc. These are discussed primarily in relation to cyclical indicators developed by international organisations such as the OECD as well as in member countries of the OECD and the European Union.

Many of the concepts used in this paper are discussed in more detail in the companion document. Readers of this document are strongly urged to refer to the companion publication.

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TABLE OF CONTENTS

CYCLICAL INDICATORS IN POLAND

1. INTRODUCTION

Business cycle analysis is an area in which post-socialist countries have had little experience to date but is one which is likely to become increasingly important as they move to market economies. The analysis of business cycles in market-oriented countries relies mainly on the work of the National Bureau of Economic Research (NBER) in the United States. In the work by the NBER, business cycles are defined as recurrent sequences of altering phases of expansions and contractions in the levels of a large number of economic and financial time series. These fluctuations are persistent and the duration of a business cycle as a rule lasts several years.

The expansion phases tend to be longer than the contraction phases (recessions) in business cycles due to the general occurrence of up upward long-term growth trends in economic time series in market oriented countries.

Fluctuations in economic time series have been observed in the past in socialist economies which had some of the characteristics of cycles in market economies. Future cycles in post-socialist countries are likely to follow much the same path as in OECD countries as they move to market economies and become more integrated in the world economy.

The OECD Secretariat has developed a "leading indicator system" for its member countries which is used by the Secretariat and member countries for analysing business cycles, and for predicting cyclical turning points. The OECD leading indicator system uses the "growth cycle" or "deviation from trend" approach. This is necessary because essential cyclical similarities between series may be obscured by different long-term trends. In periods with very high long-term growth trends the turning points in many level series are a poor guide to cyclical fluctuations in the economy because the series are dominated by the trend. This was the situation in much of the early post-war period in many industrialised countries. High growth rates may also be expected in the future in post-socialist countries. For this reason the concept of growth cycles is more appropriate for use on an international level.

This paper reports the results of a research project undertaken at the Research Centre for Economic & Statistical Studies in Warsaw in co-operation with the Transition Economies Division of the Statistics Directorate in the framework of the work program of the Centre for Co-operation with the Economies in Transition at the OECD. The project sought to explore the possibility of applying the OECD indicator approach for cyclical analysis to the Polish economy. The research focused on the identification of a set of potential leading indicators and the construction of an overall composite leading indicator for Poland.

The paper is organised as follows. Section 2 outlines the methodology employed. Section 3 presents the choice of reference series and the reference chronology, whilst growth cycles in Poland and the OECD area as a whole are examined in Section 4. A set of potential leading indicators is evaluated in Section 5,

and Section 6 deals with the construction of a set of composite leading indicators. The final section contains a summary and some concluding remarks.

2. METHODS AND DATA

2.1. Basic methodology

The set of short-term indicators for Poland used in this study show very different long-term trends over the investigated period. Some indicators, including total industrial production, which are available back to 1970 or 1975 show a high long-term trend up to 1985 and a negative trend after this period. Other indicators show a negative long-term trend over the whole period up to 1996.

Indicators available from 1983 or later are heavily influenced by the collapse in the socialist countries in 1990-91 and the very deep economic recession over this period. In Poland, industrial production fell by 24.2 per cent in 1990 and by 14.2 per cent in 1991. Since the indicator series show different long-term trends, the analysis is conducted in terms of growth cycles.

Before proceding further it is necessary first to outline the methodologies used in derivation of trend estimates and turning points. These methodologies are outlined below. This is followed by a brief discussion of methodology used to evaluate the performance of the indicators.

Trend estimation

Trend estimation is a crucial step in detecting cyclical movements and identification of turning points when the growth cycle approach is used. The trend estimation method used in this study is a modified version of the Phase-Average Trend (PAT) method developed by the NBER and used in the OECD cyclical indicator system. This method has been designed specifically to separate the long-term trends from medium-term cycles. The latter are defined according to the criteria programmed in the Bry-Boschan computer routine for selection of cyclical turning points.

Estimation of turning points

The estimation of turning point dates is a key step in the PAT procedure and the Bry-Boschan routine is used to estimate tentative turning points, identified in the deviations of the series from a first trend based on a 75 month moving-average estimate of the long-term trend. The routine specifies a minimum duration of five months for a phase, defined as the number of months between successive turning points, and fifteen months for a cycle, measured from either peak to peak or trough to trough. These tentative turning points are used as input to the final trend calculation with the PAT method.

The PAT trend of a series is estimated by first splitting the series into phases, defined by the tentative turning points identified in the Bry-Boschan routine. The means of the observations in each phase are then calculated and these phase-averages are used to compute a three-term moving average. The values obtained from the moving average are assigned to the mid-point of the three-phase-period, known as "triplet", to which they refer. The trend is then obtained by computing the slope between mid-point of successive triplets. The trend is extrapolated from the last available triplet to the end of the series by a least-square log-linear regression starting from the mid-point of the last triplet.

The turning points determined by the Bry-Boschan routine for this study were evaluated and selected to match corresponding major turning points in the reference series so that the trend estimation for each

variable was done in a manner consistent with that for the other indicators and the reference series itself. These turning points were used as input to the final trend estimation and formed the turning point chronologies for the indicator series and reference series.

Evaluation of performance of indicators

Two methods were used to evaluate the performance of the indicators. The first entailed looking at the ability of each indicator to forecast cyclical turning points in the reference series, i.e. a peak-and-trough analysis. Forecasting turning points is one of the main objectives of the cyclical indicator technique, because predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting.

For peak-and-trough analysis, mean or median lags and mean deviations from the mean were calculated at cyclical turning points of indicator series compared to the reference series. The number of extra or missing cycles in indicator series compared to the reference cycle were considered as well. However, these figures are usually not statistically significant in the usual sense due to the limited number of turning points over the period covered in the investigation.

Second, a cross-correlation analysis was used to complement the peak-and-trough analysis concerning the average lag of the indicators and to give information about the cyclical conformity of each indicator to the reference series. This is important if the cyclical indicators are to give information about the likely amplitude of the movements in the reference series.

The cross-correlation analysis was performed on de-trended and smoothed indicator and reference series. The numbers of months lag at which the correlation has the highest value is a guide to the average lag of the indicator over the reference series and the value of the correlation coefficient is a measure of the "general fit" of the indicator in relation to the reference series. However, this method measures only the linear relationship between variables and the presence of extreme values can effect the estimate of the correlation coefficient.

2.2 Data and filters

All indicators used in the study were monthly and data not accounted in physical units or in qualitative form were adjusted to constant prices with a base of 1984. Although some series go back to 1970 most only go back to 1983. The main analysis is carried out over the period 1983 to 1996. The indicators are set out in Table 4 and include 22 quantitative series and 9 qualitative business survey series.

The data were not supplied seasonally adjusted. Seasonal adjustment, a prerequisite for cyclical analysis, was carried out using the X-11 program of the US Bureau of the Census, using the multiplicative version for the quantitative series and the additive version for the business survey series.

Indicators displaying a long-term trend are considered in terms of deviations from trend. The business survey series are used in the form of balances, i.e. the difference between the percentage of respondents giving positive and negative replies. These survey series showed no long-term trends and were used in original form.

The indicator series are adjusted for irregular movements using the "Months for Cyclical Dominance" (MCD) moving average procedure. This method ensures approximately equal smoothness between series,

and also ensures that the month-to-month changes in each series are more likely to be due to cyclical than irregular movements.

The de-trended and smoothed data are standardised so that their movements have the same amplitude in the aggregation of individual indicator series to obtain composite indicators. The method used to calculate standardised indices for each component series is to first, subtract the mean and then divide by the mean of the absolute values from the mean.

3. SELECTION OF REFERENCE SERIES AND CHRONOLOGY

Cyclical indicator systems are constructed around a "reference series" or "reference chronology". This makes it possible to establish the timing classification of economic series as leading, coincident or lagging with respect to some pre-determined benchmark.

The reference series is the economic variable whose cyclical movements it is intended to predict. If a single variable is used as reference series Gross Domestic Product (GDP) would be the obvious candidate. However, GDP estimates for Poland are available only on an annual basis for the period covered by the study. The index of industrial production is however available on a monthly basis for the period back to 1975 and was used as the main reference series for Poland.

Although the industrial sector is only about one third of total GDP, it is the most timely and reliable indicator of the state of the economy and may serve as a proxy for the aggregate cycle. The industrial production index is also used as the main reference series in the OECD indicator system. This facilitated comparison of cyclical developments in Poland with those of OECD countries.

The notion of a single series as the reference series or target variable is by no means universally accepted. Because of this a set of coincident indicators combined into a composite reference index was used to verify the choice of the industrial production index as the target reference series. The set of coincident indicators used for Poland was determined by considering coincident indicators used in individual OECD countries and the availability of Polish data over a longer time period.

The indicators used as input to the calculation of the Polish composite coincident indicator were: total industrial production, freight transport, investment outlays, cement production and retail sales. Theses are all available back to 1975 with exception of cement production and retail sales, which start in 1980 and 1983, respectively. The growth cycle chronologies and cyclical characteristics of these indicators are set out in Table 1 and the cyclical profiles of the series are presented in Chart 1.

Over the period 1975-1995, the composite coincident indicator registered 4 cycles measured from trough to trough. Of the three indicators with data back to 1975, investment outlays showed 2 additional cycles. Industrial production missed 1 cycle, while freight transport showed no difference compared to the composite coincident indicator. However, the contraction phase over the period 1978-79 is very short -- only 7 months as registered by the composite coincident indicator -- and is noted in the industrial production index as a drop in output over 4 months. This is too short to be considered as a phase because the minimum duration for a phase is 5 months. If this minor cycle is excluded, the cycles in industrial production show a one to one correspondence with the cycles in the composite coincident index.

The timing relationships between the indicators and the composite coincident indicator for all cycles show an average lead in the range of 1 to 5 months for all indicators with exception of retail sales which shows a zero lag. However, if the minor cycle over the period 1983 to 1985 is excluded the average lead is

reduced to 1 or 2 months for all indicators with exception of retail sales, zero lag and cement production, which shows a lead of 5 months. The median lead is 1 to 2 months for all cycles and 1 month excluding the minor cycle for all indicators with exception of retail sales, which shows a zero lag.

The general fit between the indicators and the composite coincident indicator over the investigated period as measured by the cross-correlation coefficient is very high -- over 0.76 for all indicators and as high as 0.92 for industrial production. The peak-correlation is estimated at zero lag for all indicators except for cement production for which it is measured with a lead of 1 month.

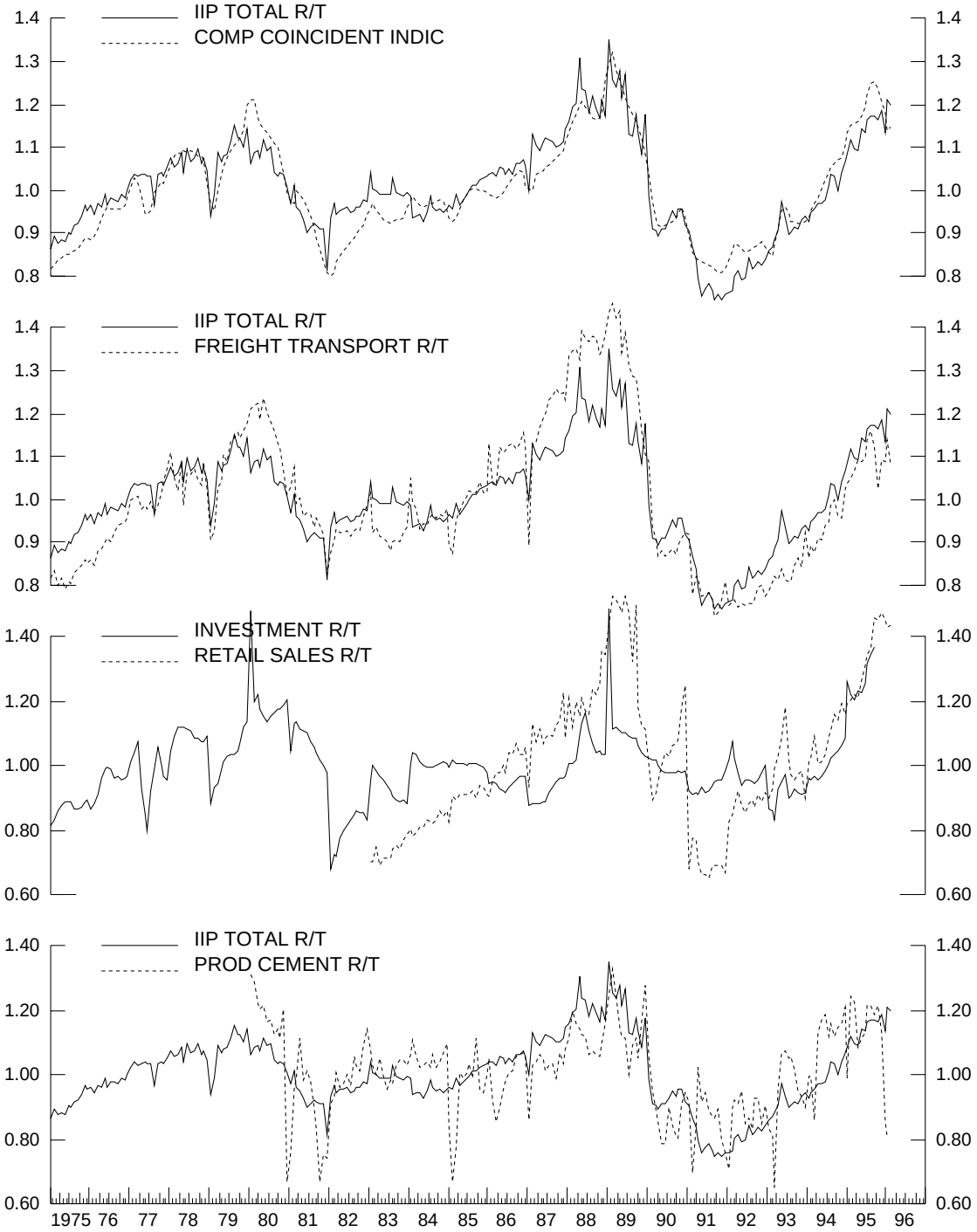
Table 1 Reference chronology and coincident indicators in Poland 1975-1995

Turning point dates and timing with composite coincident indicator

Turning points (TP)	**Composite coincident indicator**	**Industrial production**		**Retail sales**		**Freight transport**		**Cement production**		**Investment**	
	TP dates	**TP dates**	**Lag (+)**	**TP dates**	**Lag (+)**	**TP dates**	**Lag (+)**	**TP dates**	**Lag(+)**	**TP dates**	**Lag (+)**
Trough	Jan-75	Jan-75	0			Mar-75	2			Jan-75	0
Peak	Jul-78					Jan-78	-7			Mar-78	-4
Trough	Feb-79					Jan-79	-1			Jan-79	-1
Peak	Jan-80	Aug-79	-5			May-80	4	Jan-80	0	Jan-80	0
Trough	Jan-82	Dec-81	-1			Dec-81	-1	Dec-81	-1	Jan-82	0
Peak	Feb-84	Jan-83	-13			Jan-84	-1	Dec-82	-14	Feb-83	-12
Trough	Feb-85	May-84	-9			Feb-85	0	Feb-85	0	Dec-83	-14
Peak										Feb-84	
Trough										Jan-87	
Peak	Feb-89	Jan-89	-1	Jun-89	4	Feb-89	0	Feb-89	0	Jan-89	-1
Trough	Nov-91	Sep-91	-2	Jul-91	-4	Sep-91	-2	May-90	-18	Apr-91	-7
Peak										Feb-92	
Trough										Mar-93	
Number of cycles	4	3		0		4		2		6	
Extra cycles		0		0		0		0		2	
Missing cycles		1		0		0		0		0	
Lag at all cycles											
Mean			-4.43		0.00		-0.67		-5.50		-4.33
Median			-2		0		-1		-1		-1
Mean deviation			3.92		4.00		1.93		7.00		4.44
Lag excluding cycle in 83-85											
Mean			-1.80		0.00		-0.71		-4.75		-1.86
Median			-1		0		-1		-1		-1
Mean deviation			1.36		4.00		2.33		6.63		2.08
Cross-correlation											
lag (+)			0		0		0		-1		0
coefficient			0.92		0.88		0.89	0.76	0.76	0.76	0.76

The above results show the existence of a well-synchronised cyclical development in Poland and support the selection of industrial production as a proxy for the aggregate economic cycle. In the rest of this paper, industrial production is used as the target reference series for Poland.

CHART 1 POLAND COINCIDENT INDICATORS



4. GROWTH CYCLES IN POLAND AND THE OECD AREA

4.1 Main points of comparison

In the introduction it was noted that fluctuations in economic time series have been observed in socialist economies. These fluctuations had some of the cyclical characteristics of cycles in market economies. In this section growth cycles in industrial production in Poland and the OECD area will be compared on the basis of the: number of cycles, phase and cycle length, strength of cyclical amplitude and timing relationship over the period 1975 to 1995. The growth cycle chronologies and cyclical characteristics of the industrial production series are set out in Table 2. The main features and points of comparison of these cyclical characteristics are provided in the following paragraphs.

Poland registered 3 growth cycles, measured from trough to through, over the period 1975-1995. Of these, one, the cycle over the period 1983-84, may be classified as a minor cycle both with regard to duration and cyclical amplitude. The OECD total area registered 5 growth cycles over the same period, of which two, the cycles over the periods 1977-78 and 1980-81, may be classified as minor cycles on the same grounds.

The average duration of the expansion phase in Poland was about double the length of that for the OECD total area, i.e. 45 and 22 months, respectively, measured over all turning points. The same difference is registered if the phase length is only calculated over major turning points, i.e. 77 and 38 months, respectively.

The average duration of the contraction phase in Poland and the OECD area was about the same, i.e. 25 and 21 months, respectively, measured over all turning points and about the same, 30 and 35 months, respectively, calculated over major turning points.

The average amplitude of the expansion phase in Poland was about four times higher when compared to the OECD total area, 25.5 per cent and 6.5 per cent of trend, respectively, measured over all turning points and three and a half times higher, 32.9 per cent and 9.5 per cent of trend , respectively, calculated over major turning points.

The average amplitude over the contraction phase in Poland was over five times lower when compared to the OECD total area -29.8 per cent and -5.6 per cent of trend, respectively, measured over all turning points and about five times lower, if the amplitude is only calculated over major turning points, -39.4 per cent and -7.9 per cent of trend, respectively.

The average duration of the cycle in Poland, measured from trough to trough, was over one and a half times longer when compared to the OECD total area, i.e. 71 and 43 months, respectively when measured over all turning points. About the same difference is registered, if the cycle is only calculated over major turning points, i.e. 107 and 72 months, respectively. The same difference is registered, if the cycle is measured from peak to peak over all turning points, but is about two times longer if the cycle length is only calculated over major turning points.

The cyclical development in Poland as described above shows a strong cyclical pattern. This pattern corresponds closely to the definition of the business cycle in market economies, that is, with an expansion phase longer than the contraction phase and very strong cyclical amplitudes. These results differ from the

cyclical characteristics of the general cycle in the OECD area which shows a more symmetric and shorter cycle with less pronounced amplitudes. The sharp drop in output in Poland over the transition cycle in 1989-91 also contributes to the strong cyclical amplitudes registered over the study period. These differences are likely to diminish as Poland moves to a market economy and becomes more integrated in the world economy.

Table 2: Cyclical characteristics of industrial production in Poland and the OECD area 1975-1995

	Poland							OECD total area						
Turning points (TP)	**TP dates**	**Duration (months)**				**Amplitude**		**TP dates**	**Duration (months)**				**Amplitude**	
		Phase		**Cycle**		**% of trend**			**Phase**		**Cycle**		**% of trend**	
		All TP	**Maj. TP**	**All TP**	**Maj. TP**	**All TP**	**Maj. TP**		**All TP**	**Maj. TP**	**All TP**	**Maj. TP**	**All TP**	**Maj. TP**
Trough	Jan-75							May-75						
Peak								Jan-77	20				10.1	
Trough								Feb-78	13		33		-1.4	
Peak	Aug-79	68	68			27.8	27.8	Feb-80	24	57	37		6.3	14.9
Trough								Sep-80	7		31		-5.4	
Peak								Jul-81	10		17		2.7	
Trough	Dec-81	28	28	96	96	-24.6	-24.6	Dec-82	17	34	27	91	-8.4	-11.1
Peak	Jan-83	13		41		13.9								
Trough	May-84	16		29		-10.4								
Peak								May-85	29	29	46	63	6.5	6.5
Trough								Jan-87	20	20	49	49	-3.4	-3.4
Peak	Jan-89	56	85	72	113	34.7	38.2	Apr-89	27	27	47	47	7.1	7.1
Trough	Sep-91	32	32	88	117	-54.3	-54.3	Oct-93	50	50	77	77	-9.3	-9.3
Number of TP	7							11						
Maj. TP	5							7						
Number of cycles:														
Trough to trough				3	2						5	3		
Peak to peak				2	1						4	2		
Phase average:														
Expansion		45	77			25.5	32.9		22	38			6.5	9.5
Contraction		25	30			-29.8	-39.4		21	35			-5.6	-7.9
Cycle average:														
Trough to trough				71	107						43	72		
Peak to peak				56	113						37	55		

Note: Major turning points (Maj. TP) exclude the following minor TP in Poland - January 1983 and May 1984 and the following minor TP in the OECD total area - January 1977, February 1978, September 1980 and July 1981

Total OECD area excludes the Czech Republic, Hungary, Mexico, Poland and South Korea [Ronny- is this correct?]

4.2 Linkage between cyclical development in Poland and the OECD area

Cyclical fluctuations between countries are generally transmitted via foreign trade, foreign investment, capital movements and other financial flows, tourism, etc. in open economies and a regular cyclical pattern is observed between OECD countries. The linkage between the cyclical development in Poland and the OECD area is investigated in the following paragraphs. The timing relationships between growth

cycles in industrial production in major OECD countries and zones and Poland are presented in Table 3 and the cyclical developments of selected series are illustrated in Chart 2.

The investigated period is divided into two sub-periods -- pre-transition 1975-82 and transition 1983-96. The choice of 1983 as the starting year for the transition period is not based on any strict definition of the concept of transition but is selected because Polish society experienced deep crisis and the collapse of the socialist economy over this period. The shortness of the investigated sub-periods, in particular, the pre-transition period, i.e. 8 years of data, and the number of turning points over both sub-periods do not allow any firm conclusions to be drawn. The results should therefore only be taken as indications of the timing relationships between cycles in Poland and the OECD area.

The timing relationships are measured with mean and median lag at major turning points and cross-correlation lag over the relevant periods.

Over the pre-transition period 1975-82, growth cycles in Poland show a stable relationship with the North American cycle with a lead of 2-3 months as measured by the median lag or cross-correlation lag, respectively. A lead of 2 and 3 months is registered for Poland against the total OECD area and the OECD Europe area, respectively, measured by the median lag and a 6 months lead against both zones measured by the cross-correlation lag. The results over this period are however affected by the two oil crises which synchronised the cycles to a certain extent across OECD countries. Despite this, the general tendency points to a rather close connection between growth cycles in Poland and the major OECD countries and areas over this period.

The results for the transition period 1983-96 indicate a more mixed pattern compared to the pre-transition period with only the North American cycle showing a stable relationship with the Polish cycle, but now with a lead of 2-3 months when measured by the median or cross-correlation lag, respectively. On the other hand, total OECD and OECD Europe lag the Polish cycle by a little over a year measured by the median and by a little less than two years measured by the cross-correlation lag. The results over this period are however affected by the transition cycle in 1989-91 in Poland which is linked to the breakdown of trade between countries belonging to the previous COMECON market. The only major European OECD country showing close similarity with the Polish cyclical development over the transition period is the United Kingdom, with a lag of 6 and 10 months measured by the median lag and cross-correlation lag, respectively **[any reason for this].**

Future cycles in Poland are likely to follow much the same path as in OECD countries as Poland moves to a market economy and becomes more integrated in the in the world economy. The above results indicate that this link already existed in the pre-transition period. The link will certainly be stronger in the future.

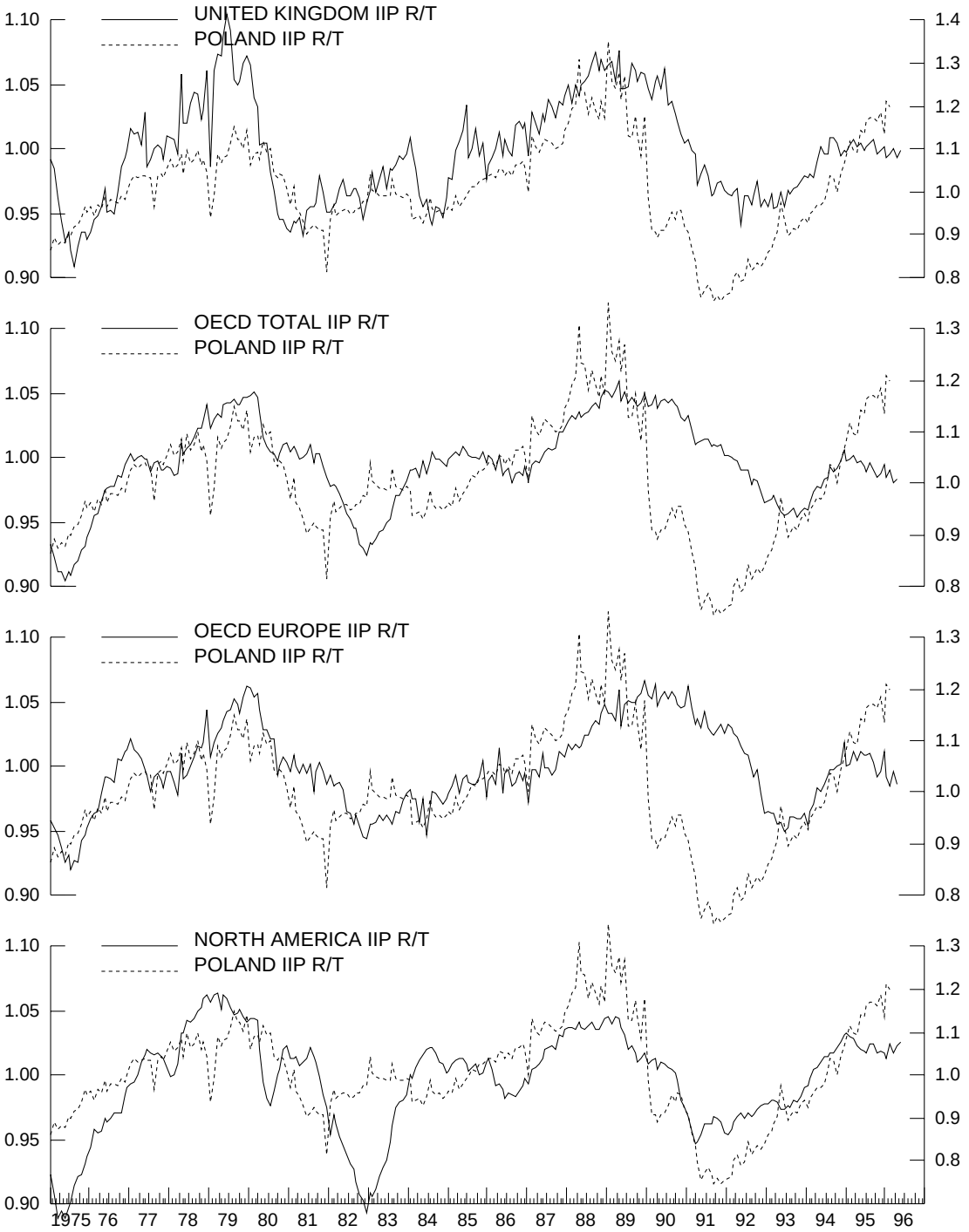
The next cyclical turning point in Poland based on conditions in a market economy will provide the first information about the future timing relationship with the OECD area.

Table 3: Growth cycles in industrial production in major OECD countries and zones compared to growth cycles in Poland

Mean and median lag (+) at major turning points and cross-correlation over indicated periods

	1975-1996					1975-1982			1983-1996		
	Mean Lag (+)	**Mean deviation**	**Median Lag (+)**	**Cross-correlation**		**Median Lag (+)**	**Cross-correlation**		**Median Lag (+)**	**Cross-correlation**	
				Lag (+)	**Coeff.**		**Lag (+)**	**Coeff.**		**Lag (+)**	**Coeff.**
Canada	-1.20	7.04	0	1	0.68	4	6	0.68	-10	-2	0.77
United States	1.20	4.96	2	0	0.58	2	3	0.73	-2	-3	0.70
Japan	12.80	8.16	10	25	0.85	6	3	0.59	23	27	1.00
France	16.00	11.60	18	21	0.59	4	1	0.75	20	25	0.81
Germany	14.40	8.88	11	27	0.73	6	2	0.74	26	33	1.00
Italy	14.40	6.88	11	17	0.51	8	6	0.55	20	17	0.54
United Kingdom	1.80	5.04	3	3	0.69	6	-3	0.83	6	10	0.88
North America	1.40	5.20	2	0	0.60	2	3	0.73	-2	-3	0.72
OECD Europe	11.00	4.40	11	20	0.66	6	2	0.77	16	22	0.82
OECD Total	**9.80**	**6.96**	**6**	**16**	**0.67**	**6**	**3**	**0.75**	**14**	**20**	**0.86**

CHART 2 GROWTH CYCLES IN POLAND AND OECD



5. CYCLICAL INDICATORS

5.1 Selection of indicators

The identification and selection of cyclical indicators in Poland over the study period 1975-1996, or 1983-1996 for most indicators, is difficult due to the fact that economic fluctuations over the transition period may be due to quite different reasons than in the pre-transition phase. These differences in the mechanism of economic growth may make it difficult to identify reliable cyclical indicators over a period that spans pre-transition and post-transition years.

To address problems related to changing cyclical behaviour the selection of cyclical indicators over the transition period must be based on a broader range of criteria than that normally used for cyclical analysis. These are:

- Cyclical sensitivity; series with a pure cyclical behaviour are preferred. This is important in a situation when the cyclical behaviour cannot be estimated from historical data.

- A second condition is linked to economic significance in the sense that the cyclical relationship should be explained by the series' ability to measure early stages of the cycle, respond rapidly to changes in economic activity and measure expectations or be sensitive to expectations.

Statistical series derived from business surveys fulfil these requirements because the cyclical profile of the series are in many cases easier to detect as they contain no trend and are usually smoother than corresponding quantitative indicators. In addition, business surveys collect information about a wide range of variables selected for their ability to monitor and forecast the business cycle.

The particular economic conditions in socialist economies make it difficult to use series related to monetary and financial conditions during the transition period. These series, such as interest rates and money supply, reflect important policy instruments in OECD countries. In the past in socialist economies they were considered irrelevant.

Series referring to marginal employment adjustments such as overtime and lay-off rate and other labour market series such as vacancies and hours worked were virtually irrelevant to the post-socialist countries in the past because they measured phenomena peculiar to market economies. This implies that it may be difficult to establish the cyclical relationship for these series over the past and the present. They will however be strong candidates for potential leading indicators in the future.

The structural changes taking place in transition countries will affect the cyclical behaviour in the different sectors of their economies. This will mean instability in the cyclical relationship and will also be a source of increased differentiation among indicators over the cycle. The latter effect will mean that leading indicator series may be found on a more disaggregated level by detailed activities and markets than is usually the case in OECD countries **[not clear why].**

Characteristics of pre-transition data

When analysing data over both the transition and pre-transition periods it is necessary to consider both the differences in the mechanism of economic growth and other statistical problems affecting data. The main

statistical problems affecting short-term data in both periods are related to coverage and recording and compilation of indices.

In the past , statistics in post-socialist countries only covered state enterprises and co-operatives. Private enterprises became legal in Poland in 1988. Since then their number has grown dramatically and they now account for about 90 per cent of the number of all economic entities (excluding agriculture). In 1995 the private sector accounted for about 50 per cent of GDP. Establishing and updating the business register and the collection of data on a sample rather than a census basis are major innovations which will take time to implement fully and effectively. As a result many series over the transition period will still cover only the state and co-operative sectors. Parts of the private sector will be missing. The extent of the omission will vary over time and from series to series.

The recording practice in the past in socialist countries was very often to collect sales or output data on a cumulative basis. Monthly and quarterly data were derived by subtracting the previously reported cummulative figure from the current cummulative figure. This sometimes led to an error in the time at which activity was recorded because errors in previous reports would not be corrected explicitly but simply incorporated in a new cumulative total. This practice introduced a distortion, at least in output data, because the data were used for monitoring production targets, expressed in quarterly or annual terms. This reporting practice resulted in a seemingly large seasonal component in the final month of each quarter and in the final quarter of each year.

In the past, prices in post-socialist countries were officially fixed by the State. These prices were used in the compilation of official price indices. Moreover, too much of the increase in prices was attributed to quality change than was justified in terms of the improved utility of the products. This under-statement of price rises led to an over-statement of quantities when volume measures, such as indices of production, were derived by dividing current price data by price indices.

Another problem affecting index numbers in volume terms was that they were calculated as current-weighted index numbers, i.e. ratios of current production at current prices to base-year production valued at current prices. The problem with this type of index is that comparisons between any two periods except the base period do not accurately reflect the change between the two periods. Index number compilation was also affected by reclassification of state enterprises from one sector to another in such a way that comparisons between different periods were invalidated.

Short-term statistics in Poland are partly affected by the above statistical problems over the study period though where possible the indicators have been corrected for these various deficiencies. Series referring to physical units were included in order to have some series not affected by problems arising from the use of defective price indices. These series were also used as controls to verify other series. The selection of indicators is however very much related to the availability of long time series with no breaks.

It is very important to have a broad range of indicators reflecting the cyclical development from different parts of the economy when analysing fluctuations in aggregate economic activity. In the selection of potential cyclical indicators for Poland the indicator series included in the OECD system of leading indicators were used as the reference frame. A number of potential cyclical indicators were pre-selected taking into account the above problems related to changing cyclical behaviour, statistical problems and data availability.

All of the potential quantitative cyclical indicators considered cover a period of at least 13 years. Also, a set of qualitative business survey series is available for a period of 10 years for most series and for about 5

years for a few series. The business survey series used in this study are compiled by the Research Institute for Economic Development at the Warsaw School of Economics. The quantitative series cover:

- production and stocks
- income and expenditure
- ransport and trade
- labour force
- prices
- costs and profits
- money and finance
- foreign trade.

The selected indicators are presented in Table 4.

5.2 Evaluation of indicators

The cyclical properties of the pre-selected indicators were evaluated against the reference series, i.e. industrial production, using the following criteria:

- length and consistency of the lag of the indicator over the reference cycle at turning points;
- "cyclical conformity" between the indicator and the reference series;
- absence of extra missing cycles in comparison with the reference series; and
- smoothness, that is, how promptly a cyclical turn in the series can be distinguished from irregular movements.

The historical cyclical performances of the pre-selected indicators are set out in Table 4 and the cyclical profiles of this set indicators are illustrated in Charts 7-12 in Annex 1. The analytical measures and statistics used in evaluating the indicators for most indicators refer to the period 1983 to 1995 or to the period starting in the year indicated in the table next to the start date of the series. However, the minor cycle over the period 1983 to 1985 is dated differently by the industrial production and the composite coincident indicator series indicating a problem in defining the reference chronology over this period. To reduce the effect of this problem in the evaluation process indicators available over the period 1983 to 1996 are analysed for performance at turning points with this minor cycle excluded in addition to the analysis over the whole period. The statistics given refer to the de-trended (ratio-to-trend) indicator series and reference series.

The main objective of the analysis is to identify leading indicators. A number of indicators showing a coincident or lagging behaviour in relation to the reference cycle were excluded from the pre-selected set

of indicators. The results of the analysis are examined by indicators and subject area in the following section.

5.2.1 Production and stocks

The analysis was conducted on large number of production series by major products. All series were expressed in physical units. Most of these series showed a coincident behaviour in relation to the aggregate production cycle over the transition period and a lagging tendency in the pre-transition period. Among these indicators, only those showing a leading tendency were included in the pre-selected set with the exception of cement production, which was selected as a component for the composite coincident indicator.

The overall results for the series relating to output of major products were disappointing. All indicators showed short leads as measured either by the mean or median lag at turning points or with the peak cross-correlation lag. All of them exhibited high irregular variation as measured by the MCD value, 3 to 6 months and most of the series showed a number of extra turns in relation to the reference series. Production of fertilisers is the only series showing some significant leading characteristics according to the mean and median lag. This lead is not however confirmed by the peak cross-correlation lag. The series on passenger cars, petroleum and sawn wood showed the best leading tendencies as measured by the peak cross-correlation lag over the whole period, and by the median lag with turning points over the period 1983 to 1985 excluded.

Two sectoral production series, food and electrical engineering industry, were included due to their importance in the Polish economy. Both series showed a coincident character based on turning points analysis over the whole period. However, the food sector showed a leading tendency according to the peak-correlation lag and a lead of 10 months as measured by the median lag with turning points over the period 1983 to 1985 excluded. The coincident status was confirmed for the electrical engineering sector on both measures.

Three stock series, total (excluding agriculture), industrial and finished products stocks, were investigated though only the finished products stocks series which exhibited a leading character in inverted form was included in the pre-selected set of indicators. This series shows a stable lead of 5 or 7 months measured with the mean or median and peak cross-correlation lag, respectively. The series is however rather irregular and shows two extra turns and one missing turn in relation to the reference series.

5.2.2 Income and expenditure

The three series considered were: personal income; investment outlays; and the ratio of food expenditure to total expenditure per capita (a measure which characterises the income level of households).

Personal income was pre-selected as a component for the composite coincident indicator but was not included in this indicator because of conflicting information concerning its cyclical character. There is clear leading behaviour according to the turning point analysis but a coincident relationship based on the peak correlation lag and a rather weak correspondence with the reference cycle.

The investment series showed a very stable relationship with the reference cycle over the whole period investigated, 1975-1996, and was selected as a component for the composite coincident indicator.

Food expenditure as a share of total expenditure showed a very long lead of 18 months in inverted form according to the peak correlation lag, but with a rather low value for the correlation coefficient of -0.37. This leading character was not confirmed by the turning point analysis carried out over the whole period, which indicated a coincident or lagging behaviour. However, when the series was considered with the minor cycle in 1983 to 1985 excluded the turning points analysis supported the leading tendency as indicated by the peak correlation lag.

5.2.3 Transport and trade

The two transport series analysed, cargo reloaded at commercial seaports and freight transport, showed a very good correspondence with the reference cycle over the pre-transition period, with a peak correlation lag of about zero and a correlation coefficient of about 0.90. This pattern continued for the freight transport series during the transition period. The cargo reloaded series changed character and became a leading indicator in the transition period with a stable lead of 11 months measured at turning points. It also showed a rather good correspondence with the reference cycle with a peak correlation lead of 16 months. The third series considered was retail sales which showed a very stable relationship with the reference cycle at zero lag and was selected as a component for the composite coincident indicator.

5.2.4 Labour force

Job advertisements and labour productivity were the only two series analysed. Job advertisements showed a weak relationship with the reference cycle over the pre-transition period though the relationship became stronger during the transition period. The cyclical character of the series over the transition was coincident measured with the median lag and peak correlation lag, but leading according to the mean lag. However, when the series was considered with the minor cycle in 1983 to 1985 excluded both the mean and median lag indicate a strong leading behaviour. Labour productivity showed a stable leading relationship with the reference cycle. The median lead was 9 months measured over the whole transition period, and 3 months excluding the minor cycle in 1983 to 1985.

5.2.5 Prices, costs and profits

The two series considered were the ratio of prices in agriculture (i.e. procurement prices of pigs to prices of a standard fodder set) a proxy for profitability in animal production and the liabilities of enterprises. Both series showed a stable leading relationship with the reference cycle. The ratio of theprices series showed a lead of 3 to 5 months in inverted form on all measures. The enterprise liabilities series showed a very long lead of 17 to 21 months on all measures.

5.2.6 Money and finance

Series analysed included money supply, personal deposits and the US dollar exchange rate treated in inverted form. All series showed long leads in the range of 10 to 20 months at turning points measured with the mean or median lag. However, this long lead was not confirmed by the peak correlation lag for the series on personal deposits and the relationship with the reference cycle was very poor for the series.

The other two series showed good correspondence with the reference cycle and the long lead at turning points measured with the mean and median lag was confirmed by the peak correlation lag.

5.2.7 Foreign trade

Changes in the recording of foreign trade statistics make it difficult to use historical data. These were due to changes in coverage and timing. As a result the only series analysed was total exports recalculated back to 1987. This series showed a short lead of 2 to 3 months at turning points on all measures and the relationship with the reference cycle was rather good.

5.2.8 Business surveys

Nine business survey series concerning assessments and expectations of economic variables by entrepreneurs in the industrial sector were analysed over the period 1986-1996 for most series and for the period 1991-1996 for a few series. The series selected included: production, new orders, finished goods stocks, employment, capacity utilisation and "business climate" measured by the average of the series on current production assessment and production expectations.

The survey series available over the period 1986-1996 showed very long leads at turning points measured by the mean or median lag with the exception of capacity utilisation which showed a coincident behaviour with the reference cycle. The mean or median lead for these survey series was in the range of 10 to 21 months and the peak correlation lag supported these results. The correspondence with the reference cycle was also very good with a correlation coefficient in the range of 0.84 to 0.94. These results concerned the following series: production and export production tendency, future production tendency, employment tendency and business climate.

The three series available over the period 1991-1996 (total and export new orders and finished goods stocks) showed good leading behaviour as well when measured with the peak correlation lag. However, the lead was not as long compared to the other survey series analysed. The shorter lead mainly concerned the new orders series. All of these series showed good cyclical relationship with the reference cycle.

In addition, all survey series showed no extra or missing turning points in relation to the reference series over the short period investigated and the irregular variation was rather low with MCD values of 3 or less for most series.

These results indicate that the survey series are very good cyclical indicators and all qualify as leading indicators except for capacity utilisation. A new business survey produced by the Central Statistical Office (GUS) was introduced in 1992. This survey is based on a larger sample with better coverage of the private sector and will increase the pool of potential cyclical indicators in the near future.

Table 4: Cyclical characteristics of selected Polish indicators, 1983-1996

Indicators by subject area	Start date of series	MCD	Number of cycles	Number of turns	Extra turns	Missing turns	Lag (+) at turning points (TP)				Cross-correlation	
							Mean	Median	Mean deviation	Excl. TP in 1983/85 Median	Lag (+)	Coeff.
Industrial production (IP)	1975 (83)	3	1	4								
Production and stocks												
Food industry production	1983	3	1	4			0.00	4	9.50	-10	-3	0.61
Electric engineering industry prod	1983	3	2	6	2		2.75	3	1.75	1	0	0.75
Production of passenger cars	1970 (83)	5	1	6	2		0.70	1	4.75	-2	-3	0.43
Production of cement	1980 (83)	6	1	4			1.75	0	7.13	-8	0	0.80
Production of petroleum	1970 (83)	6	2	6	2		2.25	3	3.25	-1	-2	0.69
Production of fertilisers, phosph.	1970 (83)	5	2	6	2		-6.50	-5	9.00	3	0	0.95
Production of sawn wood	1970 (83)	4	1	4			-1.50	2	11.50	-13	-2	0.60
Finished products stocks, inv.	1983	4	2	5	2	1	-5.00	-5	1.33	-6	-7	-0.48
Income and expenditure												
Personal income	1983	2	3	7	4	1	-10.7	-12	7.11	-10	-1	0.33
Investment outlays	1975 (83)	3	3	8	4		0.25	1	2.75	-3	0	0.50
Ratio expenditure food/ total, inv.	1983	2	2	6	2		0.00	4	8.50	-7	-18	-0.37
Transport and trade												
Cargo reloaded at sea ports	1975 (83)	4	1	4	2	2	-11.00	-11	5.00	-11	-16	0.57
Freight transport	1975 (83)	3	2	6	2		0.50	1	1.00	1	1	0.96
Retail sales	1983	3	1	4	2	2	-1.00	-1	0.00	2	0	0.77
Labour force												
Job advertisement	1975 (83)	3	1	4	1	1	-5.67	0	8.89	-9	0	0.64
Labour productivity	1983	5	2	5	2	1	-5.67	-9	5.78	-3	-8	0.63
Prices, costs and profits												
Ratio of prices , animal prod., inv.	1971 (83)	3	2	6	3	1	-4.00	-3	2.00	-5	-5	-0.41
Liabilities of enterprises	1983	1	2	5	2	1	-18.00	-20	4.00	-21	-17	0.86
Money and finance												
Money supply	1983	1	2	5	2	1	-11.00	-14	8.00	-10	-18	0.67
Personal deposits	1983	1	3	7	4	1	-11.00	-14	8.00	-10	-2	0.24
Exchange rate USD, inverted	1980 (83)	1	1	3		1	-15.7	-20	11.11	-10	-16	-0.83
Foreign trade												
Exports	1987 (87)	4	1	3	1		-3.00	-3	6.00	-3	-2	0.75
Business surveys												
Production tendency	1986 (86)	3	0	2			-10.50	-11	7.70	-11	-10	0.89
Export production tendency	1986 (86)	3	0	2			-14.00	-14	9.00	-14	-5	0.84
Employment tendency	1986 (86)	3	0	2			-10.00	-10	12.00	-10	-13	0.85
Business climate	1986 (86)	1	0	2			-18.50	-19	1.50	-19	-11	0.93
New orders	1991 (91)	3	0	1			na	na	na	na	-4	0.92
Finished goods stocks, inv.	1991 (91)	3	0	1			na	na	na	na	-10	-0.75
Export new orders	1991 (91)	4	0	1			na	na	na	na	-6	0.95
Capacity utilisation	1986 (86)	1	0	2			-2.50	-3	5.50	-3	3	0.90
Production future tendency	1986 (86)	3	0	2			-21.00	-21	2.00	-21	-14	0.94

6. COMPOSITE INDICATORS

A major tool in the NBER approach to business cycle analysis is the construction of composite indicators. This entails combining cyclical indicators into a single synthetic indicator. This may be a single reference

or coincident composite indicator, a leading or a lagging composite indicator. Indicators are constructed in order to reduce false signals and to provide a composite indicator with better forecasting and tracking qualities than any of its individual components. To the extent that the component series are not perfectly correlated, composite indicators reduce false signals due to measurement errors and irregular variation, as well as to the importance of specific cyclical developments.

The reason why a group of indicators combined into a composite indicator should be more reliable over a period of time than any of its individual components is related to the nature and causes of business cycles. Each cycle has its unique characteristics as well as features in common with other cycles. No single cause explains cyclical fluctuation over a period of time in overall activity. The performance of individual indicators will then depend on causes behind a specific cycle. It is therefore necessary to have signals from the many possible causes of cyclical changes, i.e. to use all potential indicators as a group.

The OECD method was used for the construction of composite indicators in this study. This method differs in a number of aspects from the Shiskin procedure currently used by among others, the US Department of Commerce (The Conference Board) and the Center for International Business Cycle Research (CIBCR) in the United States.

The main difference between the two methods concerns the standardisation procedure. The OECD procedure uses de-trended or ratio-to trend series as input to the calculation of composite indicators. The procedure consists of standardising each component series with respect to mean and amplitude by first subtracting the mean from the ratio-to-trend series and then dividing by the mean absolute deviation from the mean. The Shiskin procedure works with month-to-month changes either in percentage form or as differences, and the changes are standardised by dividing the month-to-month changes by the average month-to-month change.

The results of the evaluation of cyclical indicators presented in the previous section formed the basis for the selection of leading indicators to be included in a composite leading indicator for Poland. Different combinations of indicators were used as input to the calculation of a set of composite indicators and the performance of the composite indicators was evaluated against the reference series.

6.1 Composite leading indicators

The best leading indicators were selected from the set of candidate indicators in each subject area on the basis of the empirical results. A set of 14 indicators from all subject areas except income and expenditure was used to construct six different composite leading indicators. The six different sets of composite leading indicators and the component series included are presented in Table 5. The cyclical profiles of the component series are illustrated in Charts 7-12 in Annex 1.

The composite indicator CLI-14 includes all of the 14 selected indicators. A second composite indicator, CLI-12, is based on 12 of the best leading indicators in the total set of selected indicators and excludes the series on finished goods stocks and ratio of prices in animal production. Both indicators are excluded on the grounds of bad correlation with the reference series, the number of extra and missing turning points and extreme values in the case of the stocks series.

Table 5. Composite leading indicators and component series

	Composite indicator, CLI-14		**Composite indicator, short, CLI-12S**
1	Food industry production	1	Food industry production
2	Production of sawn wood	2	Production of sawn wood
3	Finished products stocks, inverted	3	Cargo reloaded at commercial seaports
4	Cargo reloaded at commercial seaports	4	Labour productivity
5	Labour productivity	5	Exports
6	Ratio of prices in animal production, inverted	6	Production tendency, BS
7	Liabilities of enterprises	7	Finished goods stocks, inverted, BS
8	Money supply	8	Export new orders, BS
9	Exchange rate USD, inverted		
10	Exports		**Composite indicator, long, CLI-12L**
11	Production tendency, BS	1	Liabilities of enterprises
12	Finished goods stocks, inverted, BS	2	Money supply
13	Exports new orders, BS	3	Exchange rate USD, inverted
14	Production future tendency, BS	4	Production future tendency, BS
	Composite indicator, CLI-12		**Composite indicator, combined, CLI-12C**
	All components in composite indicator CLI-14, excluding indicators no. 3 and 6		Components in short and long composite indicators combined
	Composite indicator, CLI-7		
1	Food industry production		
2	Production of sawn wood		
3	Cargo reloaded at commercial seaports		
4	Money supply		
5	Exports		
6	Exports new orders, BS		
7	Production future tendency, BS		

A short-term composite leading indicator was constructed from the component series in CLI-12 with leads of less than 10 months measured with mean or median lag. A long-term composite indicator was also calculated containing the longer leading series, with leads over 10 months lead according to mean or median lag. Finally, a combined leading indicator was calculated based on the short-term composite indicator and the long-term composite indicator weighted by the number of component series in each, and with the longer leading indicator lagged 6 months to adjust for the difference in lag structure.

The selection of component series for the above five composite indicators was based on the empirical results concerning performance at turning points. The cyclical relationships discovered for certain series may however reflect special conditions in the transition to a market economy which may persist only in the short run. For this reason a composite indicator (CLI-7) was constructed from the total set of selected indicators using only those with a clear economic rationale for their cyclical behaviour in market economies and those with an understandable effect on economic growth in Poland. This composite indicator included two important sectoral production series, three series related to exports and imports, money supply and production expectations. The two last mentioned indicators have a much longer lead compared to the other indicators included and were lagged 6 months when they were included in the composite indicator. This indicator will serve as a reference indicator for the other composite indicators.

The cyclical performances of the six composite leading indicators over the period 1983 to 1996 are set out in Table 6 and the cyclical profiles of the series are illustrated in Charts 3 to 6. However, as noted in section 5.2 above the minor cycle over the period 1983-85 is dated differently by the industrial production and composite coincident indicator series. This indicates a problem in defining the reference chronology over this period. Because of this the composite indicators is analysed for performance both at turning points with this minor cycle excluded, and its performance over all turning points.

The composite indicators do however indicate a minor cycle over the period 1983-85 as detected by the coincident composite indicator. When this minor cycle is included the results are as follows. The broad based composite indicator (CLI-14) shows a short lead of 1 to 2 months against the composite coincident indicator, while the stripped down indicator (CLI-12) improves considerably the lead to 11 months though with a large mean deviation of the lead. The difference in lead time between the two indicators is mainly explained by the dating of the double-trough in 1990-91 which is not clear-cut as can be seen in Chart 3.

The shorter-leading indicator shows a lead of 3-4 months and the longer-leading indicator shows a long lead of 23 months measured over two turning points. The minor cycle in 1983-85 is not picked-up. The combined composite indicator shows a lead of 4-6 months. The cyclical profile of the shorter-, longer- and combined indicator is illustrated in Chart 4 against the coincident indicator and in Chart 5 against industrial production. The reference indicator (CLI-7) shows the best performance of all indicators, with an average lead of 4-6 months and with a leading tendency at all turning points. The performances of this indicator, the stripped down indicator and the combined indicator are illustrated in Chart 6.

The analysis with the minor cycle over the period 1983-85 excluded gives about the same results for performance at turning points between the different composite leading indicators and the industrial production and composite coincident indicator as reference series. The broad based indicator (CLI-14) now shows a lead of 5-7 months against the coincident indicator and a short lead of 3 months against industrial production. The stripped down indicator (CLI-12) is improves its performance and shows a stable lead of 22 months against the coincident indicator and a lead of 20 months against industrial production.

The shorter leading indicator also improves and indicates a lead of 8 and 7 months against the coincident indicator and industrial production, respectively. The long term indicator is unchanged with a lead of 23 months against the coincident indicator and shows a lead of 21 months against industrial production. The combined indicator expands the lead to 12 months against the coincident indicator and shows a lead of 11 months against industrial production. The reference indicator (CLI-7) shows about the same results as the combined indicator.

Table 6: Composite leading indicators in Poland, 1983-1996

Turning point dates and timing with composite coincident indicator

	Reference series		Composite leading indicators											
Turning points (TP)	Composite coincident indicator	Industrial production	CLI-14		CLI-12		CLI-12S short		CLI-12L long		CLI-12C combined		CLI-7	
	TP dates	TP dates	TP dates	Lag (+)	TP-dates	Lag (+)	TP dates	Lag (+)	TP dates	Lag (+)	TP dates	Lag (+)	TP dates	Lag (+)
Peak	Feb-84	Jan-83	Jul-84	5	Feb-84	0	Feb-84	0			Feb-84	0	Jan-84	-1
Trough	Feb-85	May-84	Jan-85	-1	Jan-85	-1	Feb-85	0			Feb-85	0	Jan-85	-1
Peak	Feb-89	Jan-89	Dec-88	-2	Apr-87	-22	May-88	-10	Mar-87	-23	Sep-87	-17	Sep-87	-17
Trough	Nov-91	Sep-91	Apr-91	-7	Feb-90	-21	May-91	-6	Jan-90	-22	Apr-91	-7	May-91	-6
Number of TP	4	4	4		4		4		2		4		4	
Extra turns			0		0		0		0		0		0	
Missing turns			0		0		0		2		0		0	
Lag at all TP														
Mean				-1.25		-11.00		-4.00		-22.50		-6.00		-6.25
Median				-2		-11		-3		-23		-4		-4
Mean deviation				3.25		10.50		4.00		0.50		6.00		5.38
Lag excluding TP in 83-85														
against coincident indicator														
Mean				-4.50		-21.50		-8.00		-22.50		-12.00		-11.50
Median				-7		-22		-8		-23		-12		-12
Mean deviation				2.50		0.50		2.00		0.50		5.00		5.50
against industrial production														
Mean				-3.00		-20.00		-6.50		-21.00		-10.50		-11.00
Median				-3		-20		-7		-21		-11		-11
Mean deviation				2.00		1.00		2.50		1.00		5.50		5.00
Cross-correlation														
against coincident indicator														
lag (+)				-7		-8		-7		-16		-8		-4
coefficient				0.85		0.83		0.80		0.79		0.87		0.84
against industrial production														
lag (+)				-8		-11		-8		-16		-9		-6
coefficient				0.84		0.82		0.76		0.88		0.87		0.78

The cross-correlation results calculated over the whole period 1983-96 in general support the mean and median lag results obtained from the turning point analysis. The reference composite indicator shows the best correspondence with about the same lag at all turning points for the two measures, but with a longer mean or median lag calculated with turning points over the period 1983-85 excluded. The peak correlation lag for the stripped down composite indicator (CLI-12) is however estimated with a relatively shorter lead compared to the coincident indicator of 8 months. The longer leading indicator now shows a reduced lead of 16 months in comparison to the coincident indicator.

For the other composite leading indicators the lead estimated by the peak correlation lag is a bit longer when compared to the mean and median lag against the coincident indicator, with exception of the

combined indicator which shows a mixed pattern when compared with mean and median lag when both calculated over all turning points or with 1983-85 excluded.

The peak correlation lag against industrial production is about the same as against the coincident indicator for all composite leading indicators and the cyclical profile between the indicators and the two reference series is very good with a correlation coefficient in the range of 0.78 to 0.88 for all composite leading indicators.

The overall results suggest that the combined indicator is the best composite leading indicator series. The cyclical profile is very good with a correlation coefficient of 0.87 measured at a lead of 8 and 9 months against the composite coincident indicator (Chart 4) and industrial production (Chart 5), respectively. In addition, a longer and a shorter leading indicator are used to construct the combined indicator which means more information, in particular, advanced information about approaching turning point from the longer leading indicator. However, the results between the combined indicator and the stripped down leading composite indicator are not very different and both qualify as potential composite leading indicators (Chart 3). The reference indicator is performing very well but the lead is relatively shorter when compared to the other composite indicators. On the other hand, the reference indicator may be a better indicator for the future, while the other indicators may be a better choice for the transition period.

CHART 3 POLAND COMPOSITE INDICATORS

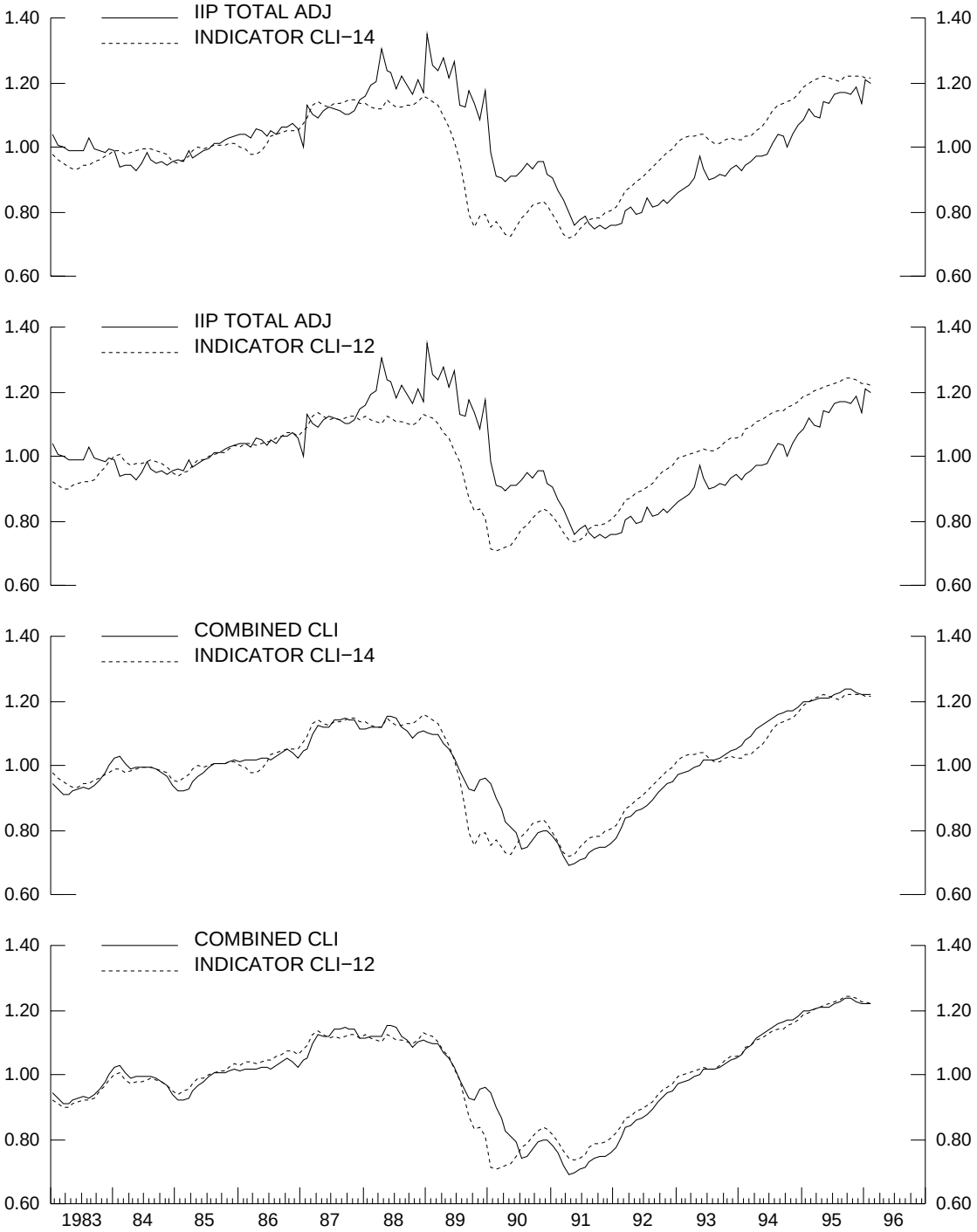


CHART 4 POLAND COMPOSITE INDICATORS

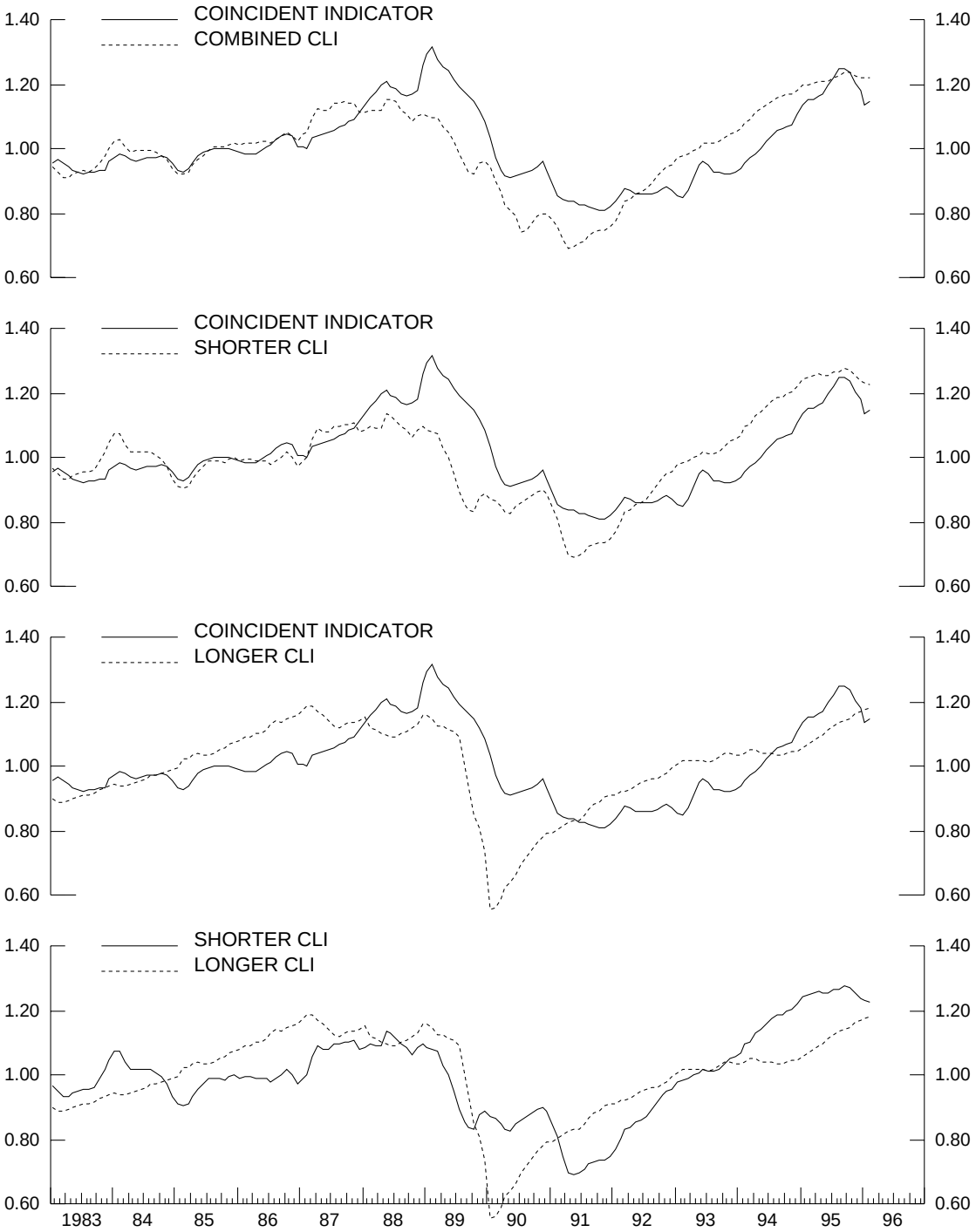


CHART 5 POLAND COMPOSITE INDICATORS

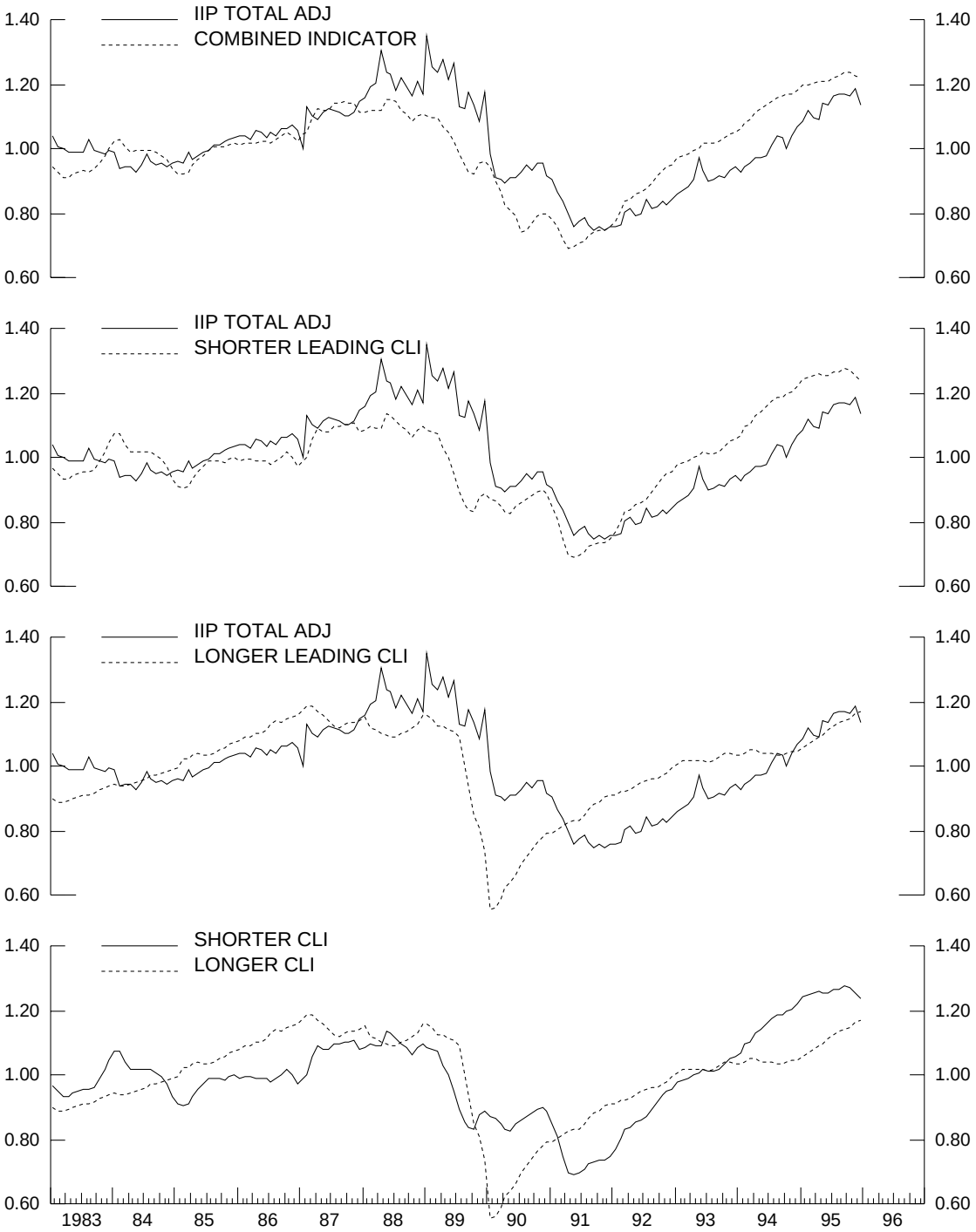
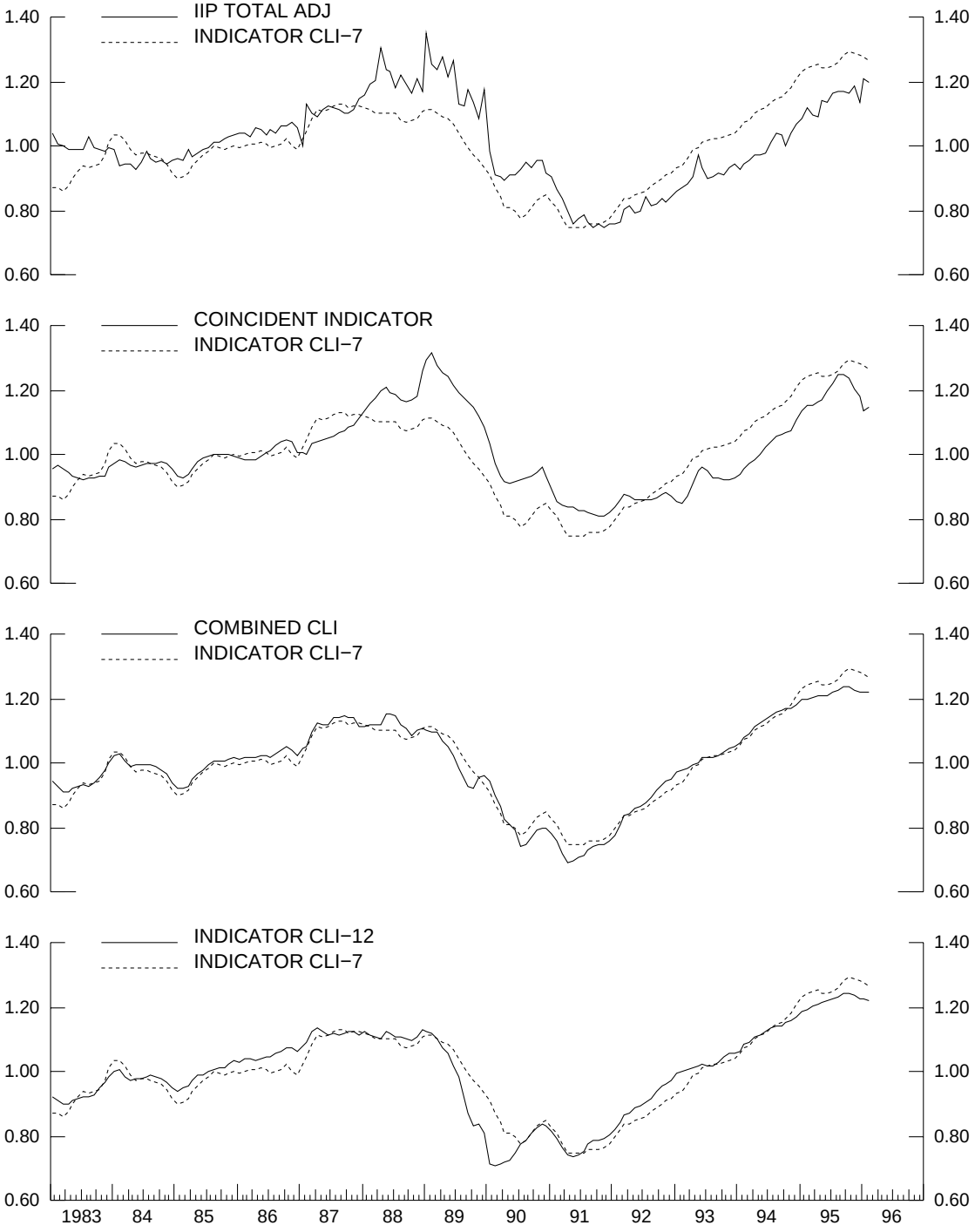


CHART 6 POLAND COMPOSITE INDICATORS



7. SUMMARY AND CONCLUSIONS

This paper has explored the possibility of constructing a composite leading indicator for assessing and forecasting cyclical fluctuations in Poland. The cyclical development of industrial production was investigated and used as the target reference series for the business cycle. A reference series based on a set of coincident indicators was constructed and used to validate the reference chronology of the industrial production cycle. A wide range of potential cyclical indicators were analysed for behaviour at cyclical turning points and a set of potential leading indicators were identified and aggregated into different sets of composite indicators. These had better forecasting and tracking qualities than any of its individual components.

The cyclical development in Poland was found to be well-synchronised across the investigated coincident indicators over the period 1975-96 and supported the selection of industrial production as a proxy for the aggregate economic cycle. The cyclical development in Poland was found to be quite different from the general cycle in the OECD area with the expansion phase about double in length compared to the OECD area and with very strong cyclical amplitudes. These were four times higher in the expansion phase and five times lower in the contraction phase compared to the OECD average. The average duration of the cycle in Poland was estimated to be one and a half times longer than the OECD total.

These differences are likely to diminish as Poland moves to a market economy and becomes more integrated in the world economy.

The timing relationships between growth cycles in industrial production in major OECD zones and Poland were found to be rather close over the pre-transition period 1975-82. The Polish cycle showed a stable relationship with a lead of about 2-3 months against the OECD total area and North America over this period.

The pattern over the transition period 1983-96 indicated a more mixed pattern. Only the North American cycle showed a stable relationship with the Polish cycle with a lead of 2-3 months, whilst the OECD total and the OECD Europe area lag the Polish cycle with over a year. Future cycles in Poland are also likely to follow much the same path as in OECD countries as Poland becomes more integrated in the world economy.

The analysis of cyclical indicators during the transition period was found to be affected by several problems which made it difficult to identify cyclical indicators based on the historical cyclical relationships between indicator series and reference series. These problems concerned the changing cyclical behaviour, statistical problems and data availability.

To address these problems, the selection of cyclical indicators was based on a broader range of criteria than is normally used for cyclical analysis. Priority was given to series with a pure cyclical behaviour and to series where the cyclical behaviour could be explained by the series ability to: measure the cycle at an early stage; respond rapidly to changes in economic activity; and measure expectations or be sensitive to expectations. The statistical series derived from business surveys fulfil these requirements and were given high priority in the selection of cyclical indicators.

Differences between economic conditions in socialist and market economies make it difficult to use series related to monetary and financial conditions and labour market series. These series were virtually irrelevant to the socialist economies in the past as they measured phenomena peculiar to market economies. However, most indicators were only analysed over the transition period 1983-96 and it was possible to find stable relationships between series such as: money supply; US dollar exchange rate;

labour productivity; and the reference cycle. Other series in these areas will be strong candidates for potential leading indicators in the future.

The structural changes taking place in transition countries will affect cyclical behaviour and create instability in the cyclical relationship. This will also be a source for increased differentiation among indicators over the cycle. This latter effect will mean that leading indicator series may be found at a more disaggregated level by detailed activities and markets in the future. In the case of Poland, a number of production series by major products were analysed. These showed a changing cyclical behaviour over the investigated period. Most series showed a coincident behaviour in relation to the aggregate production cycle over the transition period and a lagging tendency in the pre-transition period. However, several of these series showed a leading tendency over the last two turning points.

When analysing data over the pre-transition and transition periods both differences in the mechanism of economic growth and statistical problems must be considered. The main statistical problems affecting short-term data in the past were related to data coverage and practices used in the recording and compilation of indices. Short-term statistics in Poland were partly affected by these problems over the study period though the indicators were corrected as far as possible for these deficiencies.

From the set of analysed cyclical indicators, the best leading indicators were selected in each subject area on the basis of the empirical results. A set of 14 indicators was used to construct different composite leading indicators. Six composite leading indicators were constructed and evaluated:

- a composite indicator including all of the selected 14 indicators;
- a composite indicator based on 12 of the best leading indicators in the total set;
- a short-term composite leading indicator constructed from the set of component series with the shortest leads; and a
- long-term leading composite indicator constructed from the longer leading series included in the 12 component leading indicator;
- a combined leading indicator based on the short-term and long-term composite indicators weighted by the number of component series in each and with the longer leading indicator lagged 6 months to adjust for the difference in lag structure;
- a reference composite indicator constructed from the total set of selected indicators using only those with a clear economic rationale for their cyclical behaviour in market economies and those with an understandable effect on economic growth in Poland.

The overall results suggested that the combined indicator was the best leading indicator series. The cyclical profile was very good with a correlation coefficient of 0.87 at a lead 8 and 9 months against the composite coincident indicator and industrial production, respectively. However, the results for the combined and the 12 component leading indicators were not very different and both qualify as potential composite leading indicators. The reference indicator also performed well though with a relatively shorter lead compared to the other composite indicators. On the other hand, the reference indicator may be a better indicator for the future, while the other indicators may be a better choice for the transition period.

It is very important to have a broad range of indicators reflecting the cyclical development from different parts of the economy when analysing fluctuations in aggregate economic activity. In the selection of

potential cyclical indicators for Poland the indicators included in the OECD system of leading indicators were used as reference frame. However, problems relating to changing cyclical behaviour, statistical problems and data availability will mean that the selected potential leading indicators used in this study will have to be monitored regularly to see if the cyclical characteristics remain stable in the future.

The results also indicate that industrial production may not be the best reference series for the aggregate economic cycle and alternative reference series should be investigated. In addition, other series related to monetary and financial conditions, labour market conditions, foreign trade, and activity in foreign countries etc. should be analysed and new potential leading indicators may be found.

Finally, alternative business survey series in industry, construction and retail trade should be tested as potential cyclical indicators and results based on consumer surveys should be evaluated for leading characteristics.

CYCLICAL INDICATORS IN HUNGARY

1. IINTRODUCTION

The work program to introduce a system of cyclical economic indicators in Hungary commenced in 1994 with the financial assistance of the PHARE/TACIS Fund of the European Union. The objective included the development of so called leading, coincident, and lagging indicators. The work was carried out under the leadership of the Hungarian Ministry of Finance with the co-operation of experts from the Hungarian Central Statistical Office and the Hungarian National Bank. Technical assistance to the research project was provided by the Transition Economies Division, Statistics Directorate of the OECD within the framework of the work programme of the Organisation's Centre for Co-operation with Economies in Transition (CCET).

This paper provides a brief description of the research work. It covers the methodology used, the selection of the reference series and chronology, selection, evaluation and classification of indicators as coincident, leading and lagging indicators and the construction of overall composite indicators for the different categories of indicators.

Development work commenced with the assumption that examination of cyclical economic indicators and business cycles have been historically important in market economies. These indicators have been regularly published by market economies since 1960. The Hungarian economy is currently undergoing transition to a market economy and it was felt that the estimation and publication of cyclical market indicators would be a useful contribution to existing forecasting methods in that country.

Research was successfully concluded at the end of 1995 and practical application of the system commenced in early 1996. Hungary was the first transition country of Central and Eastern Europe to compute and publish such cyclical economic indicators.

2. METHODOLOGY

The analysis undertaken for the development of the cyclical economic indicators was conducted in terms of growth cycles. The trend estimation method used was a modified version of the Phase-Average Trend (PAT) method developed by the National Bureau of Economic Research (NBER) in the United States. The same method is used in the OECD system of leading indicators.

Monthly and quarterly indicators were seasonally adjusted using the X11-ARIMA method. These were adjusted for irregular movements using the Months for Cyclical Dominance (MCD) moving average method. Indicators displaying a long-term trend were considered for inclusion in the calculation of the leading indicators in terms of deviations from trend.

The identification of turning points is a key step in the PAT procedure and the Bry-Boschan routine was used to locate turning points. However, manually located turning points were used for a few series for calculation of the PAT trend.

The evaluation of the cyclical performance of the indicators was performed using two different methods:

- a peak-and trough analysis to establish the lead-lag relationship between the indicators and the reference series, i.e. to identify leading, coincident, and lagging indicators; and.

- a cross-correlation analysis to complement the peak-and-trough analysis, and to provide information about the cyclical conformity of the indicator series with respect to the reference series.

3. REFERENCE SERIES AND CHRONOLOGY

The purpose of the reference series is to serve as a proxy for the aggregate economic cycle and as the target series in a cyclical indicator system. The reference series and reference chronology are used to establish the timing classification of indicators as leading, coincident and lagging with respect to the selected target series.

The main reference series used in the Hungarian project was the volume index of industrial production which is available on a monthly basis from 1980. Although the industrial sector accounts for only one third of total Hungarian Gross Domestic Product (GDP) it is the most timely indicator of the state of the economy and serves as a proxy for the aggregate cycle. GDP would have been the obvious candidate series for a single reference series however GDP estimates were only available in Hungary on an annual basis for the study period.

The industrial production index is also currently used as the main reference series in the OECD's leading indicator system. This facilitated comparison of cyclical developments in Hungary with that of OECD countries.

The growth cycle chronologies, and cyclical characteristics of industrial production in Hungary and OECD total area are presented in Table A. The cyclical profiles of the series are shown in Chart A.

Using this information it is possible to identify two growth cycles in Hungary over the period 1980-1995. The first cycle for the 1980-1985 period is rather weak compared to the second cycle which is dominated by the strong transition recession in 1989-1991. The amplitude of the 1980-1985 cycle (about 11 per cent relative to trend) is very difficult to measure and may be over-stated as the cycle in the industrial production series is not strongly marked. The first cycle also contains a relatively high degree of irregular variation. The duration of this cycle, estimated at 56 months, should be regarded as a preliminary estimate for the same reason.

The second cycle (over the period 1985-1991) shows a very clear picture with a strong expansion with an amplitude of about +22 per cent relative to trend over a period extending just over three years (40 months). This is followed by the transition recession, with an amplitude of about -36 per cent relative to trend with a duration of close to three years (34 months).

The average duration of the cycle in Hungary, measured from trough to trough, was about the same as the OECD total area, i.e. 65 and 63 months respectively. The average duration of the phases for OECD total

area were also about the same in Hungary, 34 and 28 months respectively, when measured over the expansion phase, and 31 and 35 months, respectively when measured over the contraction phase.

The average amplitude of the expansion phase in Hungary was about two and a half times higher compared to the OECD total area, at 16.4 per cent and 6.8 per cent relative to trend, respectively. The average amplitude of the contraction phase in Hungary was about three times lower compared to the OECD total, area at -23.9 per cent and -7.9 per cent, respectively.

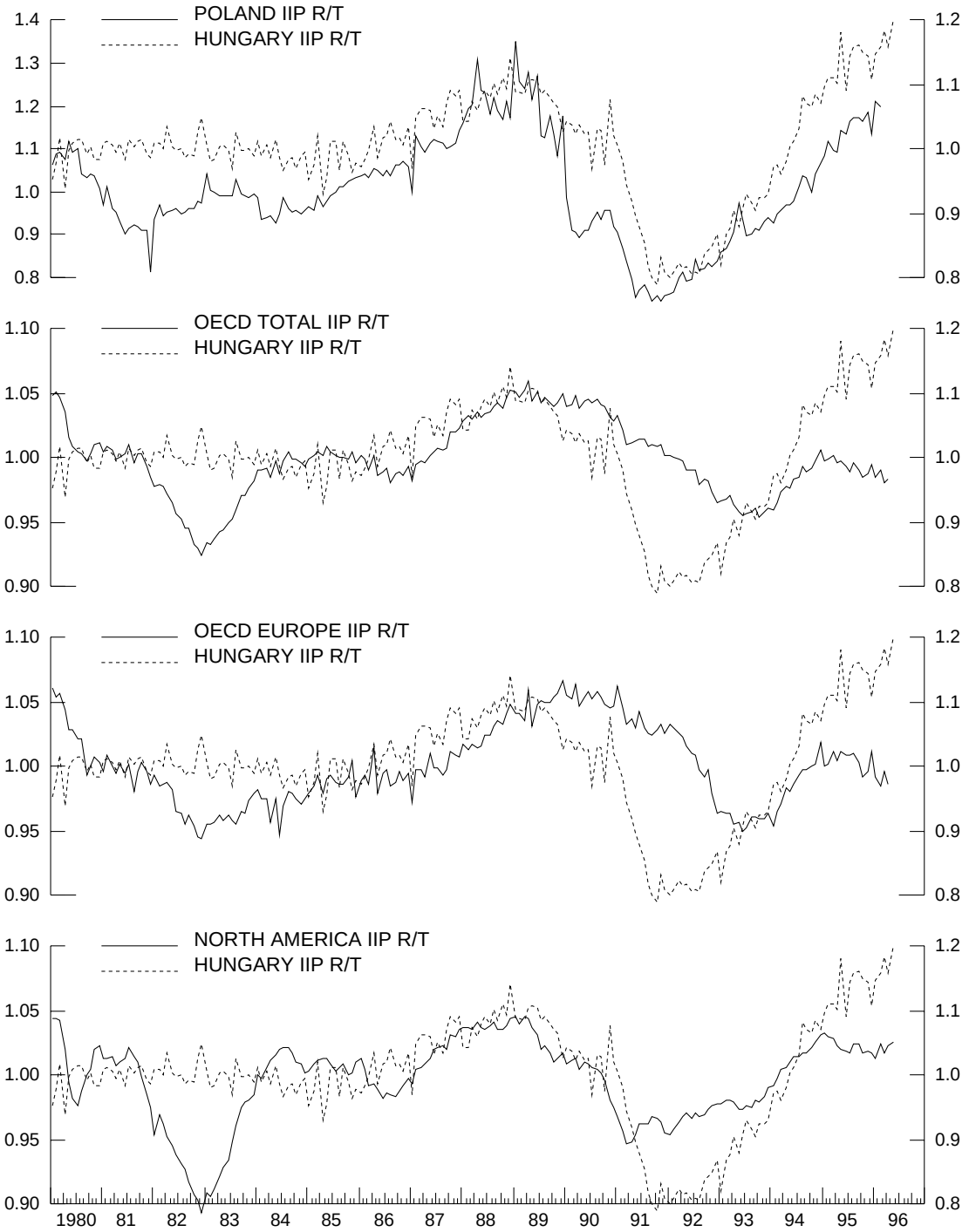
Growth cycles in industrial production in Hungary and major OECD zones and Poland are also provided in Chart A. The brevity of the investigated period and the and the resultant restricted number of cycles do not allow any firm conclusions to be drawn concerning the timing of relationships between cycles in Hungary, major OECD zones, and Poland.

However, if only the period 1985-1996 is considered the timing relationships measured by the cross-correlation lag indicate that over the transition period (1985-1996) the growth cycle in Hungary showed a stable relationship (with peak-correlation of about 0.90) with a lag of 2 months compared to the Polish and 5 months for North American cycles. On the other hand, OECD total and OECD Europe lag behind the Hungarian cycle by about a year and a half, measured with a peak-correlation of about 0.80.

Table A: Cyclical characteristics of industrial production in Hungary and the OECD area, 1980-1995

		Hungary				**Total OECD area**		
Turning points (TP)	**TP dates**	**Duration (months)**		**Amplitude**	**TP dates**	**Duration (months)**		**Amplitude**
		Phase	**Cycle**	**% of trend**		**Phase**	**Cycle**	**% of trend**
Peak					Feb-80			
Trough	Apr-80				Dec-82	34		-11.1
Peak	Dec-82	28		11.2	May-85	29	63	6.5
Trough	Apr-85	28	56	-11.7	Jan-87	20	49	-3.4
Peak	Dec-88	40	68	21.7	Apr-89	27	47	7.1
Trough	Oct-91	34	74	-36.1	Oct-93	50	77	-9.3
Number of TP	5				6			
Number of cycles:								
Trough to trough			2		2			
Peak to peak			1		2			
Phase average:								
Expansion		34		16.4		28		6.8
Contraction		31		-23.9		35		-7.9
Cycle average:								
Trough to trough			65				63	
Peak to peak			68				55	

CHART A GROWTH CYCLES IN HUNGARY AND OECD



4. SELECTION OF INDICATORS

The identification of potential cyclical indicators in Hungary commenced with an investigation of about 30 time series. These were selected using knowledge of the Hungarian economy and experiences with cyclical indicators used in other countries, particularly indicators included in the OECD system of leading indicators.

The quantitative indicators were provided by the Hungarian Central Statistical Office and the National Bank of Hungary. The qualitative business survey data were supplied by the Institute for Economic, Market Research and Informatics Ltd (KPINT).

A number of the indicators selected initially were subsequently excluded from the list of cyclical indicators investigated due to the lack of a long time series with no breaks. The indicators excluded from the analysis were:

New orders	available monthly from 1992
Order stocks	available monthly from 1992
Inventories in industry	available monthly from 1990
Construction permits dwellings	available quarterly from 1993
Job vacancies	available monthly from 1992
Short-term deposit rate for enterprises	available monthly from 1990
Number of company bankruptcies	available monthly from 1992

These series will however be suitable candidate series for cyclical indicators in the future and their cyclical properties should be evaluated as soon as a sufficient time series is available.

Preliminary investigation of the cyclical characteristics of two of the pre-selected indicators indicated unusual correlations and were subsequently excluded from the final list of potential cyclical indicators. The excluded indicators comprised total international arrivals, and tourist arrivals. Both showed an inverse relationship to the reference series with a very long lead of 18 and 15 months respectively.

Two series on imports of intermediate goods expressed in US dollars and Forints were included in the pre-selected set of indicators. These showed strong conformity with the reference series and were considered as coincident indicators. However, as a result of a change in 1996 in the commodity classification used in Hungary the division “materials, semi-finished products and spare parts” is no longer available and the two series were also subsequently excluded from the final list of potential cyclical indicators.

4.1 The Selected Indicators

The potential cyclical indicators were selected on the basis of a preliminary investigation of the timing relationships with the reference series, i.e. industrial production. The time series of the indicators considered covered at least 9 years, and were classified as follows:

• Coincident indicators	
Total industrial production	available monthly from 1980
Manufacturing production	available monthly from 1980
Total energy consumption	available monthly from 1985
Electricity demand in the production sphere	available monthly from 1985
Production of cement	available monthly from 1980

Production of crude steel	available monthly from 1980
Gross real wages in industry	available quarterly from 1985
Gross real wages in construction	available quarterly from 1985
Retail sales volume	available monthly from 1985
• Leading indicators	
Production, future tendency (business survey series)	available quarterly from 1987
Order books level (business survey series)	available quarterly from 1987
Savings households, deflated with consumer price index	available monthly from 1987
Consumer prices: monthly changes, inverted	available monthly from 1985
Credit rate for enterprises, maturity less than a year, inverted	available monthly from 1985
• Lagging indicators	
Production of bony raw meat	available monthly from 1985
Number of persons employed in industry	available quarterly from 1985
Number of persons employed in construction	available quarterly from 1985
Number of registered unemployed, inverted	available monthly from 1985

This preliminary classification of the selected indicators into different timing categories was for most indicators supported by a more detailed evaluation conducted in spring 1996. This is reported in Table B.

4.2 Analysis of the Selected Indicators

Most of the indicators classified above as coincident show a strong correlation, with a lead or lag within -3 to +7 months, as measured by the mean or median lag or peak-correlation lag against total industrial production as the reference series. However, gross wages in construction show a peak-correlation lag of 15 months. This is not supported by the mean or median lag. Also, gross wages in construction and retail sales volume show a weak correspondence with the reference series with a correlation coefficient of 0.46 and 0.38 respectively.

Most of the indicators classified above as leading indicators show very long leads of around 12 months as measured by the mean or median lag, and leads in the range of 16-19 months based on the peak-correlation lag. The order books series is the only indicator which shows a shorter lead of 6 months according to both measures. The indicators show a strong correspondence with the reference series with a correlation coefficient above 0.82 for all indicators with the exception of consumer prices (at -0.55).

Indicators classified above as lagging indicators show a relatively weaker correspondence with the reference series when compared to most other indicators, with a correlation coefficient in the range of 0.42 to -0.72. All indicators show lags from 8 to 20 months as measured by the mean or median lag. However, the peak-correlation lag is much shorter for all indicators and indicates a zero lag for registered unemployment, and a lead of 3 months for employment in construction.

4.3 Conclusions

The above results are very much influenced by the short time period investigated for most indicators (i.e. 1985-1996) which provides a limited number of turning points. They are also influenced by problems affecting the collection and compilation of short-term statistics. These include data coverage and response. However, the results suggest that the indicators evaluated may be used as cyclical indicators.

The classification of the above indicators into the three different timing categories is fairly understandable in most cases. The use of production expectations, order books, and household savings as leading indicators is linked to their positive effect on economic growth. However, the increase in inflation and interest rates over the period 1985-1995 was followed by a decline in output at the beginning of the period. This was followed by the reverse relationship in the later part of the period. This is consistent with the argument that the existing high level of inflation has a negative effect on economic growth. Relationships may differ from those of market economies with low inflation but in the short-run these relationship will persist.

The classification of employment as a lagging indicator may also be explained by the rigid situation in the labour market during the transition period. The indicator method has been developed for short-term forecasting, and the system of indicators, in particular, the leading indicators, definitely require modification in the future.

Table B: Cyclical characteristics of selected Hungarian indicators, 1985-1996

Indicators	MCD	Extra turns	Missing turns	Lag (+) at turning points			Cross-correlation	
				Mean	Median	Mean deviation	Lag(+)	Coeff.
Composite indicators								
Coincident indicator	1			2.33	1	3.11	0	0.93
Leading indicator	1			-5.00	-7	3.33	-16	0.95
Lagging indicator	1			14.00	14	2.67	5	0.71
Coincident indicators								
Total industrial production	4			0.00	0	0.00	0	1.00
Manufacturing production	4			0.00	0	0.00	0	0.99
Total energy consumption	6	2		6.00	6	3.33	3	0.76
Electricity demand in production	4			6.00	7	1.33	2	0.82
Production of cement	5	2		4.67	2	6.89	-2	0.76
Production of crude steel	5	2		-1.00	-2	2.00	0	0.87
Gross wages in industry	1Q	2	1	0.00	0	0.00	-3	0.46
Gross wages in construction	1Q			2.00	-3	6.67	15	0.84
Retail sales volume	3	4		4.00	0	5.33	-1	0.38
Leading indicators								
Production, future tendency (BS)	2Q			-12.00	-12	6.00	-18	0.95
Order books, level (BS)	2Q			-6.00	-6	0.00	-6	0.82
Savings, households (defl. CPI)	2	1		-13.00	-13	7.00	-16	0.94
Consumer prices: changes, inv.	6	2		-10.00	-10	2.67	-19	-0.55
Credit rate for enterprises, inv.	1			-9.50	-10	8.50	-17	-1.00
Lagging indicators								
Production of bony rawnmeat	4			20.67	20	8.22	16	0.42
Employment, industry	1Q		1	10.50	11	1.50	6	0.65
Employment, construction	1Q		1	12.00	12	0.00	-3	0.59
Unemployment, registered, inv.	1	2		7.50	8	5.50	0	-0.72

5. CALCULATION OF COMPOSITE INDICATORS

The selected leading, coincident and lagging indicators evaluated in the previous section (presented in Table B) were also used as component series for the calculation of composite indicators for the three different categories. The calculation of composite indicators was based largely on the OECD method.

The performance of the different composite indicators over the period 1985-1996 against total industrial production as the reference series is set out in Table B. The cyclical profiles of the series are illustrated in Chart B.

The composite coincident indicator shows a stable relationship with the reference series at zero lag measured by the cross-correlation lag, and 1-2 months lag measured by the median and mean lag, respectively. The cyclical profile between the coincident indicator and the reference series is very good with a correlation coefficient of 0.93.

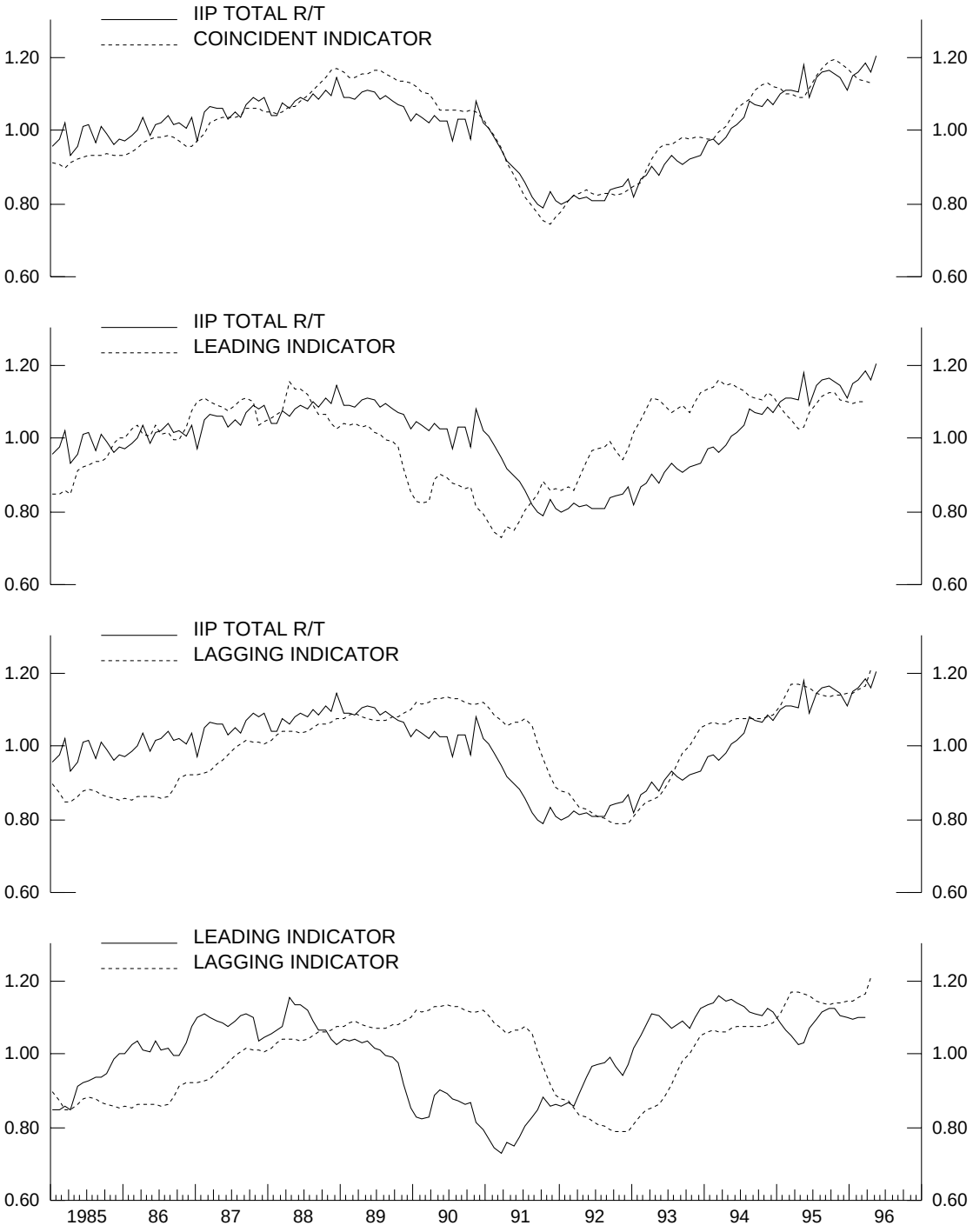
The composite leading indicator shows a lead of 5-7 months against the reference series according to the mean and median lag, respectively, and with a lead of 16 months as measured by the correlation lag. The difference in the lead is mainly explained by the short time period investigated and the limited number of turning points over this period. The cyclical profile between the leading indicator and the reference series is very high with a correlation coefficient of 0.95.

The composite lagging indicator shows a lag of 14 months against the reference series, as measured by the mean and median lag. However, it shows a lag of 5 months when measured by the correlation lag. This difference in lag is mainly explained by the same reasons noted above concerning the leading indicator. The cyclical profile between the lagging indicator and the reference series is rather good with a correlation coefficient of 0.71.

5.1 Interpretation of the Current Developments in Economy Using the Composite Indicators

Developments in the Hungarian economy over the period 1994-1996 as shown by the composite indicator is especially interesting. In mid-1994 the composite leading indicator started to decline, pointing to a slowdown in activity. However, in mid 1995 the indicator started to rise again and is now indicating continued slow growth. The composite coincident indicator and industrial production index followed this development with about a year's lag. According to the latest data a slight decline has occurred in industrial output. If the development of the composite leading indicator is correct the current slowdown will be followed by moderate growth in 1996. This is basically in line with current economic expectations.

CHART B HUNGARY COMPOSITE INDICATORS



6. FINAL REMARKS

It is essential for the practical application of the indicator system to be undertaken concurrently with their on-going development. In particular, this entails on-going identification and selection of better indicators. The main problem with the current set of cyclical indicators is the lack of suitable available monthly leading indicator data. However, as noted in Section 4 above, a number of potential monthly leading indicators are available though the time series are too short at present. These potential indicator series should be further evaluated as soon as sufficient time series are available.

The transformation of the Hungarian economy closer to a market economy will also have beneficial effects for the cyclical indicator approach due to the fact that changes in economic activity will be more differentiated among indicators over the cycle. This will affect the cyclical behaviour of the indicators and improve the identification of new potential indicators.

The experimental work described above fully demonstrated the practical applicability of the regular calculation of the composite indicators. The continuous improvement of these indicators in future will mean that even more valuable information will be gained about the cyclical behaviour of the Hungarian economy.

All of the experts involved in the experimental work fully support this conclusion and recommend the regular calculation and publication of composite indicators from 1996. The main application of the indicator would be to support the monitoring and forecasting activities of the Hungarian Ministry of Finance.

ANNEX 1

CHART 7 POLAND INDICATOR SERIES

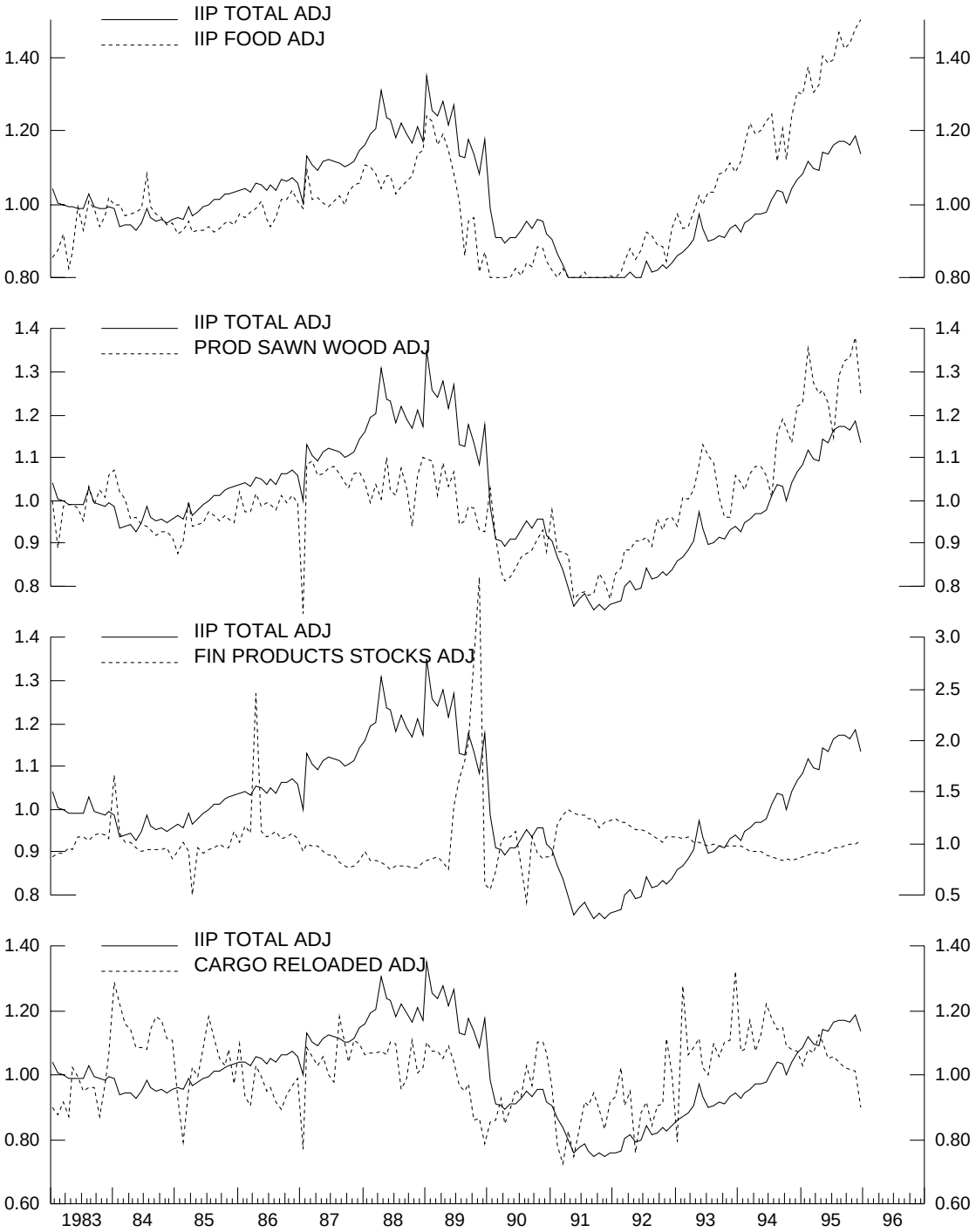


CHART 8 POLAND INDICATOR SERIES

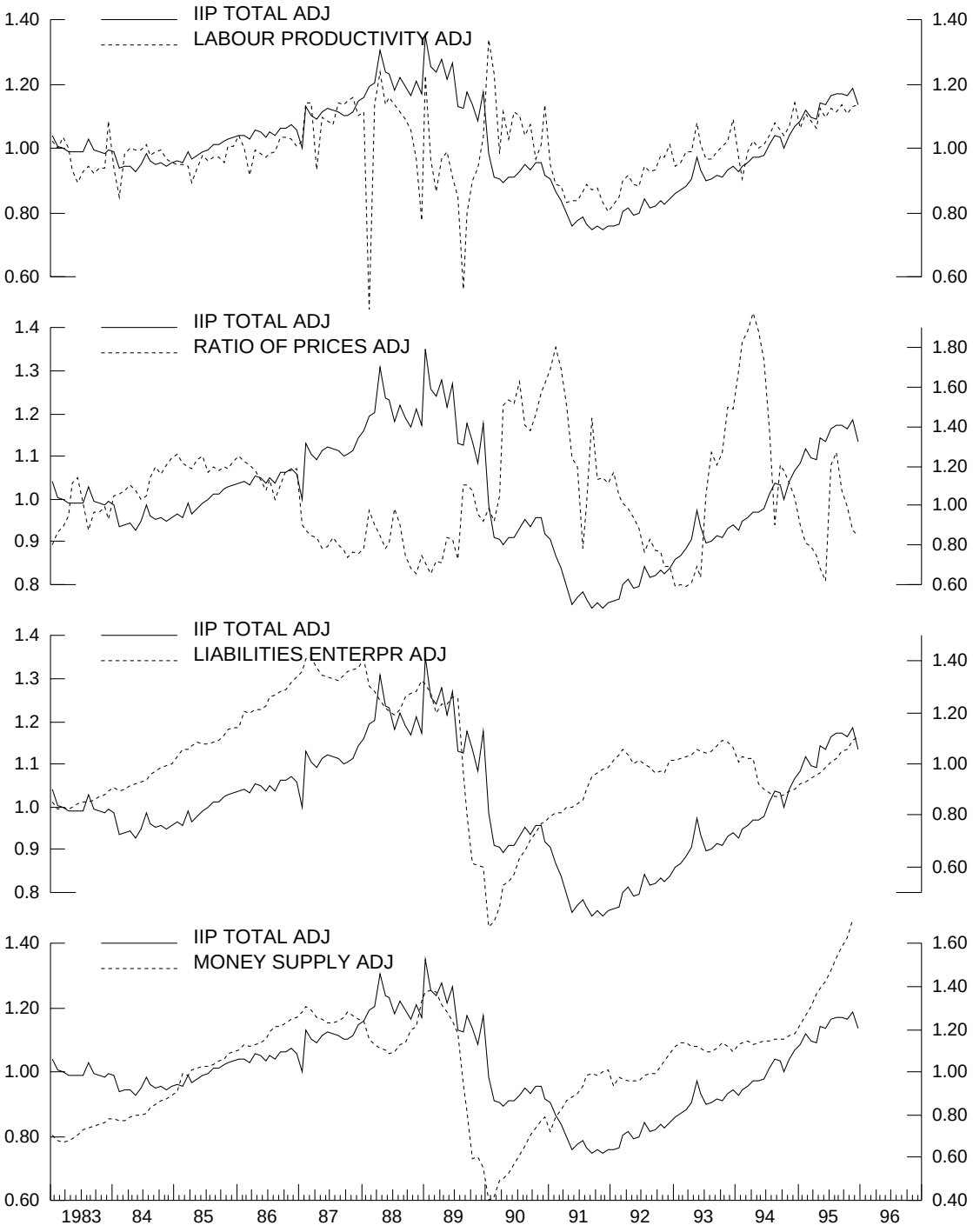


CHART 9 POLAND INDICATOR SERIES

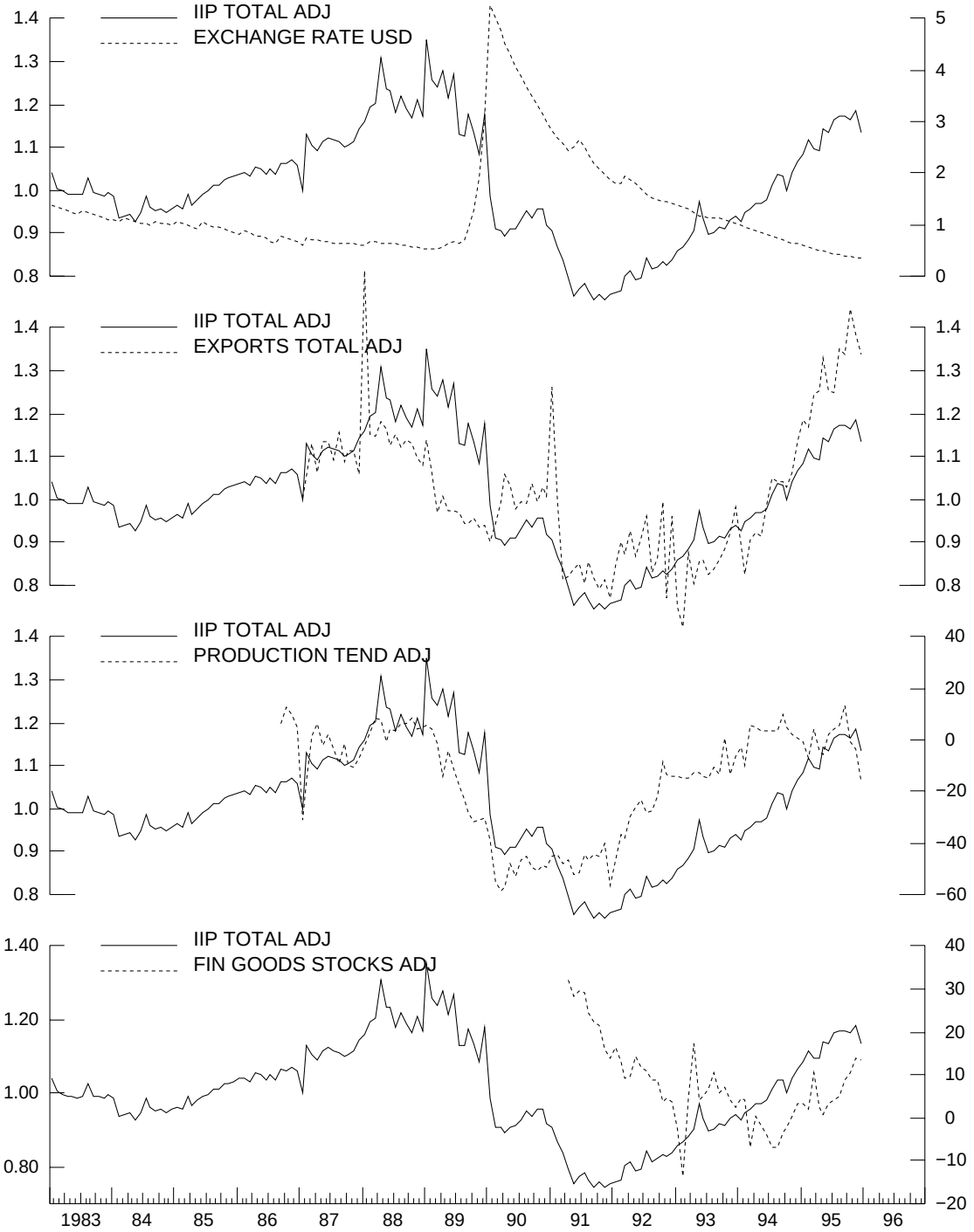


CHART 10 POLAND INDICATOR SERIES

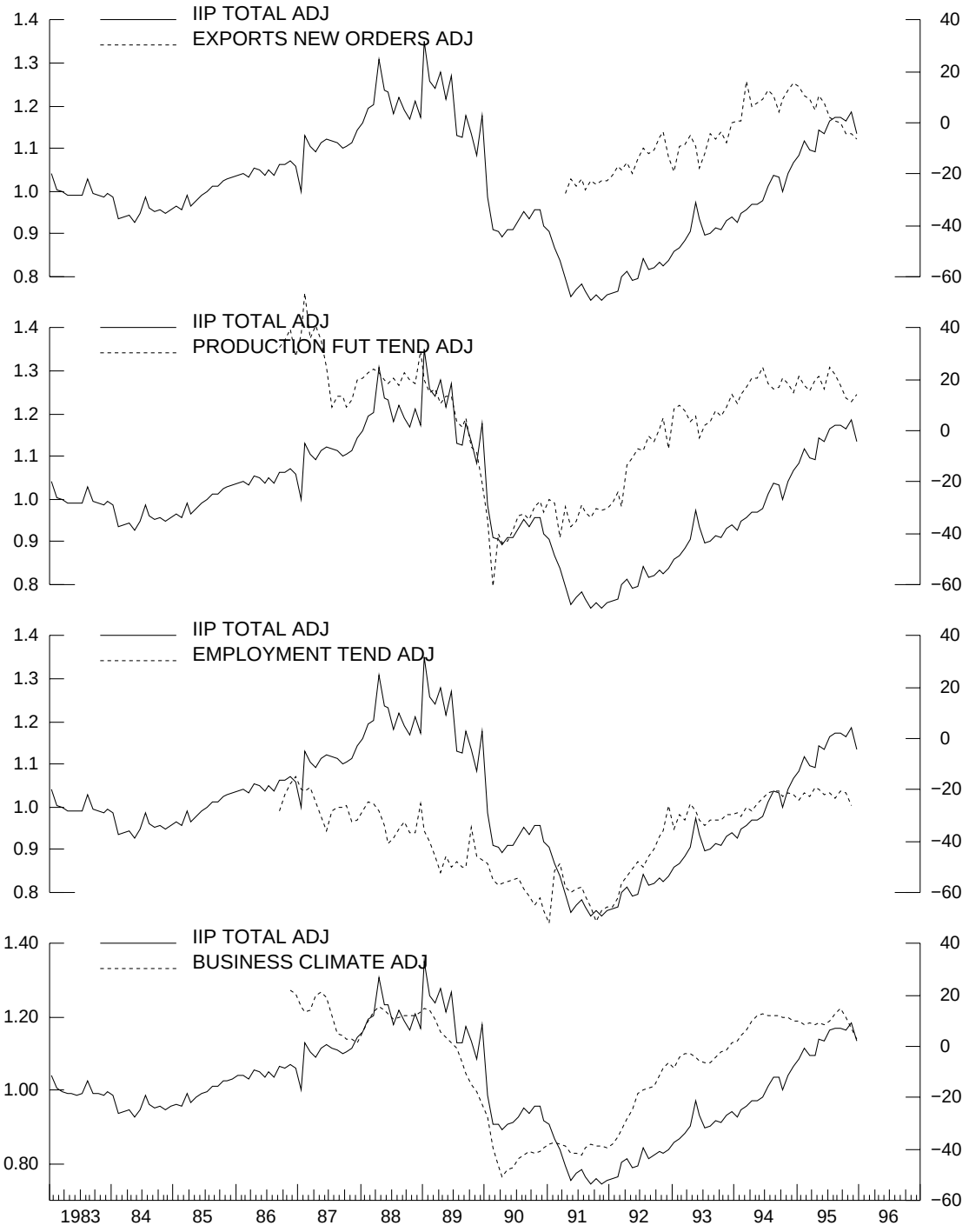


CHART 11 POLAND INDICATOR SERIES

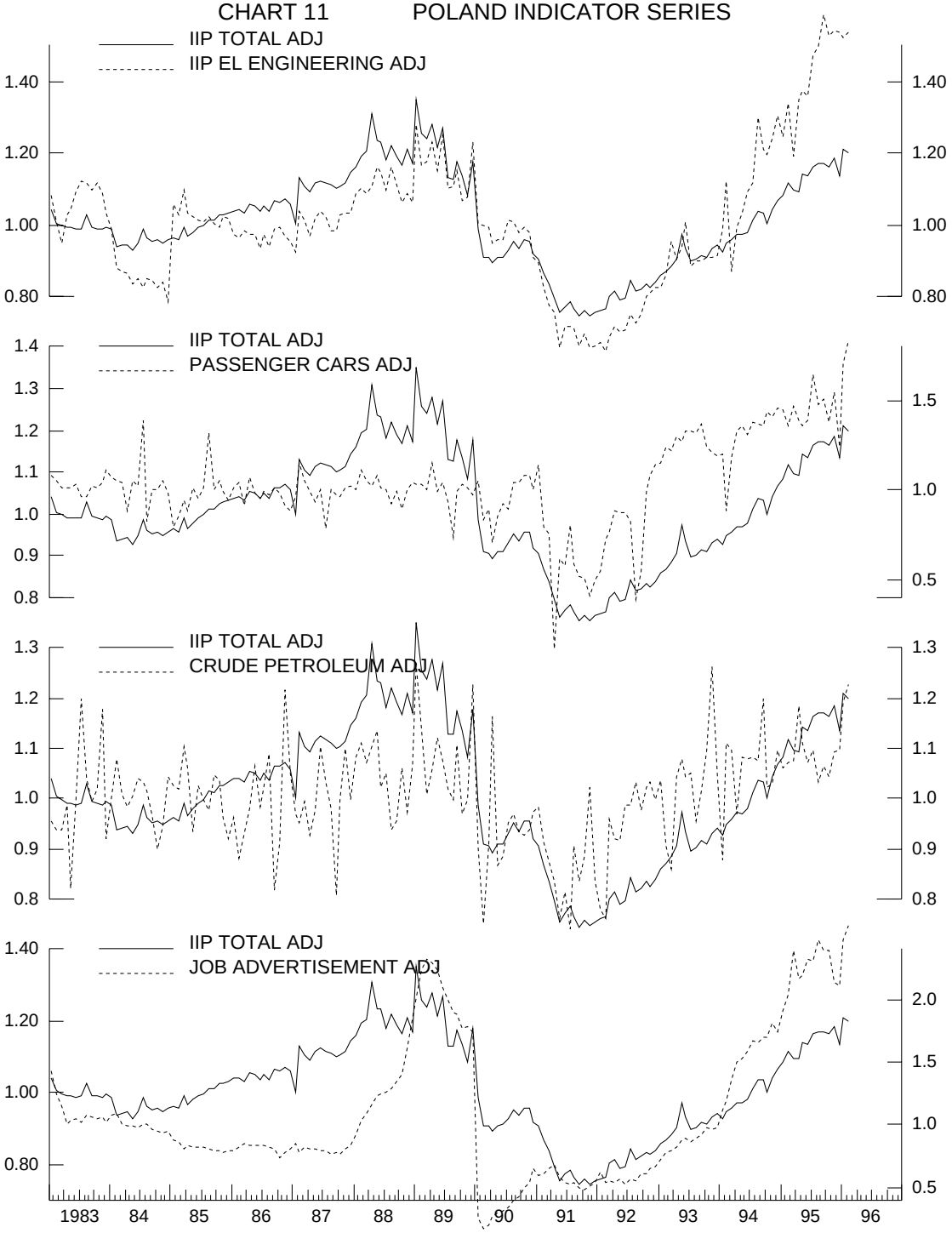


CHART 12 POLAND INDICATOR SERIES