

LEADING AND COINCIDENT INDEXES

1. Introduction

Poland is of growing importance in the European and global economy, especially once it becomes a member of the European Union. Since 1989, the Polish economy has undergone a transition process from central-planned into market economy. The market mechanism is just beginning to work and in many fields there is still too much state regulation and too little market rules. Especially while observing early stage of the transition, one should be aware of this.

Approaches to measure business fluctuations in Poland have been already made by Drozdowicz-Bieć and Zarnowitz (2000). Much earlier Matkowski (1996) developed another set of composite indexes of business cycles for Poland. Some attempts to determine and describe cyclical patterns of development of the Polish economy were already made during the 1970s and 1980s, when the economy was centrally planned, but it showed fluctuations similar to those experienced by market economies.

The aim of this paper is to present a set of leading and coincident business cycle indicators for Poland, developed strictly with the methodology used by The Conference Board. A brief history of this approach is presented in Section 2, and the methodology used in calculation of indicators is described in Section 3.

2. Measuring business activity by composite indexes

The development of cyclical indicators has a long and interesting history, which began in its present form in 1930s, when Mitchell and Burns of the NBER compiled business cycle indicators for the U.S. economy. Moore, Boschan, Bry, Shiskin, Zarnowitz and others affiliated with NBER conducted subsequent work on business cycle indicators.

During the 1960s, the Bureau of the Census together with the NBER and later the Council of Economic Advisors have extensively developed a research program on business cycle indicators for the U.S. and major trading partners. In 1972, the program was shifted to the Bureau of Economic Analysis at the Department of Commerce.

The Conference Board, which took over the program of development and production of business cycle indicators for U.S. in 1995, has established the new Global Indicators Research Institute to extend the indicators approach to other

* Sebastian Stolorz is a Research and Teaching Assistant, Chair of Economics II, Warsaw School of Economics.

The author is grateful for comments by the staff of the Department of Economics at The Conference Board and the Chair of Economics II, Warsaw School of Economics. The views expressed herein are those of the author and not necessarily of those institutions.

countries and engaged in the development of business cycle indicators for countries all over the world.

3. Methodology

According to TCB methodology, the procedure for calculating the composite indexes has five following steps:

- (1) Calculation of symmetric month-to-month changes¹ – the changes (r) are calculated for each component (X) according to the formula:

$$r_{i,t} = 200 \times \frac{(X_{i,t} - X_{i,t-1})}{(X_{i,t} + X_{i,t-1})}$$

If the component variable X is in percent change form or an interest rate, simple arithmetic differences are calculated: $X_t = X_t - X_{t-1}$.

- (2) Equalisation of the volatility – month-to-month changes of each component are adjusted to have the same volatility. The adjusted change (s) in each component is computed by multiplying the month-to-month change (r) by the corresponding standardisation factor (w) for each component:

$$s_{i,t} = w_{i,t} \times r_{i,t}$$

- (3) The standardisation factors for all components are computed by inverting standard deviations of the changes in each component. Then values of standardisation factors are recalculated so that the index component standardisation factors sum up to one.

$$s_{i,t} = \sum_{i=1}^n c_{i,t}$$

- (4) The values of the index are computed by use of symmetric percent change formula. The first value of indicator (I_1) is given (e.g. it equals 100) and the next value is calculated in the following way:

$$I_2 = I_1 \times \frac{(200 + s_2)}{(200 - s_2)} = 100 \times \frac{(200 + s_2)}{(200 - s_2)}$$

This formula is used recursively to compute the following index levels for each month that data are available:

¹ The given formula for calculating symmetric percent changes, treats positive and negative changes symmetrically. This does not happen with the use of conventional formula of calculating percent change. The symmetric percent change formula has been used since the public debate of the composite indexes in the late 1960s. Nonetheless, both formulas produce very similar cyclical patterns.

- (5) Rebasement – values for the index are rebased to have an average of 100 in 1995. All values are multiplied by 100 and divided by the average for the twelve months of the year 1995.

4. The coincident index for Poland

All components used to calculate the coincident and leading index were tested for the presence of seasonal factors, and in case of their importance, data was seasonally adjusted. In most cases, data was further adjusted for changes in the price level by use of appropriate deflators. The coincident index is treated as a reference cycle indicator and the leading index was developed to predict its changes.

The coincident index consists of 4 components:

- Sales of industry and construction,
- Real income,
- Import
- Retail sales.

All components of the coincident index were seasonally adjusted by means of the ARIMA X-12 program. The next step was the calculation of symmetric changes for all components. Finally, the coincident index was computed with appropriate standardisation factors, so as to prevent the most of volatile components from dominating the index. All chosen time series, components of the coincident index, are broad measures of different aspects of economic activity. In its aggregated form, the coincident index shows the performance of the economy. However, in some periods, the performance of the coincident index differs from that of the real GDP.

Sales of industry and construction

The first component is a sum of two times series, published monthly by the Central Statistical Office of Poland in current prices: sales of industrial production and sales of construction (i.e. the industry and construction sector, respectively). After removing the seasonal components of both series, they were summed up and deflated by the producer's price index (PPI).

Sales of industrial production and construction represent a broad range of activity (including manufacturing and mining). The data is registered by CSO from enterprises (both private and public) employing more than 9 people.

Retail sales

The retail sales are published monthly as index of year-over-year (YoY) changes and index of month-over-month (MoM) changes. Levels of retail sales are available only as annual data. The way in which data for retail sales are officially published made us unable to use this data in its initial form as a component of the coincident indicator. An estimate of monthly real retail sales was used instead. It was calculated, by using all available information: changes of retail sales (in both forms: MoM index and YoY year

index) and levels of annual nominal retail sales. First, one-based indexes were computed for each year of observation by cumulating real MoM changes (seasonally adjusted). Then, all indexes were connected into the long series with use of YoY changes, and recalculated so that the sum of monthly data for a given year was equal to the level of nominal annual retail sales. Time series was deflated by CPI.

Real income

Real income was calculated by multiplying the number of employed people in the enterprise sector (at the end of a month) and the average monthly wages and salaries in the enterprise sector, and then deflated by consumer price index (CPI). Data for employment and wages is published monthly by CSO. Data for enterprise sector concern all enterprises (both private and public) employing more than 9 people (5 people till December of 1999).

Imports

Data for imports is available monthly and is measured in U.S. dollars.² Original data have been seasonally adjusted but not deflated – with the assumption that changes in imports measured in U.S. dollars reflect the changes in imports volume much precisely than those measured in deflating local currency.³ An alternative version of the coincident index including imports measured in real PLN was also calculated. It did not show any significant differences in the general performance of the index, compared to its original version.

Performance of the coincident index

Coincident index starts in January 1990 with three components (excluding retail sales) and since January 1991 it is calculated with all four components. It shows four turning points: two troughs and two peaks. Data indicate that from the beginning of the Polish transition (June 1989) there was a recession till 1992. Then an expansion began that ended in 2000 and was most pronounced during the years 1994-1995.

In January 2000, a strong decrease occurred, driven by most of the coincident components, followed by further slight increase, which finally ended in June 2000. It may seem that a peak appeared in June 2000 rather than in December 1999. The choice of a peak in December 1999 was made by a widely accepted computer procedure, developed by Boschan and Bry during their work for the NBER. The lower turning points are better articulated. Further research and eventual inclusion of additional coincident components should lead to a more precise and less doubtful indication of the upper turning point in the Polish economy in year 2000.

² It is Euro rather than U.S. dollar that plays a major role in Polish foreign trade due to the importance of E.U. markets and the accession process with E.U.

³ A very high rate of inflation, which occurred in Poland (especially in early 1990s), makes deflation of the most of economic aggregates very difficult.

Since June 2000 the coincident index remained flat, with slightly decreasing trend. The trough occurs in April 2002 beginning a moderate recovery, which lasted at least till July 2003.⁴

The coincident index vs real GDP

Real GDP (officially reported by the CSO) shows two periods of slowdowns in the years 1999-2001 and one decrease, between the third quarter of 2001 and the second quarter of 2002. The recession indicated by the coincident index was shorter and lasted only about 6 months (from October 2001 to April 2004).⁵

5. The leading index for Poland

This index is composed of 6 time series:⁶

- Share price index - Warsaw Stock Exchange Index (*WIG*)
- Real monetary base (*M0*)
- Consumer confidence indicator (*WOK* by Ipsos)
- 13-weeks treasury bond yield (inverted)
- Job vacancies
- Nominal exchange rate of Euro

Share Price Index (WIG)

WIG is an official index of share prices, noted at the Warsaw Stock Exchange since the beginning of its activity in April 1991. Data used are monthly averages of the index at the closing of all the trading days.⁷

Real monetary base (M0)

Monetary base was deflated by the consumer price index and is seasonally adjusted. Changes in the monetary policy affect the levels of the monetary base, which influences changes in broader monetary aggregates (*M1* or *M2*) and thus, changes in economic activity.

⁴ At the time of preparing this article, no later data were available.

⁵ CSO reports GDP in constant prices only in prices of the previous year. As this form of data could not be used as a reference for the coincident index, alternative data of real GDP (in prices of 1995) was calculated. According to GDP in constant prices of the previous year (as published by CSO), there was no decrease at all (only slowdown) in late 1990s – early 2000s.

⁶ For a more detailed comparison of leading components (including dates of turning points, leads and lags and dates of first observation, see Table 1.

⁷ Seasonal adjustment was not implemented by assumption that on such liquid markets as stock exchange any regular pattern is immediately discounted and eliminated by investors.

Consumer confidence indicator

The consumer confidence indicator is published monthly by an independent research agency Demoskop-Ipsos. Data is based on a survey, made every month among representative sample of households (1050 units). It is a diffusion index presenting net balance of positive and negative opinions on: general present and future economic condition of the economy as well consumer sentiments and their tendency to consume.

13-weeks Treasury bond yield (inverted)

The inverted yield on Treasury bonds is an estimate of the price of bonds. As the prices of bonds tend to lead the general economic activity, the inverted yield on 13-weeks Treasury bonds was included as a component of the leading index. The data does not contain a seasonal movement, thus a seasonal adjustment was not needed.

Job vacancies

This time series is the number of job vacancies at the end of the month reported by CSO. Data is given in thousands of job vacancies, reported by local labour offices. The series has been seasonally adjusted.

Exchange rate of Euro

The nominal exchange rate of Euro (EUR) in Polish Zlotys (PLN) is the average monthly rate published by National Bank of Poland since January 1999. Data for the earlier period is the exchange rate of German Mark (DEM) in PLN, multiplied by a fixed exchange rate of DEM to EUR.⁸ The authors are assuming that appreciation of the EUR should tend to improve the terms of trade for Poland and affect an increase of foreign consumption and investment in Poland.

Performance of the leading index

For the year 1991 (since April 1991) only stock prices are available. The leading index started as composite index in January 1992 with three components (excluding inverted treasury bond yield, consumer confidence, and monetary base). Since July 1992 it is calculated with four components (with monetary base), and since January 1993 – with all, six components. All turning points of the coincident index were preceded by the corresponding turns in the leading index.⁹

Since April 1992 the leading index shows a smooth increase until May of 1999, with two slowdowns: the first, lasting nine months in 1994–1995; the second, nineteen months between beginning of 1997 and fall of 1998.

May 1999 was the first upper turning point, predicting a peak of the coincident index (December 1999) with a lead of seven months. Then the leading index kept

⁸ The fixed value of exchange rate DEM to EUR was 1.984.

⁹ The first turning point of the leading index (September 1991) should be treated as a tentative turning point. Only one component is available for that period.

decreasing till June 2001 (trough). Afterwards, a new phase of increase started (with a short decrease between February and April 2002). The trough denoted in June 2001 anticipated the trough of the coincident index (April 2002) with a lead of ten months.

6. Summary

Both the leading and the coincident index show changes in the aggregate economic activity in Poland, but the first with earlier timing. In the period covered by indexes, at least one full cycle occurred. It contained an expansion from May of 1992 until December 1999, and a recession between December 1999 and April 2002.

The data available for the earlier period show a deep fall from beginning of 1991 until May of 1992, which should be considered as a recession of the early stage of transition. An increase in the coincident index from March 1990 until February 1992 should be considered as a short brake in that recession.

References

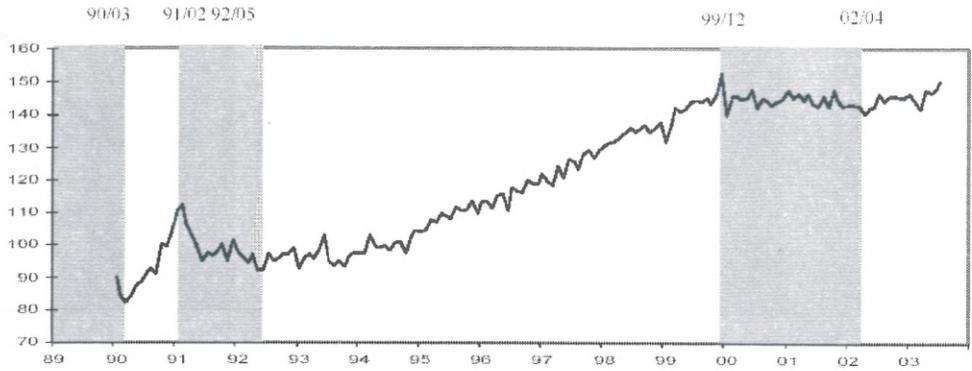
- Bry G., C. Boschan. 1971 *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*. New York: NBER.
- Matkowski Z. 1996. "Composite Leading Indicators for Poland and the Concept of the Reference Cycle." Paper prepared for the OECD Meeting on Leading Indicators. Paris: OECD.
- Mitchell W.C., A.F. Burns. 1938. "Statistical Indicators of Cyclical Revivals." *Bulletin* 69. NBER.
- Zarnowitz V., M. Drozdowicz-Bieć. 2000. "The Coincident and Leading Indexes for Poland After Two Years of Observation." Paper prepared for the 25th CIRET Conference in Paris.

Table 1. Components of Coincident and Leading Indexes for Poland

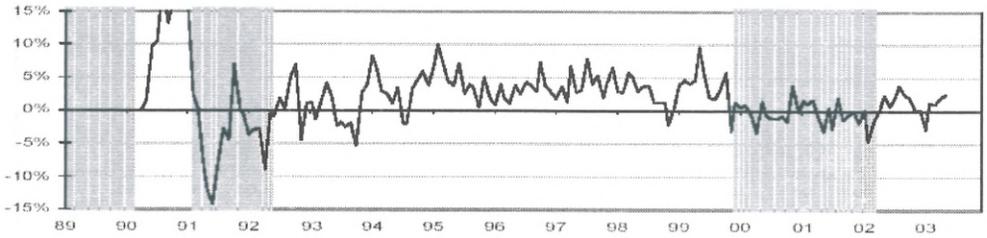
<i>Time Series</i>	<i>Troughs</i>	<i>Lead/Lag</i>	<i>Peaks</i>	<i>Lead/Lag</i>	<i>Start date</i>
Coincident Index	90.03*	-	91.02	-	90.01 (3 comp)
	92.06	-	99.12	-	91.01 (4 comp)
	02.04	-			
Sales of Production (Industrial + Construction)	90.06	+3	90.10	-4	90.01
	91.09	-8	89.01	0	
	99.01	x	95.11	x	
	02.05	+1	00.06	0	
Personal Income	93.08	+15	99.06	-6	91.01
Retail Sales	90.02	-1	91.02	0	90.01
	92.06	0	93.06	x	
	94.05	x	99.12	0	
	00.10	-18			
Import (USD)	90.01	0	91.04	+2	90.01
	91.08	-9	98.11	x	
	99.05	x	99.12	0	
	01.12	-4			
Leading Index	91.10	-8	99.05	-7	91.04 (1 comp)
	01.06	-10			92.01 (3 comp)
					92.07 (4 comp)
				93.01 (all comp)	
WIG (share price index)	92.05	0			91.04
	95.03	x	94.03	x	
	98.10	x	97.10	x	
	01.07	-9	00.03	+3	
Consumer Confidence	96.12	x	96.02	x	92.01
	01.09	-7	97.06	-27	
Job Vacancies	92.04	-1	95.03	x	92.01
	96.03	x	97.04	-32	
	01.11	-5			
13-weeks bonds yield (inverted)	97.12	x	96.12	x	92.07
	01.02	-14	99.05	-7	
M0 (monetary base)	94.01	x	99.04	-8	93.01
	01.06	-10			
exchange rate PLN/EUR	98.11	x	97.11	x	93.01
	01.06	-10	99.10	-2	

* For purpose of computation of the turning points, the longer series were taken, starting earlier than January 1990.

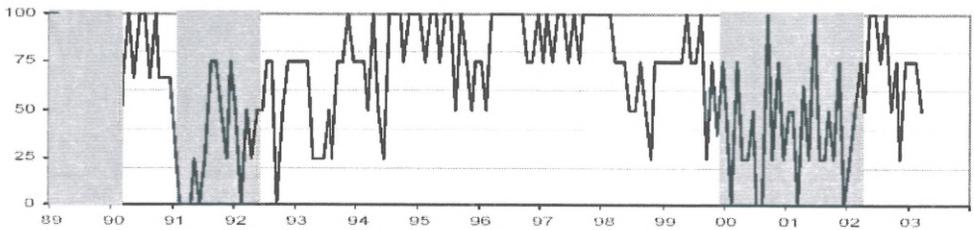
Chart 1A. The Coincident Index for Poland



Composite index of 4 coincident components

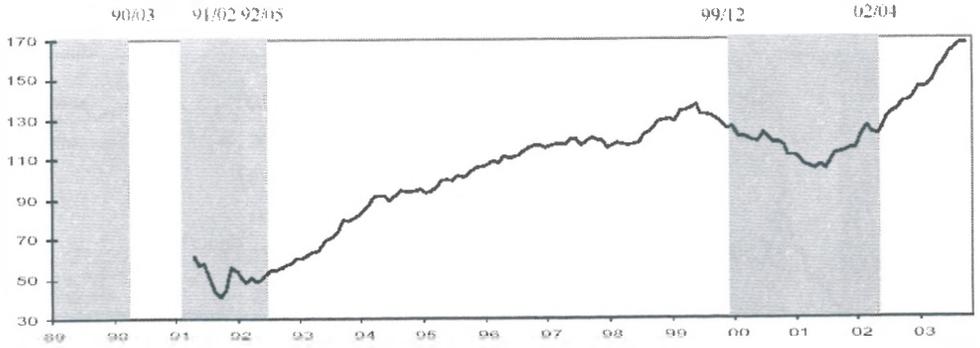


Percent Change over 6-month span (centered)

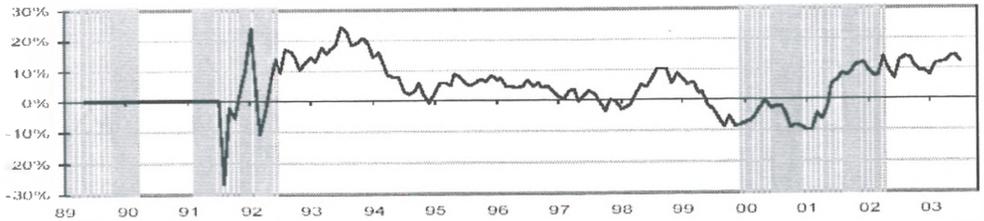


Diffusion index of 4 coincident components (over 6 month span)

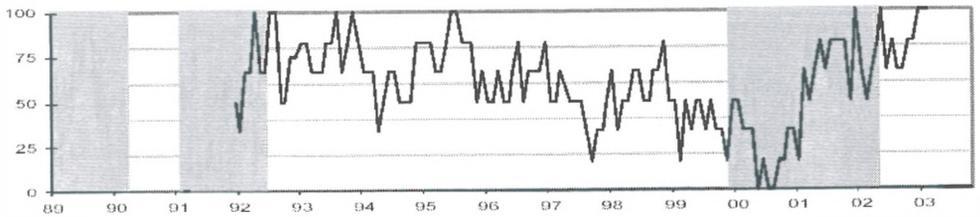
Chart 1B. The Leading Index for Poland



Composite index of 6 leading components



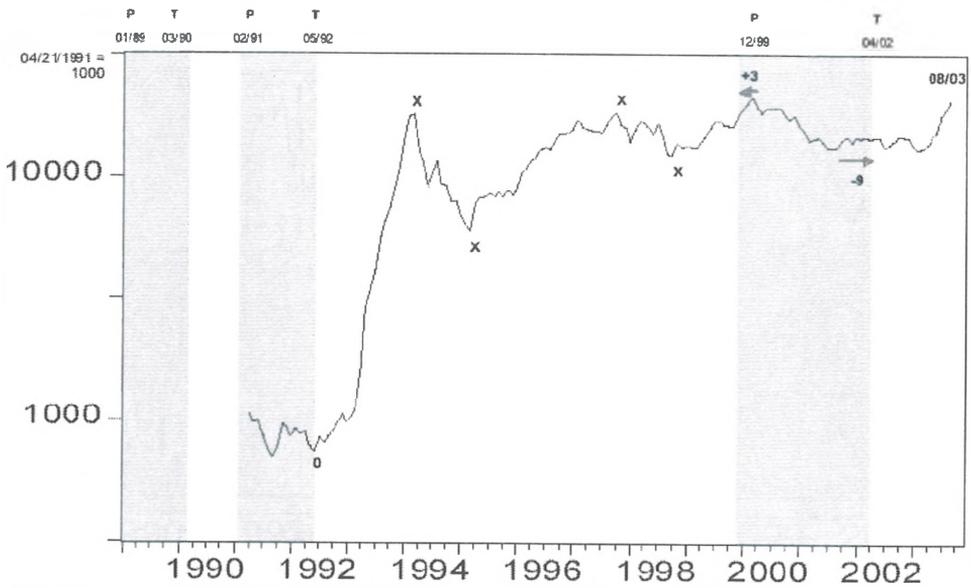
Percent Change over 6-month span (centered)



Diffusion index of 6 leading components (over 6 month span)

Chart 2A. Components of Leading Index for Poland

Share Price Index (WIG)



Consumer Confidence

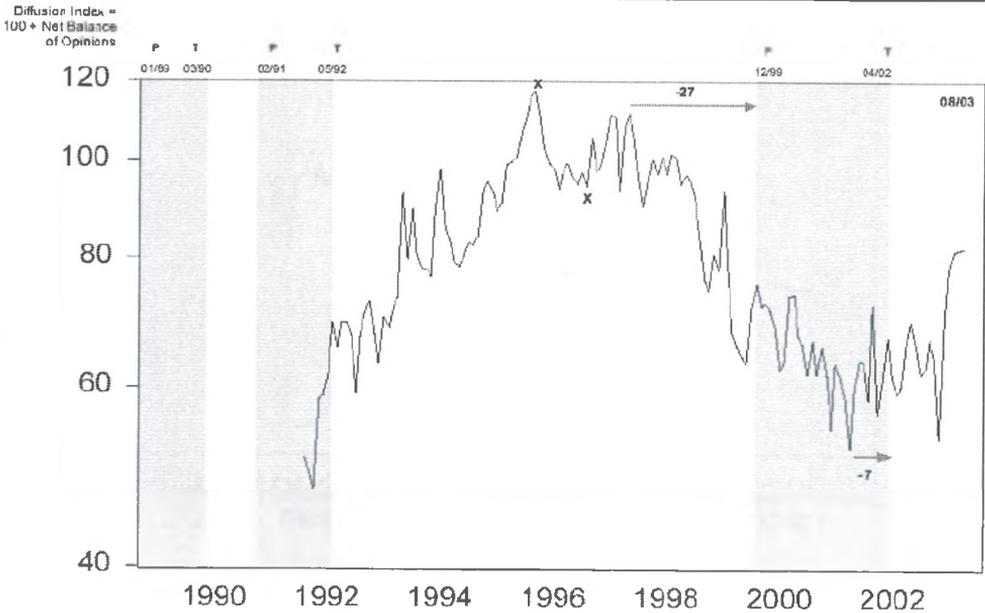
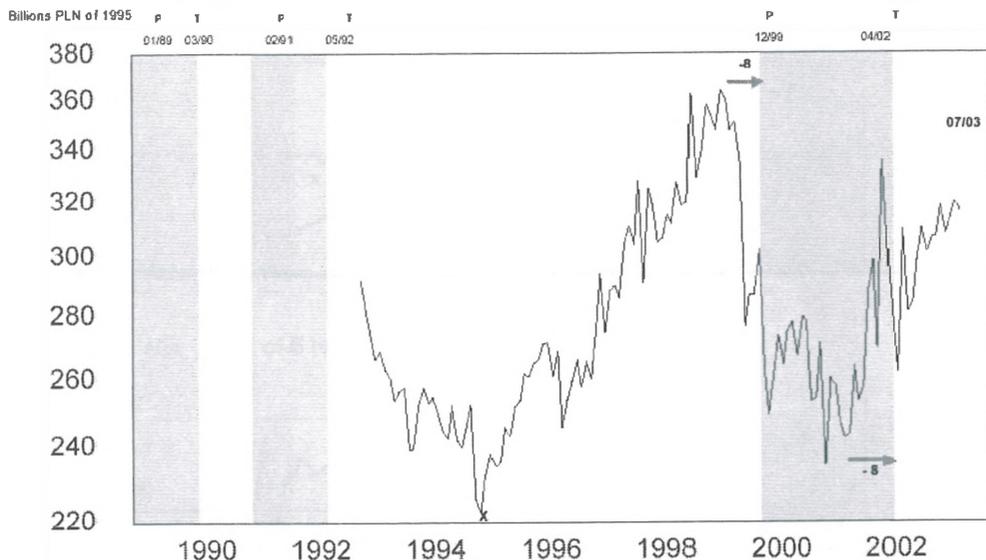


Chart 2B. Components of Leading Index for Poland

Real Monetary Base (M0)



Job Vacancies

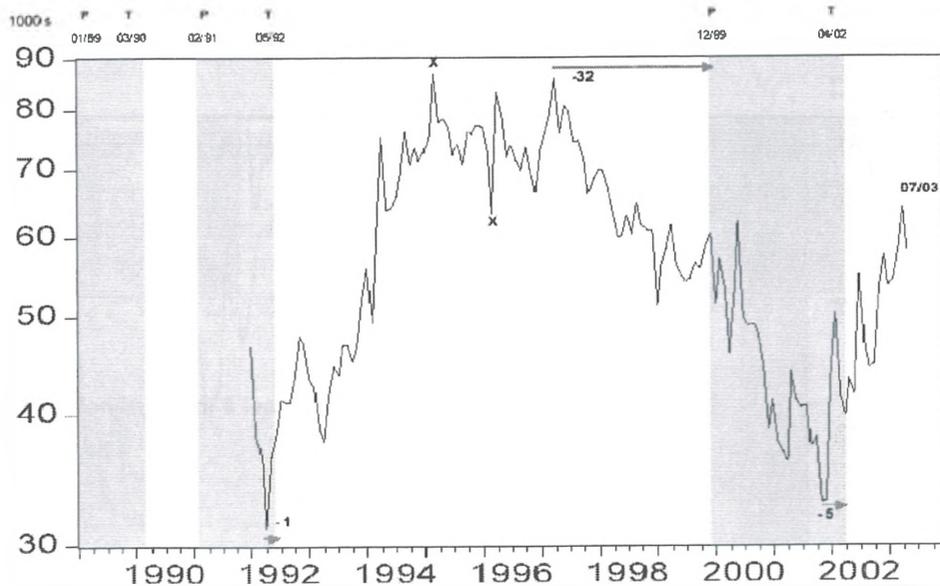
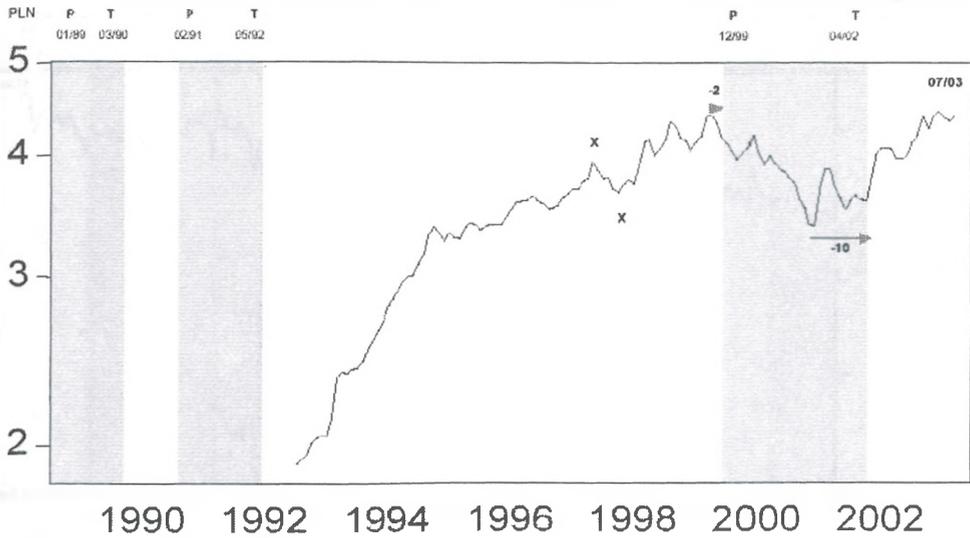


Chart 2C. Components of Leading Index for Poland

Nominal Exchange Rate PLN/EUR



13 weeks Treasury Bond Yield (inverted)

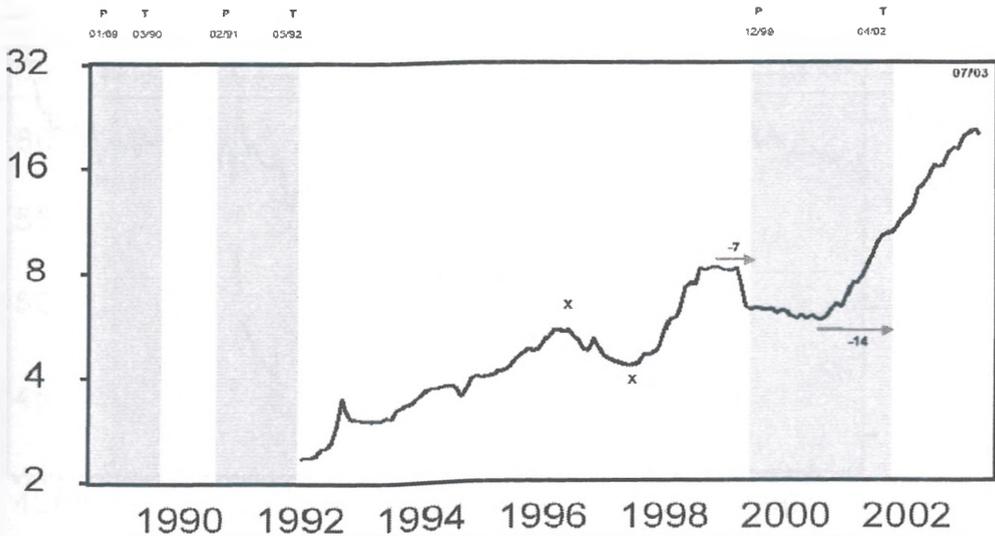
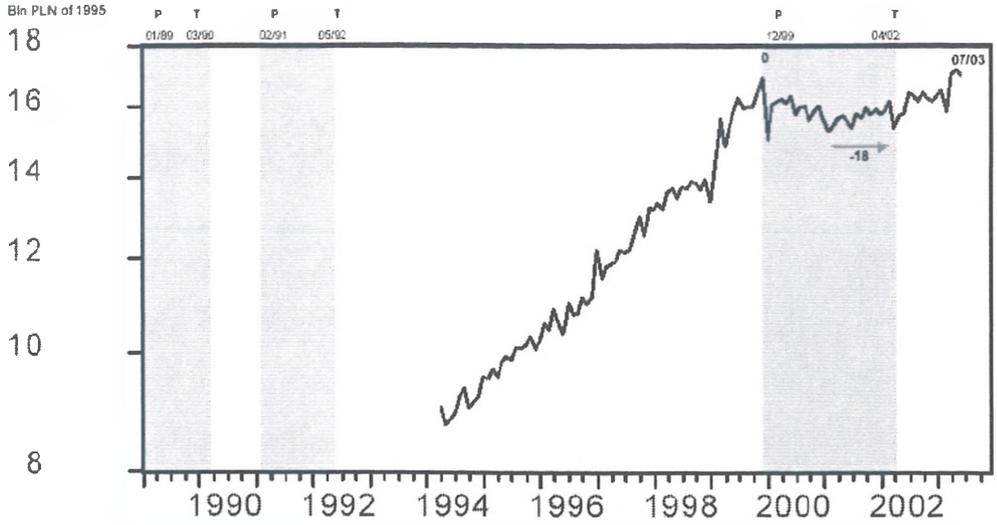


Chart 3A. Components of Coincident Index for Poland

Retail Sales



Sales of Production

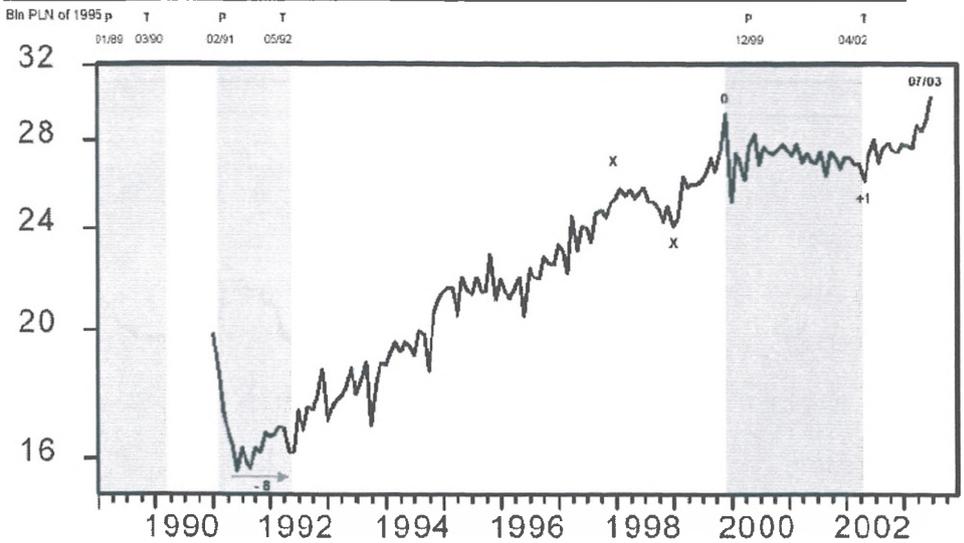
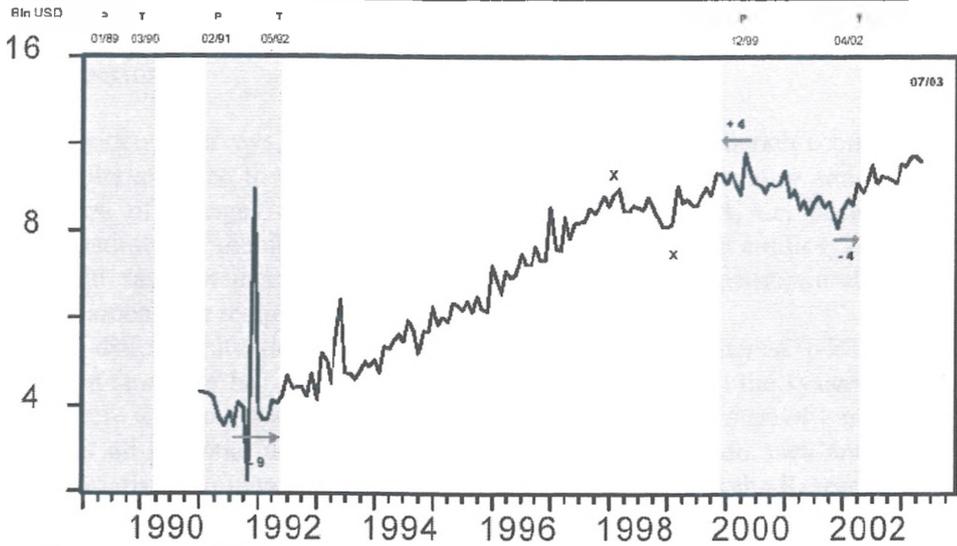


Chart 3B. Components of Coincident Index for Poland

Import (USD)



Personal Income

