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APPLICATION OF THE ECONOMY BAROMETER IN WARNING FORECASTING IN AGRICULTURE AND FOOD INDUSTRY

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ABSTRACT

The paper presents construction of the economy barometer for agriculture and food-industry. Moreover, referential indexes and aggregated leading indexes were constructed. On the base of the referential indexes, analysis of cyclical changes in food-economy in the 1975-2003 years was carried out. Finally, warning forecasts for agriculture and food-industry were created.

Key words: the economy, barometer of the economy, warning forecasting, referential indexes, agriculture, food industry.

INTRODUCTION

Analysis of the economy belong to essential and widely applied economic research that aims at revealing reasons and structure of cyclical fluctuations of the economy both as whole and its particular parts. The aim of analytical works is not only to define present or past condition of the economy, but also answer a question if it is possible to seek the beginnings of economic growth's slowdown, crisis as well as recover from recession – and to what extent in advance. In this aspect, the economy <footnote 1> research comes down to identification of symptoms indicating coming crisis.

A market economy and wider approach to international exchange increase Polish economy susceptibility to cyclical fluctuations of the economy. It increases significance of diagnosis and forecasting of the economic situation, especially warning forecasting what means signalizing in advance possibilities of unfavourable economic situation.

Barometers of the economy are one of major methods of current economic activeness' evaluation and forecasting in many countries. However, in Polish food economy this problem has been passed over. Although, it is necessary to implement evaluate the method in research and forecasting of the economic situation, especially concerning warning forecasting.

The scope of research includes agriculture and food processing. The aim of research concentrates on implementation and evaluation of the economy barometer, as a method of the warning forecasts' construction in the food economy. Realization of the aim required:

1. designing synthetic indexes of activeness in agriculture and food industry, in monthly intervals and reconstruction of cyclical fluctuations' image of 1975-2003;
2. evaluation of referential barometers indexes' usefulness for illustration of current economic situation;
3. selecting from analysed series these which are signalizing unfavourable economic situation;
4. construction of aggregated leading indexes for the years of 1975-2003 and 1992-2003.

SOURCE MATERIALS

Main sources of the empirical material were mass statistics data in forms of the Central Statistical Office's, the Eurostat's and the OECD Main Economic Indicator's publications. According to the needs, other publications were used, i.e. thematic elaborates of Central Statistical Office, the Ministry of Finances' annuals, stock exchange indexes as well as publications of the Institute of Agriculture Economics and Food Economy, Institute of Economic Development in Warsaw School of Economics and other research institutes.

The analysed period includes the 1975-2003 years. It was determined by the main aim of research, which realization requires use of long time series. Retrospection depth of the time series describing values of particular variables was varied in relation to avail of comparable data. As a result, two data basis were prepared – one including the 1975-2003 years (94 time series) and another including the 1992-2003 years (57 time series). They were constructed by mass statistic data within indexes of production's dynamics, society's incomes, foreign and internal trade, investments, labour and financial markets, prices, research on state of the economic situation in Poland and in other ten countries (USA and EU).

Criteria of selection of the economy barometer's indexes, accepted in research practice in OECD countries [5], were implemented in the research.

METHODICAL ASSUMPTIONS OF THE ECONOMY BAROMETER

The method of the economy barometer in selection or/and construction consist of an index or a group of indexes, which allow to define current or further direction of economic activeness' changes in a country or a sector of the economy. Barometers of the economy are these sets of statistical indexes, which are sensitive to the economic situation's changes and derived from them aggregated indexes, built on the base of observations of directions and sequences of various economic issues' changes, based on models of leading and delays. The economy barometers do not illustrate mechanisms of the analysed process and the method is based on variables, which are not divided according to a cause and effect scheme, but only according to time relations to a referential (foreseen) index. Opportunity of foreseeing results from a symptomatic relation between the foreseen index and the leading index, which is preceding it. The barometer's indexes can be divided into three groups, according to sequences of their changes in relation to reference index. These are leading, coincident and delayed indexes. There are leading indexes that have direct foreseeing significance. Others are used to evaluation of the economic situation.

Only these indexes can be used in the barometer, which change regularly and present similar reactions in historic cycles, holding promise to behave similarly in future. The barometers base only on indexes registered quarterly, monthly or in shorter intervals. Their construction is based on these time series, which are long and homogeneous enough and allow to observe regularity of cyclical development, while the time series' selection is depending on mainly formal-statistic criteria, not substantial connections between the phenomena.

METHOD OF RESEARCH

The analysis of the statistical material was based on rules of barometers' construction, criteria of indexes' selection and evaluation as well as methods of data transformations, accepted by the Department of Economy and Statistics of the OECD, concerning creation of barometers for the OECD countries. In particular phrases of the analysis following methods were implemented.

1. Seasonal correction (deseasonalization) using the Census II X-11 method [2, 7].
2. Trend's elimination (detrendization) using linear regression method or use of the quadratic polynomial.
3. Time series' smoothing in order to eliminate random factors (derandomization) using moving average by the MCD <footnote 2> (months of cyclical dominance) method.
4. Interpolation, on the base of neighbouring points, in relation to substantially important time series presented quarterly.

5. Identification of economic cycles' turning points in accordance with Bry-Boschan's method [6];
6. Normalization <footnote 3> in order to ensure comparativeness of the statistic data, cleaned out of seasonality, trend and accidental fluctuations.
7. Cross correlation analysis of in order to define lead and delay of particular indexes of the economy barometer in comparison to reference indexes.
8. Aggregation of partial indexes using the aggregation function in a form of weighted arithmetic average or simple arithmetic average.

STRUCTURE OF REFERENTIAL RATES

Works on the economy barometers demanded to define reference indexes for the barometers in agriculture and food industry. The research has defined leading indexes and created list of morphologic characteristics of economic fluctuations.

Referential index of the economy barometer in agriculture

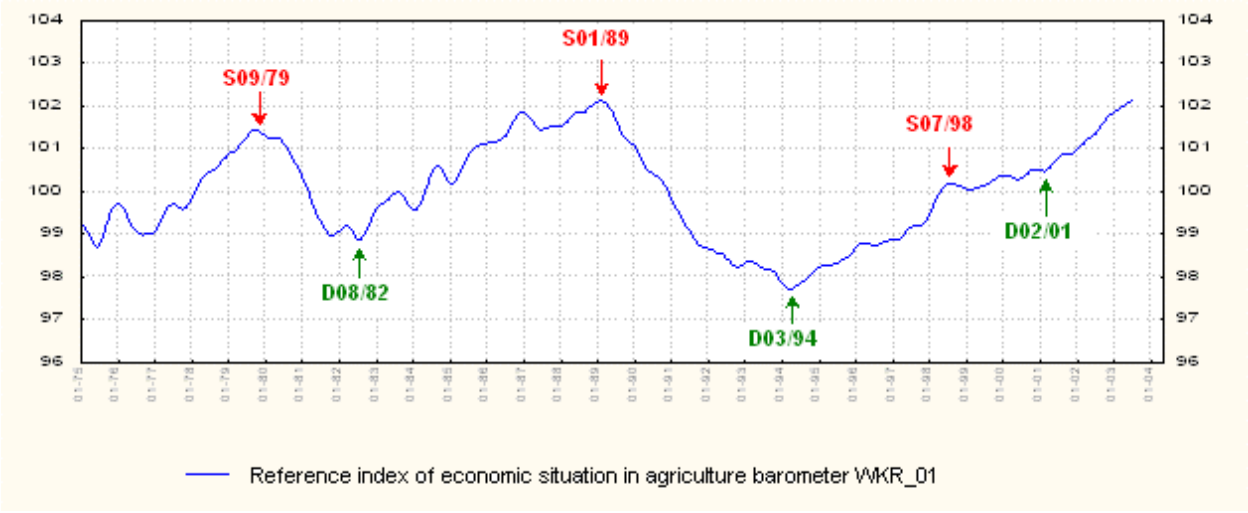
Contemporary economic statistics does not directly bring any index, which might be a referential index of economic situation in agriculture barometer. For the analysis, a reference index of economic situation in agriculture was calculated by aggregation of partial indexes of purchase of livestock, milk, four main cereals and potatoes, with annually changing weights, corresponding to the products' purchase share in total amount of agricultural products' purchase a year. Reference index of the barometer amounted on average to 70% out of total commercial production of agriculture. It can be a substitute for not-existing in quarter or month intervals' reporting of commercial production of agriculture, which was more reliable and complete basis for cyclical identification of activeness changes in agriculture. Aggregation of normalized characteristics was done on the basis of aggregating function in a form of arithmetic weighted average <footnote 4>:

$$WKR\_01_t = \frac{W1_t PR\_11_t + W2_t PR\_14_t + W3_t PR\_15_t + W4_t PR\_16_t}{W1_t + W2_t + W3_t + W4_t}$$

where:
WKR_01_t – index of economic situation in agriculture;
PR_11_t – purchase of milk, $W1_t$ – weights of milk purchase during period *t*;
PR_14_t – purchase of seed of four main cereals, $W2_t$ – weights of the seed purchase during period *t*;
PR_15_t – purchase of potatoes, $W3_t$ – weights of potatoes' purchase during period *t*;
PR_16_t – purchase of livestock, $W4_t$ – weights of livestock purchase during period *t*.

Index of economic situation in agriculture (WKR_01) was decomposed by the Census II X-11 in order to distinguish seasonality, any irregular fluctuations and a growth-cyclical component. Average length of one-direction cyclical changes amounted to eight months. The cyclical component was explaining 21% of variability, and 65% of seasonality. Number of moths necessary to make sure that one-direction change in series were cyclical, not accidental (MCD), amounted to three.

Graph 1. Reference index of economic situation in agriculture barometer (WKR_01), from January 1975 to June 2003



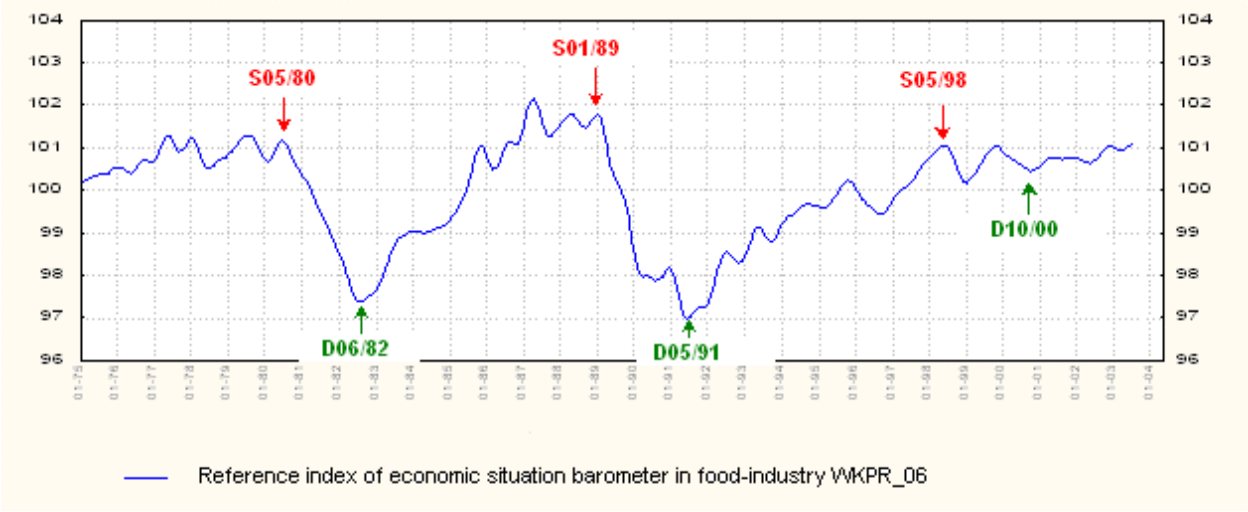
S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data.

Analysis of cyclical changes of the economic situation in agriculture barometer WKR_01 (graph 1), in the period of 1975-2003, revealed existence of two strong recessions in the periods of S09/79-D08/82 <footnote 5> and S01/89-D03/94 as well as weakening of the economic situation in the period of S07/98-D02/01. Length of a cycle between the lower turning points amounted to about 12 years, between the upper ones – a bit more than 10 years. Two Juglar's cycles appeared during the research period. The first phase of the economy situation downfall lasted for 35 months, the second one – 62 months and the third one – 31 months. Long-lasting recession of the period of S01/89-D03/94 resulted in unusual in the research period decrease of agricultural production amount. Moreover, period of adjusting to the market conditions was considerably long in agriculture, and was characterised by great decrease of commercial production. Production level of the end of the research period (June 2003) approached nearly to the level of 1989. However, the production level of 1991 was already reached in 1998, when (S07/98) another upper turning point appeared and started a phase of stagnation, lasting to D02/01, when – from the second quarter of 2001 – next phase of growth can be observed. From March 1994, three essential phases of growth can be marked: the first one – from D04/94 to S02/96, the second one from D02/97 to S07/98 and the third one from D02/01.

Referential index of economic situation's barometer in food-industry

An index of monthly value of sold production in that branch, in constant prices of December 2002, created basis for evaluation of economic situation in food industry (graph 2). That series was decomposed by Census II X-11 in order to evaluate particular components of dynamics and define a cyclical variability pattern. A cyclical component was explaining 39% of variance, whereas a seasonal component – 39.5%. Average length of one-way changes of the cyclical component amounted to eight months, and number of months necessary to make sure, that the observed changes in the series had a cyclical character, not an irregular one (MCD), amounted to three months.

Graph 2. Reference index of economic situation's barometer in food-industry (WKPR_06), from January 1975 to June 2003



S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

Chronology of cycles of the index of economic situation in food industry (WKPR_06) involved two Juglar's cycles, with recessions from S05/80 to D06/82 and from S01/89 to D05/91. The first recession lasted for 25 months, whereas the second one – 28 months. What is more, in the first period, a phase of growth lasted for 79 months, whereas in the second one – 101 months. From 1999 to 2001, dynamics of growth of food industry production decreased and it closed the expansion phase of the 90's with the upper turning point S05/98. On the other hand, phase of decrease in years of 1999-2000, as opposed to previous years, was characterised by slowdown of growth, but not a spectacular absolute fall of production (graph 2).

Recession in food industry from S05/80 to D07/82 lasted for 10 months less that in agriculture; whereas the second decrease of production in food industry (from S01/89 to D05/91) was by 34 months shorter than in agriculture. According to the above, the period of agriculture adjustment to market economy conditions and coming out from the 90's crisis was longer in agriculture than in food economy, what proves unequal development of these two branches of the food economy.

STRUCTURE OF ECONOMIC SITUATION'S BAROMETERS

Leading indexes of the economy barometers

Indexes qualified for construction of the economy barometer should allow to receive unambiguous answer to a practical question: when an observed change in a particular index variation can be treated as a cyclical one, and when it is caused by random factors only. Criteria, assumed in the OECD research practice, play the key role in components' selection to analytic works on barometers [5].

The first of the indexes selection stages was preparation of draft list of time series, selected on the base of economic meaning of the indexes, their wide subject scope, relevance and continuousness of data, easiness and quickness of an access to published data, depth of retrospection as well as frequency of publishing.

The second stage of the analysis was based on results of the Census II X-11 analysis. It concerned using such criteria as: number of months necessary to reveal cyclical changes (MCD) <footnote 6>, regularity and smoothness of cyclical changes in the time series, role of seasonal and cyclical components as well as irregular changes in observed variability of the time series.

In the third stage of the indexes' selection cyclical fluctuations were identified on the base of distribution of the turning points of the cycles. This stage of verification was supported by results of a spectral analysis. As a consequence, these time series, which were too short to be basis for cyclical fluctuations selection or these, which had not concerned at least two complete cycles, could be eliminated. Therefore, 11 time series were eliminated from the 94-series database, concerning years 1975-2003 as well as 10 time series were eliminated from the 57-series database, concerning years 1992-2003.

The fourth stage of the selection was conducted on the base of results of cross correlation research of particular time series in relation to reference indexes of barometers. Results of the analysis, combined with evaluation of graphs of the time series' cyclic component and analysis of the turning points' distribution, allowed to establish a status of particular time series as leading, parallel or delayed indexes in relation to the reference indexes of the economy barometers. Consequently, there were marked some potential leading indexes of barometers of the economic situation in food economy, including agriculture and food industry for two periods: 1975-2003 and 1992-2003.

In the last stage of the indexes' selection, the course of graphs of potential leading indexes' cyclical fluctuations was evaluated in relation to the reference indexes of the economy barometers, eliminating at the same time both anti-cyclical and a-cyclical indexes, which, if included into the barometer, might cause emission of incorrect signals. The indexes, which were not qualified for further analysis, were disqualified by impermanent leading of signal in the turning points and desynchronization of the cyclical course in relation to the reference index (especially at the end of the period). Furthermore, values of cross correlation coefficients equally frequently amounted to similar values of wide range of delays, without significantly marked maximum, what indicated fluctuations of signal's leading time and disqualified these indexes.

The cyclical components of the time series were normalized before integrating them into aggregated indexes. All the indexes were included into the barometer with equal weight (1); it means that the aggregated leading index was calculated as simple arithmetic mean of the components. Depending on the length of leading indexes' signal leading in relation to reference indexes for agriculture, food industry or food economy, several barometers were marked: short barometers (1-6 months of leading); long barometers (7-12 and 7-18 months) as well as mixed barometers (1-12 and 1-18 months). Moreover, the barometers were also constructed on the base of leading barometers concerning either lower or upper turning points. An attempt to construct the barometers only on the base of leading indexes evidently correlated with reference indexes of the barometers was also taken up.

Barometer of the economic situation in agriculture

During the cross correlation analysis, concerning the period of 1975-2003, 35 time series were defined as potential leading indexes of the economic situation in agriculture barometers. In table 1, 15 time series were presented, which were used in construction of aggregated leading indexes of the barometers as a result of the last stage of the selection.

Table 1. Leading indexes of barometers of the economic situation in agriculture in relation to reference index WKR_01 (data of 1975-2003)

Index code	Components of aggregated leading indexes	Cross correlation in relation to reference index WKR_01	
		Leading [in months]	R
I_04	Investment expenditure on machines, technical devices and tools	-16	0.67
KUSA_01	Index of economic situation of USA	-15	0.64
I_03	Investment expenditure in whole industry	-12	0.71
KHIS_01	Index of general economic situation of Spain	-12	0.70
PR_18	Production of phosphorus fertilizers per pure component	-10	0.81
PR_06	Sold production of food industry	-9	0.63
I_01	Total investment expenditure in national economy	-8	0.80
PR_03	Building and assembly production	-7	0.94
H_05	Total import of goods	-6	0.78
T_02	Total trans-shipments at seaports	-4	0.51
KUE_01	Index of general economic situation of the EU member countries	-2	0.59
PR_05	Production of machines, devices and tools for agriculture and forestry	-2	0.81
T_01	Total transport of cargo	-2	0.84
I_02	Investment expenditure on fixed assets in national economy	-1	0.67
PR_02	Sold production of whole industry	-1	0.85

R – cross correlation coefficient
Source: Author's calculations.

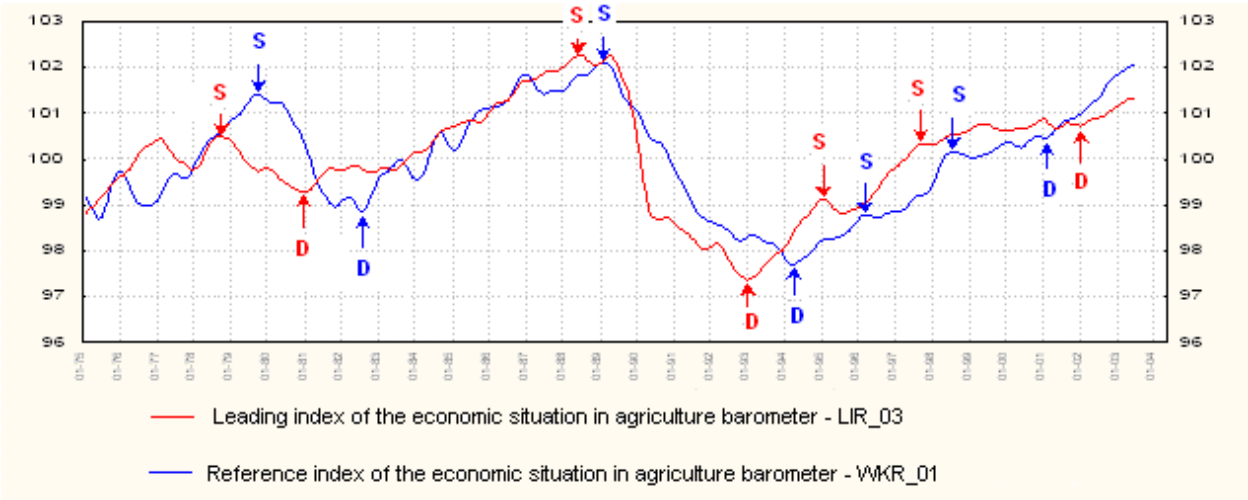
On the base of the leading indexes, presented in the table 1, 14 different versions of barometers of the economic situation in agriculture were constructed (table 2). All of them were evidently correlated with the reference index (WKR_01), keeping at the same time leading of the signal from 1 to 12 months. Eleven from 14 aggregated leading indexes signalized last slump of the economy in 1998, whereas eight barometers signalized the crisis of 1989-94. Recovering from the crises of 1979-1982 and 1989-94 (the lower turning points) were forecasted by all barometers versions, except for the LIR_09 one (table 2). In the period, good leading features had three barometers: LIR_03 (graph 3), LIR_13 (graph 4) and LIR_09; however, none of the others signalized the lower turning point in 2001 (table 2).

Table 2. Aggregated leading indexes of barometers of the economic situation in agriculture, in relation to reference index WKR_01 (data of 1975-2003)

Barometer's code (leading of components' signal)	Components of aggregated leading indexes of barometer	Leading (-) or delay (+) of reference index WKR_01 in turning points of the Juglar's cycle [in months]						Cross correlation in relation to reference index WKR_01	
		S 09/79	D 08/82	S 01/89	D 03/94	S 07/98	D 02/01	Leading [in months]	R
LIR_01 (7-16)	I_04, I_03, KUSA_01, KHIS_01, PR_18, PR_06, I_01, PR_03	-10	-3	0	-11	-8	+8	-12	0.83
LIR_02 (7-16, R 0,7)	I_03, KHIS_01, PR_18, I_01, PR_03	-10	-19	0	-10	-7	+11	-10	0.85
LIR_03 (7-16, D)	**KUSA_01, PR_06, PR_03, I_03**	**-13**	**-19**	**-9**	**-15**	**-12**	**+9**	**-10**	**0.84**
LIR_04 (7-16, S)	PR_18, PR_06, I_04	-19	-4	-8	-31	0	+13	-12	0.77
LIR_05 (7-16, S&D after 1988)	PR_18, PR_06, PR_03, I_04	-20	-3	-9	-33	0	+12	-11	0.82
LIR_06 (1-6)	H_05, T_02, KUE_01, PR_05, T_01, I_02, PR_02	0	-3	+1	-16	+3	+12	-1	0.85
LIR_07 (1-6, R 0,7)	H_05, PR_05, T_01, PR_02	+8	-1	-8	-28	-3	+3	-1	0.86
LIR_08 (1-6, D)	H_05, PR_05, T_01, I_02, PR_02	+7	-3	-3	-27	-3	+2	-1	0.87
LIR_09 (1-6, S)	**H_05, PR_05, KUE_01, PR_02,**	**+6**	**+1**	**-2**	**-7**	**-3**	**+2**	**-2**	**0.86**
LIR_10 (1-12)	I_03, KHIS_01, PR_18, PR_06, I_01, PR_03, H_05, T_02, KUE_01, PR_05, T_01, I_02, PR_02	0	-3	0	-9	-8	+10	-6	0.85
LIR_11 (1-12, R 0,7)	I_03, KHIS_01, PR_18, I_01, PR_03, H_05, PR_05, T_01, PR_02	+4	-2	0	-10	-3	+12	-4	0.88
LIR_12 (1-12, D)	KHIS_01, PR_06, PR_03, H_05, PR_05, T_01, I_02, PR_02	+1	-2	+2	-15	-1	+12	-4	0.88
LIR_13 (1-12, S)	**PR_18, PR_06, PR_03, I_04 H_05, KUE_01, PR_02, PR_05**	**-1**	**-1**	**-4**	**-1**	**-4**	**+2**	**-6**	**0.87**
LIR_14 (7-12)	I_03, KHIS_01, PR_18, PR_06, I_01, PR_03	-10	+1	-1	-15	-14	+11	-10	0.83

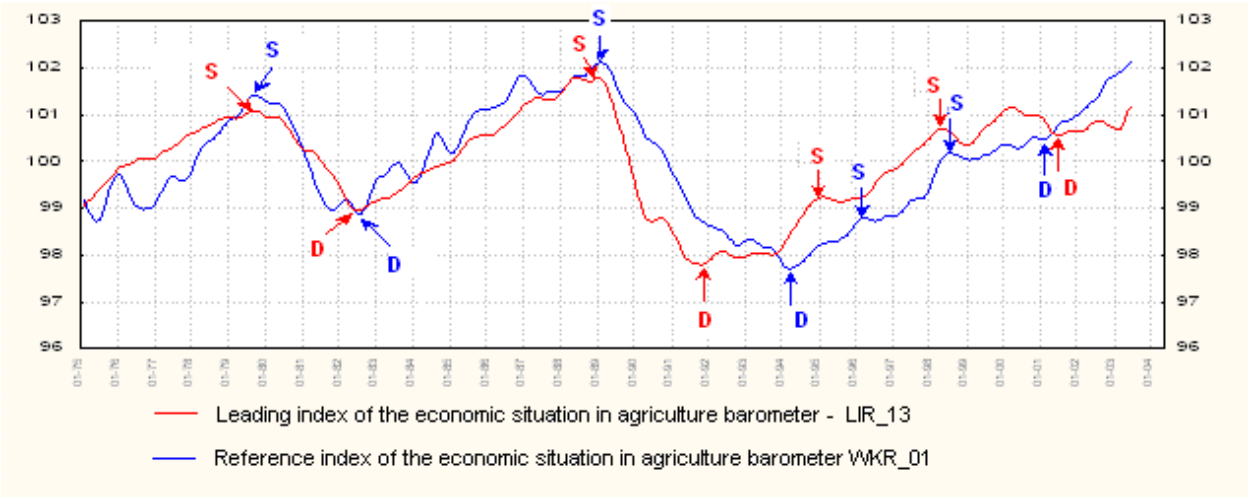
R – cross correlation coefficient; S – upper turning point; D – lower turning point, * the indexes' codes correspond to their description in the table 1.
Source: Author's calculations.

Graph 3. Aggregated leading index LIR_03 of barometer of the economic situation in agriculture, in relation to reference index WKR_01 (from January 1975 to June 2003)



S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

Graph 4. Aggregated leading index LIR_13 of barometer of the economic situation in agriculture, in relation to reference index WKR_01 (from January 1975 to June 2003)



S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

The subject of the analysis was also an attempt to construct the barometer for agriculture, using the statistical database consisting of the time series starting from January 1992. The list of components included into the aggregated leading indexes of barometers of the economic situation in agriculture (WKR92_01) from January 1992 consisted of 24 positions (table 3) out of 39 marked as potential leading indexes in the cross correlation analysis.

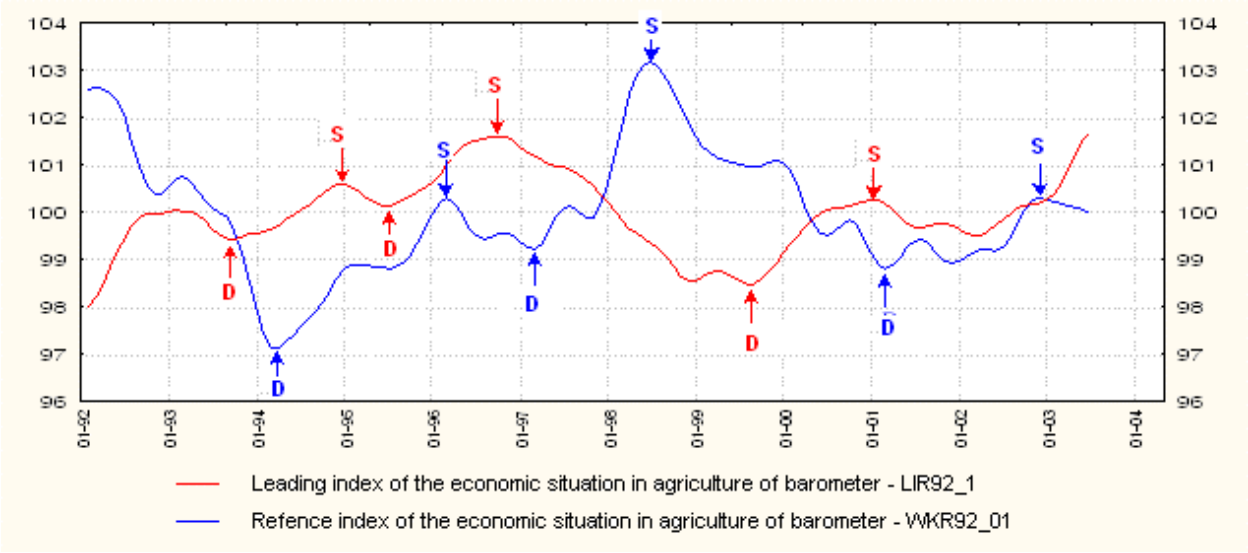
Table 3. Leading indexes of barometers of the economic situation in agriculture in relation to reference index WKR92_01 (data of 1992-2003)

Index code	Components of aggregated leading indexes	Cross correlation in relation to reference index WKR92_01	
		Leading [in months]	R
C_01	Wheat purchase prices	-25	0.53
C_02	Rye purchase prices	-24	0.44
PR92_19	Production of nitrogen fertilizers per pure component	-23	0.38
BA_18	Economic situation's index in the PENGAB bank posts	-22	0.32
H92_07	Current account of foreign balance	-22	0.48
BA_17	Economic situation's forecast of enterprises producing machines and devices for agriculture and forestry	-21	0.49
BA_12	Financial commitments' forecast of enterprises producing foodstuffs, beverages and tobacco products	-19	0.35
C_03	Porkers purchase prices	-19	0.28
BA_15	Employment forecast in production of foodstuffs, beverages and tobacco products	-12	0.64
I92_05	Investment expenditure in food industry	-12	0.55
BA_02	Index of general situation of enterprises in industry processing	-11	0.20
B_01	Total income of national budget	-10	0.40
H_02	Export of food and livestock	-8	0.48
PR92_18	Production of phosphorus fertilizers per pure component	-8	0.60
PR92_06	Sold production of food industry	-5	0.25
PR92_20	Sale of concentrates	-5	0.63
PR92_21	Headage of porkers	-5	0.61
H92_05	Total import of goods	-4	0.55
PK_08	Cash in circulation	-4	0.51
PR92_02	Sold production of whole industry	-3	0.45
PR92_04	Production of electro-machine industry	-3	0.27
P_04	Average employment in the sector of enterprises – transport and communication	-2	0.58
P92_07	Job offers	-2	0.57
H92_04	Terms of trade	-1	0.27

R – cross correlation coefficient.
Source: Author's calculations.

Eleven barometers were constructed; ten of them signalized upper turning point in 1996, whereas all of them signalized a slump in 1998 (however, with different leading). None of the barometers forecasted the lower turning point of 2001. Among the barometers, the best forecasting features had the LIR92_1 barometer (graph 5). It included time series of: wheat, rye and porkers purchase prices as well as production of nitrogen fertilizers per pure component. Furthermore, the barometer included results of the economic situation's test, consisting of the economic situation's index in the PENGAB bank posts, forecast of economic situation of enterprises producing machines and devices for agriculture and forestry as well as forecast of financial commitments of enterprises producing foodstuffs, beverages and tobacco products.

Graph 5. Aggregated leading index LIR92_1 of barometer of the economic situation in agriculture, in relation to reference index WKR92_01 (from January 1975 to June 2003)



S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

Both in the period of 1975-2003 and in the period of 1992-2003, the time series that were leading in relation to reference indexes for these years were identified. They concerned total import of goods, production of nitrogen fertilizers per pure component, sold production of whole industry and sold production of food industry.

Barometers of the economic situation in food industry

In order to construct barometers of the economic situation in food industry, in analyzing years of 1975-2003, 21 time series were marked, which course forecasts changes in reference index of the barometer of economic situation in food industry (WKPR_06). Finally, eight indexes were qualified to the barometers' construction (table 4) and on their base six barometers were built (table 5). Indexes, which were not qualified for further analysis, were disqualified by desynchronization of cyclical course in relation to the reference index and lack of leading in the turning points in relation to the reference index of barometer of the economic situation in food industry.

Table 4. Leading indexes of barometers of the economic situation in food industry in relation to reference index WKPR_06 (data of 1975-2003)

Index code	Components of aggregated leading indexes of barometers	Cross correlation in relation to reference index WKPR_06	
		Leading [in months]	R
P_08	Average employment in food industry, beverages and tobacco products	-25	0.27
P_07	Job offers	-24	0.30
PR_12	Production of cigarettes	-12	0.52
KUK_01	Index of economic situation of Great Britain	-5	0.51
T_02	Total trans-shipments at seaports	-5	0.50
I_03	Investment expenditure of whole industry	-2	0.76
I_04	Investment expenditure on machines, technical devices and tools	-2	0.80
KUSA_01	Index of economic situation of USA	-1	0.56

R – cross correlation coefficient.
Source: Author's calculations.

Each of six barometers presented unsatisfactory behaviour near turning points, especially in upper turning points in 1989 and 1998. In most cases, they did not inform about the end of recession in 1991 and 2000. Signal leading in relation to the upper turning point of 1998 was presented by short barometers of 3-months leading: LIPR_63 and

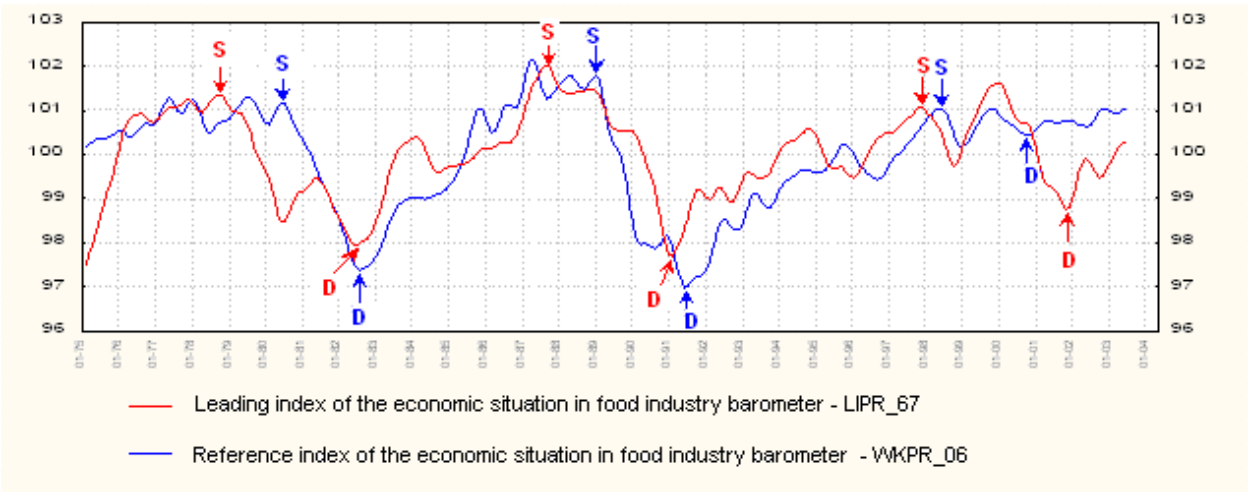
LIPR_67 (graph 6). However, extended time of the indexes' fall after 2000 (especially including the barometer LIPR_63) makes some reservations, as the barometer reaches lower turning point with 2-year delay. Nevertheless, it is not possible to decide if these barometers could alert to a next slump.

Table 5. Aggregated leading indexes of barometers of the economic situation in food industry in relation to reference index WKPR_06 (data of 1975-2003)

Barometer's code (leading of components' signal)	Components of aggregated leading indexes of barometers	Leading (-) or delay (+) of reference index WKPR_06 in turning points of the Juglar's cycle [in months]						Cross correlation in relation to reference index WKPR_06	
		S 05/80	D 06/82	S 01/89	D 05/91	S 05/98	D 10/00	Leading [in months]	R
LIPR_62 (24-25)	P_08, P_07	-8	-11	-20	+8	+3	+16	-22	0.34
LIPR_63 (1-5)	KUK_01, T_02, I_03, I_04, KUSA_01	-10	-3	0	-3	-5	+24	-3	0.62
LIPR_64 (1-5 R≥0,7)	I_03, I_04	-4	-2	0	-7	+5	+24	-2	0.82
LIPR_65 (1-12)	PR_12, KUK_01, T_02, I_03, I_04, KUSA_01	-5	-3	0	-2	+8	+11	-4	0.80
LIPR_66 (1-12, S)	PR_12, T_02, I_03, I_04,	-3	-9	0	+7	+5	+17	-5	0.79
LIPR_67 (1-5, D)	**KUSA_01, KUK_01**	**-20**	**-1**	**-15**	**-5**	**-7**	**+12**	**-3**	**0.79**

R – cross correlation coefficient; S – upper turning point; D – lower turning point, * the indexes' codes correspond to their description in the table 4.
Source: Author's calculations.

Graph 6. Aggregated leading index LIPR_67 in relation to reference index of barometer of the economic situation in food industry WKPR_06 (data from January 1975 to June 2003)



S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

Construction of the aggregated leading indexes for food industry, on the base of 1975-2003 years, did not allow to construct any satisfactory version of the barometer, especially due to desynchronization of course of the leading indexes' and the reference index (WKPR_06) as well as small number of potential leading indexes among 94 analysed time series.

Moreover, an attempt to construct the economic situation in food industry barometer was taken up, but on a database of shortened time series (1992-2003). In that case, the list of indexes marked as leading in relation to the reference index (WKPR92_06) in food industry included 24 time series. Fifteen indexes were qualified to the barometers' construction (table 6), but two of them only were evidently correlated with the reference index.

Table 6. Leading indexes of barometers of the economic situation in food industry in relation to reference index WKPR92_06 (data of 1992-2003)

Index code	Components of aggregated leading indexes	Cross correlation in relation to reference index WKPR92_06	
		Leading [in months]	R
PR92_20	Sale of concentrates	-25	0.29
C_01	Wheat purchase prices	-21	0.52
PK92_05	Term deposits of private persons	-21	0.35
C_02	Rye purchase prices	-18	0.42
H92_07	Current account of foreign balance	-18	0.22
H_03	Import of food and livestock	-16	0.51
I92_05	Investment expenditure in food industry	-13	0.28
PR92_15	Potatoes purchase	-13	0.42
PR92_11	Milk purchase	-11	0.32
C_03	Porkers purchase prices	-6	0.32
KHIS92_01	Index of economic situation of Spain	-6	0.27
KUSA92_01	Index of economic situation of USA	-6	0.23
KUK92_01	Index of economic situation of Great Britain	-4	0.28
KN92_01	Index of economic situation of Germany	-3	0.24
KUE92_01	Index of economic situation of the EU member countries	-2	0.21

R – cross correlation coefficient.
Source: Author's calculations.

Analysis of a course of the aggregated leading indexes in relation to the reference index in food industry (1992-2003) proved that only one barometer out of nine, marked as LIPR92_062, was revealing leadings in the turning points. The barometer included indexes of investment expenditure in food industry, value of import of food and livestock as well as rye purchase prices. In other indexes, especially after 1996, cyclical fluctuations disappeared or an index from leading one became a delayed one. Similar situation had place in research concerning years of 1975-2003. Consequently, it can be supposed, that after 1996 specific cycles have been revealed, characteristic for that type of activity, causing difficulties in marking leading indexes on the base of activities in other branches of the economy or results of survey research.

Both in the period of 1975-2003 and the period of 1992-2003, features of the leading indexes were kept by indexes of economic situation of Great Britain and USA, but none of them did not forecast with leading any turning point after 1999.

Use of leading indexes of barometers in forecasting

In order to receive forecast using the method of economic situation's barometer, a course of the aggregated leading indexes must be analysed; they are treated as an early source of information of changes in the economy, as a result of research carried out on a historical material. On the base of calculation of the MCD values of leading indexes it can be said, that three following months of growth proves growing tendencies, whereas three following months of the index value fall provide evidence for tendencies of a slowdown in the economy, what may be a warning signal. However, the rule is usually supplemented by another one, which says, that at the moment of change of the indexes' course, all observed changes must be recorded, revealed and popularized.

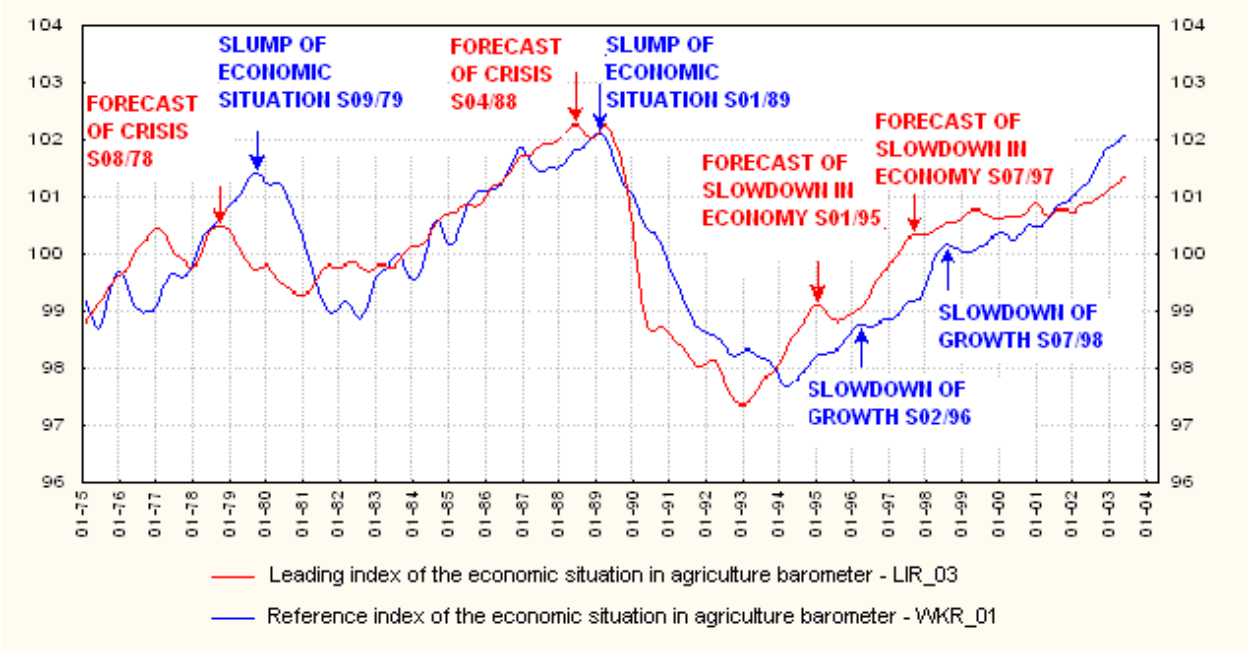
The constructed barometers allow to create forecast with varied time perspective, determined by amount of leading of indexes in relation to reference indexes, usually up to one year. The longest periods of leading signals for the barometers take place in agriculture.

Forecasting using the economy barometer has got quality character and in an operational aspect consists in statement, whether improvement or decline is going to happen or if there any changes are going to take place in the reference index course. Furthermore, possibility of turning previous courses of changes by the turning points' forecasting is evaluated, also based on analysis of the leading indexes course. On the base of the barometers constructed in the paper, direct construction of quantity forecast is not possible. In addition, methodological assumptions of the barometer's construction do not entitle to make any statement on mechanisms of economic activeness' fluctuations.

In accordance to agriculture, an example barometer LIR_03 with ten-months signal leading in the period included into the forecast perspective (from July 2003 to April 2004) indicated improvement of the economic situation in agriculture (graph 7).

The established course of changes did not allow to conclude about unbeneficial changes of the economic situation in the period of the forecast perspective. The changes observed were evident and their dynamics was relatively stable. The leading index of barometer LIR_03 included four components, and all of them presented growth during previous ten months taken into the analysis. It indicated dissemination of the growing course of changes in the leading index. In the forecast period, warning signals informing about decrease of the economic situation were not emitted.

Graph 7. Aggregated leading index LIR_03 in relation to reference index of barometer of the economic situation in food industry WKR_01 (data from January 1975 to June 2003)

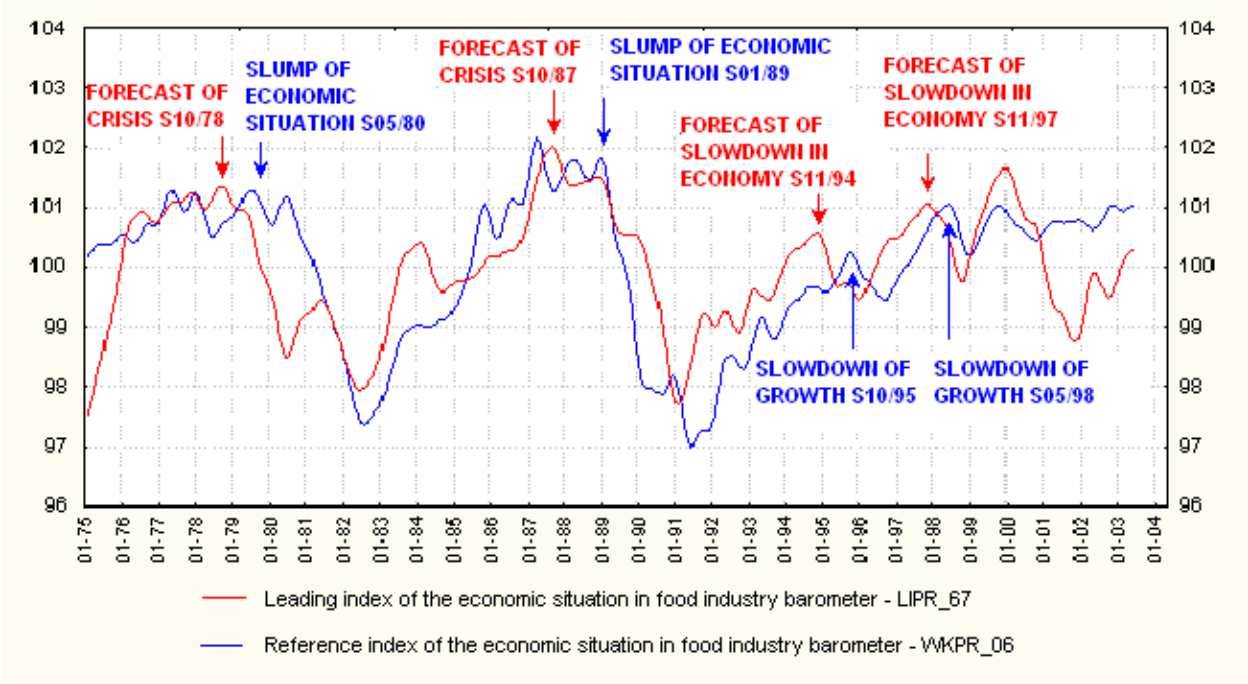


S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

In accordance to the economy barometer construction for food industry, there are great limits connected with a small number of leading indexes. It is a consequence of changes of sold production's value happening relatively early in relation to the other economic indexes' course. The LIPR_67 which was preferred out of the analyzed barometers for food industry and it had three-month signal leading. In the period of the forecast horizon, the changes observed allowed to evaluate changes of the economic situation in food industry positively (graph 8). What is more, there is no signal of potential disadvantageous economic situation during the forecasted period. According to the rule mentioned above, changes in the course of leading index were recorded, revealed and popularized; however, components of the leading index represent economic situation of the USA and the EU member countries.

The barometers presented in the paper were some constructions that need more analyses and improvements. Nevertheless, the result obtained allow to assume, that using the barometer of economic situation method enable to reconstruct an image (course) of fluctuations and use some regularities of time series' course to find early turns of the economic situation. Important for the leading index advantages' evaluation is its past behaviour. It is especially important not to let the leading indexes generate false signals – it means such signals that after a turn of the leading indexes there is no turn of the reference index, in particular if a slump of the economic situation is not leaded by a turn of the leading indexes. The second situations of the mentioned above did not take place in the barometers presented, what can be evaluated positively.

Graph 8. Aggregated leading index of the economic situation in food industry barometer - LIPR_67 WKPR_06 (data from January 1975 to June 2003)



S – upper turning point, D – lower turning point.
Source: Author's calculations based on CSO data

The research confirms the assumption that economic recessions are a cyclical phenomenon. So that, if the next recession's happening is possible, it substantiates a need of warning forecasts' construction that would predict possibilities of the economic growth slowdown or absolute fall of production.

CONCLUSIONS

The empirical material analyses as well as theoretical discussion entitle to make following statements and conclusions.

1. The food economy in Poland has been subject to economic fluctuations. Reconstruction of a cyclical course image allows to identify two deep crises of 1979-82 and 1989-91 essential slowdown of the economic growth in 1998-2000. In the research period two types of cycles were identified: 7–11.5-year cycles as well as sorter, 2.5-5.5-year ones. Average length of dominative cycles amounted to about 9.5 years.
2. The economic situation barometers are helpful in evaluations of contemporary state of food economy and in its short-term forecasts, including warning forecasts.
3. Morphologic characteristics of economic fluctuations in food economy are analogical to the course of cycles in whole industry, building, transport and trade, which were also affected by crises of 1979-82 and 1989-91. However, the crises affect mostly agriculture, though it is developing to some extent in its own tempo, having much longer recessions and delayed coming into the boom phase in relation to other branches of the economy.
4. The last decade does not allow to mark precisely the turning points, which take character of calm spheres of the economic situation turn instead of its sudden breakdown, what indicates a change of morphologic characteristics of the economic situation barometers.
5. Evaluation of the turning points dissemination and the cross correlation results indicate that first of all, changes of economic situation take place in agriculture supplies, then in food industry sold production and at the end in agriculture.
6. The leading indexes for agriculture and food industry play forecasting functions better in recession phases than in expansion phases, when they show tendency to remain behind the reference index. However, upper turning points are signalized earlier in relation to changes in the reference index, what proves that the barometers are useful in the economic situation slump's monitoring.
7. Complexity of a central planned economy and the period of adjusting to a market economy is a barrier in the economy barometer construction. Change of substantial features of cyclical fluctuations in the last decade lean towards separate analyzing of the period of central planned economy and the period which was en effect of the 90's transformation.

8. The economic situation cycles' analysis for the period starting from 1992 does not justify to identify correctly possible cyclical fluctuations. The period is too short to decide if the phenomena observed are long-lasting development regularities. The findings concerning seasonal fluctuations are more reliable and would probably keep their power in future.
9. The cross correlation analysis results depend on the research period. In the most of cases, groups of the leading indexes in relation to the reference indexes, identified on the base of the two research period (from 1975 and from 1992) are different, and the indexes change their status from leading to parallel and from parallel to leading. Shortening of the research period to 1992-2003 resulted in change of the turning points moments in some of the time series.
10. Adaptation of the cyclical fluctuations methods and the economy barometers' construction methods implemented in the OECD countries brings positive results in cycles' analysis and barometers construction in food economy in Poland. However, application of particular indexes as leading, on the base of the cross correlation analysis' results only, does not always give positive results. According to that, an additional analysis of the turning points' conformity in relation to the reference indexes is necessary.

FOOTNOTES

1. Definition of economic situation is usually used in two meanings. In the first one it means "indicators of the economic life in their entirety such as production, employment and others, defining state of the economy or markets" [4]. In a limited meaning it is defined as a pendulous movement around the main macroeconomic indicators' trend line. Economic fluctuations "... are changes in economic activeness of society that are expressed in expansion or contraction of the activeness around the trend line" [1]. Both of the definitions are in conformity with the methods of economic cycles' research, used in the paper.
2. MCD (months of cyclical dominance) means length of a period (number of moths), necessary to make sure that the tendency observed is signifying a new phase of a cycle, not accidental changes.
3. Implemented formulae of normalization means relative deviations from average of the whole period of research in relation to absolute average deviation, adjusted by adding 100. Normalized variables amount to values of the 95-105 interval.
4. Values of the economic situation's barometer illustrate relative deviations from average of the research period in relation to absolute deviation, adjusted by adding 100. Value "100" indicates that in a particular month value of the index equalled to value of average of the whole research period.
5. Formulae "S09/79" indicates that the upper turning point appeared in September 1979; "S" - stands for an upper turning point, whereas "D" – a lower turning point.
6. In practice of the OECD barometers it is assumed, that the MCD critical value equals 6, and at the same time, all time series, where the MCD value exceeds 6 ought to be not included into the analysis [3].

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Responses to this article, comments are invited and should be submitted within three months of the publication of the article. If accepted for publication, they will be published in the chapter headed 'Discussions' and hyperlinked to the article.
