DEFINITION AND MORPHOLOGY OF BUSINESS FLUCTUATIONS
IN THE POLISH ECONOMY UNDER TRANSFORMATION

Introduction

The processes of business fluctuations exist in all economic systems. This concerns both market economies and the countries where transformation processes from the centralised economy to the system in which market mechanisms play the most significant role are in progress.

Fluctuations occurring in the system under transformation take shape in specific institutional, political and social conditions. The level of economic growth and the role of long-term changes in the sphere of ownership and in the structure of sectors are also different as compared with the conditions existing in the economies where market structures are well developed.

The aim of this paper is to define business fluctuations occurring in the Polish economy under transformation and to analyse empirically their structure and most important morphological features.

Therefore, the subject of analyses is morphology of business fluctuations which determines the structure, shape and forms in which particular elements of the dynamic business processes are manifested. In the related literature external aspects of the fluctuations are described by means of morphological features, i.e. the properties which characterise the development of whole business cycles, their particular turning points and phases. The empirical analyses will include two macroeconomic indicators: GDP and the sold production of industry. In West European countries these indicators are most frequently used to study business fluctuations. The research covers the period 1990-1999 as the processes of transformation in Poland started on January 1, 1990 and one of the transformations was the change in the principles and methodology of estimating the time series which reflect economic processes.
I. Business fluctuations in the market economy and in the system under transformation

In the economy of transformation period, like in the market economy or the command economy, there occur business fluctuations which are discussed in the literature on the subject. This means that in each time series of absolute or relative values, describing dynamic changes of the basic economic magnitudes, there occur long-term changes (trend), business fluctuations, seasonal oscillations and random changes. The character of transformation processes however, may change the significance of particular fluctuations as compared with the market economy or the centrally planned economy. In the system under transformation, a greater role may be played by random changes because during profound quantitative and qualitative transformations the economy is less capable to assimilate the negative or positive effects of those phenomena. Under such conditions long-term changes and business fluctuations may also be of different significance and may have different features.

In the economic system where central planning and management are gradually being replaced by the market mechanism (and these transformations are a function of time) the existing business fluctuations can be defined by accepting two solutions. Firstly, determination of those fluctuations may contain common, supra-systemic elements independent of the mechanism of functioning of a given economy. The other possible procedure in the process of defining business fluctuations may add some details to the previous solution. This procedure will assume that those fluctuations are determined by the phenomena and processes governing the market economy and the elements attributed to the centralised system may only modify the mechanism and morphological features of the fluctuations.

In the literature on business conditions one can find a relatively big number of sometimes mutually exclusive definitions of fluctuations and the resulting business cycles occurring in the highly developed market economies. As these concepts are very often identified with other elements of dynamic economic processes, it frequently leads to some theoretical-cognitive misunderstandings.

An already classical definition of the business cycle occurring in the market economy was formulated by A.F. Burns and W.C. Mitchell. This definition interprets the business process as a sequence of phenomena occurring in the market economy. However, this definition does not reflect the most significant features relating to the origin of this process and the mechanism of its development; it contains only most general concepts as concerns the sequence of successive phases. This definition is also inadequate and does not describe the specific features of the business cycles today. Therefore, I. Mintz modified Burns's and Mitchell's concept adjusting it, however only partially, to the modern conditions, and at the same time
introducing the idea of "growth cycle" to define the business cycle today. In her opinion growth cycles are fluctuations in the aggregated economic activities. They consist of a period of a relatively high growth rate occurring simultaneously in major part of economic activities and of the following general period of relatively low growth rate, leading to the phase of the high growth rate in the next cycle.

Therefore, according to I. Mintz, the modern business cycle consists only of two phases and the basic difference between the modern and the classical cycle concerns the criterion of differentiating particular phases. In the classical cycle a general direction of changes in the economic activity is a basis for periodicity. In the case of the growth cycle a criterion to distinguish its phases is the relation of a given rate of changes in the economic activity to the accepted normal rate or average rate. Two statistical procedures are most frequently used in the process of estimating normal rate. In the first approach it is assumed that this rate is identical with the values of trend line estimated in a given series. In this case the periodicity criterion is the ratio of empirical values to the estimated values: if the rate of growth of empirical values is higher than the rate of growth of estimated values, the growth is defined as relatively high and the phase differentiated in this way is called a high-rate-phase. If, however, the rate of growth of empirical values is lower than the rate of growth of estimated values, the growth is defined as relatively low and the phase received is called a low-rate-phase. The growth cycles differentiated on the basis of the obtained quotients of empirical values of the series and estimated values are called deviation cycles. The above-mentioned concept is criticised because phases of a cycle differentiated in this way depend to a large extent (among others) on the formally accepted form of the trend, on the criterion evaluating adjustment of the trend values to empirical values, on the length of the analysed period and on the extreme values of the time series. Along with the change of these sometimes arbitrarily assumed elements the estimated values of the trend are changed which results in the change of morphological features of a business cycle. Limitations of the first procedure have led to devising the second method of estimating normal rate and to the concept of the so-called step cycle. In this case the basis for distinguishing the cycle phases is the rate of growth of absolute values of a given statistical series after eliminating the seasonal fluctuations. The normal rate is here the average rate of growth for the whole analysed period. The step cycle, being methodological variant of the growth cycle, also consists of two phases: in the first one all estimated rates of growth are higher than the average values, whereas in the second phase they are lower.

Accepting the mechanism of investment multiplier – an accelerator as a theory explaining business fluctuations in the market economy, one can state that the essence of contemporary business cycle is not disturbing the overall balance but it is cumulative changes in
the relation between the volume of effective demand and global supply under incomplete utilisation of production factors. In this case a business cycle is defined as: "...fluctuations in the relation between effective demand and potential supply occurring in the process of economic growth". Therefore, it is "...a pendular movement of the economic activity reflected in the changes of the extent to which production potential is used". The analysis of the growth cycle based on the indicators of fixed capital use consists in studying the deviations of the current global supply from the corresponding hypothetical values which can be obtained if all input factors are fully used.

Apart from the above-mentioned concepts of deviation cycles, step cycles and cycles in the use of production potential, other definitions are also used in the practical studies into contemporary business fluctuations in the market economies. The best-known and at the same time the simplest one is the definition based on certain indicators – aggregates, such as e.g. GDP which help to differentiate and analyse economic oscillations. The growth cycles are defined in this case either as deviations of the relevant empirical values of the GDP from the estimated values of the trend or as: "... changes in the real growth of GDP".

Business fluctuations understood as short and medium-term relatively regular changes in the level of economic activity were also analysed by the economists who deal with the centralised economy. The research in this field, however was different and the very idea of oscillations was interpreted in different ways over time. There was a significant evolution in the views – from those totally negating the existence of any fluctuations in the command economy to the statement that business fluctuations were an immanent feature of this system caused by internal factors.

The evolution of views as to the occurrence of economic fluctuations in the command economy indicates that there is no unanimous approach as regards their definition. Depending on the period in which a given concept was formulated, various definitions were applied starting from leap growth, through stage growth, investment cycles, development cycles, growth cycles. Subsequent definitions to determine changes in the level of economic activity indicate a stronger and stronger belief in the occurrence of economic fluctuations and in a gradual development of business conditions studies in the centrally planned economies. As the related literature does not offer univocal criteria by means of which one could qualify given fluctuations as a group of oscillations of cyclical character, it is difficult to determine definitely to what extent the business cycles were created by the fluctuations observed.

As results from the above-mentioned, out of necessity very brief, review of the definitions of business fluctuations occurring in the market economy and in the centrally planned system, the most "neutral" for the functioning of the system are those definitions which
contain general properties of contemporary business cycles and at the same time formulate the principles as regards the selection of empirical indicators or statistical-econometric tools used to differentiate them. Thus, on the basis of these considerations it can be said that business fluctuations in the economy under transformation are a movement of pendular type around the trend line of the basic macroeconomic indicators (national income, production, investment, consumption, employment, etc.), which reflects over time changes in the level of economic activity. To this interoperation trend there also belongs the definition which says that business fluctuations in the transformation period present absolute or relative changes of the real gross national product over time. Such definitions express what is common and at the same time characteristic of business conditions, independently of the system analysed, i.e. they confirm that there exist dynamic, relatively regular oscillations around the trend line, the range of which comprises the whole economy. At the same time these definitions show which indicators should be taken into account in the empirical analyses and how they should be constructed.

Another approach to the problem of defining business fluctuations in the economy under transformation assumes that these fluctuations are determined by the phenomena and processes occurring in the market economies and their possible modifications result from the centrally planned system. Accepting this way of reasoning, however, one encounters some cognitive problem connected with the selection of a theoretical concept which explains the emergence and development of the oscillations in the market economies. Fluctuations in the economy based upon the assumption of internal instability of the studied system (e.g. in Keynesian economy) will be interpreted differently from those where a classical thesis about permanent market equilibrium is assumed. Accepting Keynesian approach one can state that business fluctuations in the economy under transformation are more or less regular changes in the level of economic activity, generated by internal mechanisms which function in this system. On the basis of the theses of classical economy, business fluctuations may be determined as relatively regular deviations from the state of equilibrium, caused by monetary or non-monetary random events (shocks) from outside the system.

Analyses of business fluctuations in the centrally planned systems clearly indicate that a dominating role in the process of their generation and development was played by the system of overall economic planning particularly the process of investment planning and the implemented economic policy. Planning cycles created in this way led to the changes in the real magnitudes related to investment activity. Investment cycles were a consequence of the planning cycles. If this hypothesis is accepted, then, on the grounds of Keynesian economy one can state that business fluctuations in the economy under transformation are relatively regular changes in the
level of economic activity, generated by the factors linked with the planned and executed investment activity.

When the Keynesian economy theses about the endogenous reason for fluctuations and the assumption about their relative regularity are accepted, one can conclude that, according to G.W.Kołodko's criterion, fluctuations in the economy of the transformation period are also of cyclical character.

The formulated hypothesis as to the cyclical nature of business fluctuations existing in the system under transformation facilitates the analysis of their morphology. According to the concept of morphology accepted in the related literature, one can observe that these fluctuations also consist of two elements, i.e. turning points and phases. As regards the turning points, in the system under transformation one can accept the definitions and kinds of turning points referring to the market economy. These definitions are of supra-systemic character, therefore they can be used in the analyses of business conditions processes taking place in the systems under transformation. The second element of oscillations, i.e. a phase, can also be defined like that in the market systems. Thus, the phase of fluctuations in the economy under transformation is the time interval between subsequent turning points of different nature. By analogy, a business cycle consists of two phases: favourable business conditions occurring between the lower and upper turning point and the phase of unfavourable business conditions which occurs between the upper and lower turning point. In the related literature the criteria of further division of the phases into sub-periods, referring to the conditions of market economy or centrally planned economy, are not explicit. This means that the further division of the phases of business processes occurring in the systems under transformation is impossible.

II. Methodological problems of differentiating contemporary business fluctuations in the Polish economy of the nineties

In the empirical research on contemporary business fluctuations carried out in the countries of Western Europe, two macroeconomic indicators are used most frequently: sold production of industry and GDP. Analogous measures were accepted to analyse the morphological features of business conditions processes occurring in the Polish economy. The selection of source materials was justified by access to data in the required time and spatial profiles.

Changes in the activity of the Polish economy are analysed for the years 1990-1999. The initial date for start of the analyses results from the fact that on January 1, 1990 L. Balcerowicz introduced the stabilisation programme which started the process of economic transformation.
1. Industrial production and GNP as empirical indicators reflecting business fluctuations in Poland

The Polish public statistics, defining the value of sold production of industry, recognises that it is accounted for by the extractive and manufacturing industries and by enterprises dealing with generating and supplying electricity, gas and water. The volume of production sold is estimated without indirect taxes whereas the GDP illustrates the final result of the activity of all entities of the national economy, i.e. legal persons, other organisational units and natural persons carrying out economic activity. The basic element of the GDP as regards generation is the sum of gross value added of all sectors of the national economy. The value industrial production sold was analysed for each month. The data for the GDP were studied every quarter but time lags in the publications of official estimates forced the authors to omit quarter IV of 1999. All data were converted into fixed prices of 1990. However, the specific nature of the period of social and economic transformations is responsible for the fact that the indicators applied are not free from certain shortcomings.

Identification of business fluctuations requires the gathering of homogeneously aggregated, many-year time intervals. This proves considerably difficult under transformation of the Polish economy. As regards the sold production of industry the change of classification in the public statistics was a problem: in 1994 the Classification of National Economy (CNE) was changed into European Classification of Activity (NACE) i.e. from the MPS system to the SNA system. This change is necessary due to the adjustment of the principles of aggregation used in our country to the European requirements and standards, however, it is a serious obstacle to the construction of many-year comparable time series. The change in classification disturbs internal coherence of the data, therefore the conclusions made on the basis of such source materials must be formulated very cautiously.

As regards the analyses of economic activity in Poland, another very important shortcoming was the absence of the GDP estimates for the periods shorter than one year. In the developed countries such statistics are available every quarter of the year, however, implementation of the System of National Accounts (SNA) in Poland was not quick enough to reconstruct similar data from the beginning of the decade. Nevertheless the Central Statistical Office made some backwards calculations tracing back to 1994. They are based upon a direct method which uses statistical reports of the national economy entities, mainly financial reports of enterprises, reports on sales and employment and budget reports for non-market sectors. Additionally there appeared estimates which use econometric models and thus facilitate indirect determination of the value of GDP. Econometric methods generate indications which do not
differ significantly from the information provided by the Central Statistical Office. The results of relevant comparisons made it possible to create quarterly estimates of the GDP from 1990. Thus, for the further analysis a series of GDP was constructed where the data for the years 1990-1994 were taken from the article of A.Welfe and R.Kelm, whereas the values for the remaining part of the interval considered come from the publications of the Central Statistical Office\textsuperscript{21}. However, it must be remembered that a part of the collected source materials is not belong to the official GDP statistics, therefore the conclusions formulated must be regarded as merely preliminary results.

Due to the above-mentioned methodological problems, it should be underlined that only longer time series, constructed on the basis of permanent methodological assumptions, may render more univocal observations as regards the morphology of business fluctuations in the Polish economy under transformation.

2. Statistical-econometric procedure of differentiating business fluctuations

Empirical analyses the aim of which is to differentiate and characterise the changes occurring in macroeconomic aggregates are based on the assumption that the following elements can be distinguished in the structure of a time series: trend, business and seasonal fluctuations and random changes. On the basis of the source materials observed the authors of the article assume that these particular elements remain in the additive relationship. Therefore, the time series accepted for the analyses can be presented as a sum:

\[ X_t = TR_t + C_t + S_t + \xi_t, \]

where:

- \( X_t \) – empirical values of the time series under analysis;
- \( TR_t \) – element of trend;
- \( C_t \) – changes in business conditions;
- \( S_t \) – seasonal fluctuations;
- \( \xi_t \) - irregular changes expressing random disturbances.

Table 1 presents the methodology of distinguishing business fluctuations in the analysed series expressed in fixed prices. The first stage was to eliminate seasonal and random changes. This step was made with the use of procedure Census II/X --11\textsuperscript{22}. The data prepared in this way were subject to transformations facilitating spectral analysis the aim of which was to identify the periodicity of fluctuations in the analysed measures of the economic activity. Therefore, the series obtained earlier were replaced by their first differences, then their mean arithmetical value was subtracted and the values of linear trend were removed. A certain number of zeros was added at the end of the series which enlarged the range of frequencies possible to distinguish.
Monthly data were extended to 243 observations, whereas quarterly data were lengthened up to 100. The numbers of zeros introduced were a compromise between the intention to cover a possibly wide spectre of frequency and on the other hand actual observations could not be dominated by the artificial elongation.

Table 1. Stages of differentiating business fluctuations in the sold production of industry and in the GDP of Poland under transformation

<table>
<thead>
<tr>
<th>No.</th>
<th>Kind of statistical-econometric operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Clearing the series of random and seasonal changes by means of procedure Census II/X- 11 – the first approximation of the sum of trend and cyclical fluctuations is obtained by means of Henderson's filter</td>
</tr>
<tr>
<td>2.</td>
<td>Preparation of the series for spectral analysis – exchange of values for their first differences, subtraction of their mean arithmetical value and removal of the value of linear trend</td>
</tr>
<tr>
<td>3.</td>
<td>Determination of the periodicity of cyclical fluctuations by means of spectral analysis</td>
</tr>
<tr>
<td>4.</td>
<td>Verification of the hypothesis on the origin of spectrum density from the population of even distribution by means of Kolmogorov-Smirnov test</td>
</tr>
<tr>
<td>5.</td>
<td>Estimation of a model of the form: ( \hat{X}_t = TR_t + \sum (A_i \cos 2\pi \omega_i t + B_i \sin 2\pi \omega_i t) = TR_t + H_t )</td>
</tr>
<tr>
<td></td>
<td>where: ( \hat{X}_t ) estimator of a given economic magnitude;</td>
</tr>
<tr>
<td></td>
<td>( H_t ) - subsequent harmonics;</td>
</tr>
<tr>
<td></td>
<td>( A_i, B_i ) - amplitudes of particular harmonics;</td>
</tr>
<tr>
<td></td>
<td>( \omega_i ) - frequency of fluctuations with ( \omega_i = 1/\text{fluctuations period} ) (fluctuations period is a value shown by spectral analysis)</td>
</tr>
<tr>
<td>6.</td>
<td>Determination of indicators of the form: ( i_t = \frac{\text{values obtained from model reconstruction (results of step 5)}}{\text{values received from the estimated trend function}} \times 100 % )</td>
</tr>
</tbody>
</table>

Source: The author's own calculations.

The next stage of the research was estimating econometric models constituting the sum of trend and harmonics of already determined periodicity. These models take the form indicated in the Table (step 5)25. In result of appropriate calculations it is also possible to obtain the picture of a sum of the growth tendency and trigonometric harmonics, shifted in the phase, which are a reflection of the cyclical fluctuations.

When applying the above-presented methodology, a monthly series of the value of the sold production of industry expressed in fixed prices from 1990 was cleared of seasonal and random fluctuations and prepared to the spectral analysis. Upon this basis it was stated that the peaks of the spectrum appeared at the points which correspond to fluctuations periods equalling: 81.0; 40.5; 30.4; 22.1; 17.4; 13.5 of a month. The value of Kolmogorov-Smirnov statistics amounted to 0.4055. The critical value determined at the significance level of 0.05 and 25 points of spectrum, i.e. \( D_{0.05, 25} \) is equal to 0.2540. Therefore, it was possible to reject the hypothesis that the obtained distribution of density is caused by “white noise”. Thanks to this the occurrence of fluctuations of the periods mentioned was accepted. This was a starting point
for the specification of the model reconstruction of the dynamics of monthly sold production of industry in Poland\textsuperscript{26}.

2. \[ \hat{X}_1_t = 3751,34 + 0,25*t^2 + 89,26*ZS_1 + 236,82*ZC_1 + 148,21*ZS_2 + (507,69) + 212,68*ZC_2 + 32,85*ZS_3 + (20,48) + 89,26*ZC_3 + (12,47) - 236,82*ZS_4 + (9,93) + 148,21*ZC_4 + (30,00) + 18,30*ZC_5 + (11,37) + 129,60*ZS_6 + (507,69) + 149,33*ZC_6 + (18,43) + 19,90*ZS_7 + (9,93) - 14,33*ZC_7 + (2,97) + 69,30*ZC_8 + (3,71) + 18,29*ZC_9 + (3,60) - 11,83*ZS_10 + (2,95) - 21,63*ZC_10 + (2,99) - 19,90*ZS_11 + (3,71) + 80,96*ZC_11 + (3,60), \]

where: \( \hat{X}_1_t \) - estimator of sold production of industry,

\( ZS_i \) - auxiliary variable of the form \( ZS_i = \sin{(2\pi t / \text{period of fluctuations})} \),

\( ZC_i \) - auxiliary variable of the form \( ZC_i = \cos{(2\pi t / \text{period of fluctuations})} \),

\( i = 1, \ldots, 6 \),

Let us add that for equation 2. \( F_{(13, 106; 0,05)} = 3864,96; R^2 = 0,998; s = 51,69. \)

By means of adequate transformations, the above-mentioned dependence was changed into the sum of trend and harmonicas shifted in the phase, which yielded:

3. \[ \hat{X}_1_t = 3751,34 + 0,25*t^2 - 253,09*\sin{(2\pi t/81,00 - 1,21)} + 149,33*\sin{(2\pi t/40,50 + 0,12)} + 146,96*\sin{(2\pi t/30,40 + 0,49)} + 82,22*\sin{(2\pi t/22,10 - 1,40)} - 27,33*\sin{(2\pi t/17,40 + 1,12)} + 27,03*\sin{(2\pi t/13,50 - 0,74)}, \]

for this equation \( R^2 = 0,997; s = 60,55. \)

The graphic shape of model 3. is presented in Fig. 1.

Fig.1 Monthly sold production of industry in Poland in the period January 1990-December 1999

\[ \text{Source: Authors' own calculations.} \]

Having an algebraic description of the dynamics of sold production of industry, the authors determined the cyclical deviations from the trend. These were obtained through dividing the values from model 3. by the values of long-term growth tendency, which yielded a series of indicators for which 100\% means full compatibility with the trend and the values over (under) 100 characterise \emph{in plus (in minus)} deviations. Such a series is presented by Fig 2.
Using similar statistical-econometric tools, the GDP dynamics for Poland under transformation was reconstructed. After the spectral analysis the smoothed out course of spectrum density revealed peaks at the points which corresponded to 33,33; 14,29; 9,10; 5,88; 4,35 of a quarter. The value of Kolmogorov-Smirnov statistics amounted to 0,2736. The critical value $D_{(0.05; 25)}$ equals 0,2540, therefore it was possible to reject the hypothesis that the obtained distribution of density is caused by “white noise”. It was a basis for the assumption that in the GDP series appear fluctuations of the periods mentioned. Thus it was possible to estimate the equation illustrating the development of GDP:

$$\hat{X}_t^2 = 13659.98 + 4.26t^2 + 574.49Z_{S1} - 612.47Z_{C1} + 87.15Z_{C2} +$$
$$- 192.65Z_{S3} + 221.67Z_{C3} + 136.67Z_{C4}$$

$$F(7; 38; 0.05) = 831.35; \ R^2 = 0.995; s = 191.10;$$

where: $\hat{X}_t^2$ – estimator of quarterly GDP.

Model 4., having been changed into the sum of trend and harmonics shifted in the phase, can be formulated as follows:

$$\hat{X}_t^2 = 13659.98 + 4.26t^2 - 839.74\sin(2\pi t/33.33 - 0.82) +$$
$$+ 87.15\sin(2\pi t/14.29 + 1.57) + 293.69\sin(2\pi t/9.10 - 0.86) +$$
$$+ 136.67\sin(2\pi t/5.88 + 1.57),$$

for this equation $R^2 = 0.995; s = 185.22.$

Fig. 3 is a graphic representation of the dependencies obtained.
Another step of the analysis was to determine the indicators characterising cyclical deviations from the trend. The indicators obtained are presented in Fig. 4.

III. Morphology of business fluctuations occurring in Poland during the period of transformation

The empirical analysis of business fluctuations in the indicators of sold production of industry and GDP covered only the most important morphological features, i.e. the period of the occurrence of turning points (upper and lower), the length of the whole cycle and its phases, amplitude of particular phases and the whole cycle as well as the intensity of oscillations. It was assumed in the analysis that the upper (lower) turning point appears in the period when the value of the analysed indicator reaches its maximum (minimum). In other words these turns are
the points occurring on the curve illustrating the previously estimated harmonics (these curves may be additionally interpreted as deviations from the trend). After the turning points have been established it is possible to differentiate the phases of the business cycles. In this case it was assumed that the phase is a period lasting at least 9 months and occurring between the two subsequent, opposite turning points. Therefore, each cycle consists of a growth phase (between the lower and upper turning point) and a decline phase (between the upper and lower turning point). Another important morphological feature of contemporary business cycles is amplitude which can be interpreted in terms of the amplitude of a phase or the amplitude of the whole cycle. In the first case it is the value of the difference between extreme points belonging to the same phase. An amplitude of the cycle is a difference between the amplitude of the growth phase and the decline phase. Estimation of the occurring oscillations in the form of adequate indicators, i.e. information by what percentage a given value differs from the value of the growth tendency, makes it possible to calculate the standard deviation of the changes observed. This provides an opportunity to examine the dispersion of the series around the trend line which expresses the intensity of oscillations. However, due to different values of the mean arithmetic for particular series of the fluctuations, it was not possible to compare the analysed measures from the viewpoint of dispersion. Therefore, it was assumed that a classical coefficient of variability in the form of the relation of standard deviation to the mean arithmetic value is a measure which facilitates appropriate comparisons.

Specification of the studied morphological features of the fluctuations distinguished in the indicators of sold production of industry and GDP in Poland is presented in Table 2 and Table 3.

Despite a relatively short period of analysis it was possible to differentiate certain significant features of the structure of business processes in the approved indicators of economic activity. As regards the industrial production sold, the first turning point was distinguished in August 1990, thus it was located at the beginning of the analysed series which may mean that its identification is not fully unanimous. This results from the fact that it is impossible to find out whether it was actually preceded by a turning point of the opposite character. If the differentiated extreme values are to be accepted, it can be said that three phases of the business cycle process occurred in the Polish economy in the period from January 1990 till December 1999.

The first one is a decline phase in the business conditions (August 1990-September 1991) during which the trough of Poland's transformation recession could be observed. The subsequent years witnessed a gradual improvement in the state of the economy. Fluctuations which occurred in this period were not significant enough to qualify them as separate phases.
The upper turning point which completed the growth phase fell on November 1997. This may be related to changes in Poland’s macroeconomic environment (breakdown of the Russian market). The subsequent months were a very unfavourable period for the economy of our country, with the phenomena which clearly indicate slowdown in the dynamics of economic growth. It seems that the lower turning point completing that phase falls on March 1999.

Table 2. Specification of some morphological features of the business cycles differentiated in the indicators of the variable basis of the volume of sold production of industry in the period January 1990-December 1999.

<table>
<thead>
<tr>
<th>Morphological features of a cycle</th>
<th>Phases of business cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>decline phase</td>
</tr>
<tr>
<td>Length:</td>
<td></td>
</tr>
<tr>
<td>- phases (in months)</td>
<td>15</td>
</tr>
<tr>
<td>- cycle (in months)</td>
<td></td>
</tr>
<tr>
<td>Amplitude:</td>
<td></td>
</tr>
<tr>
<td>- phases (in %)</td>
<td>23,97</td>
</tr>
<tr>
<td>- cycle (in %)</td>
<td></td>
</tr>
<tr>
<td>Intensity of fluctuations (in %)</td>
<td></td>
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</tbody>
</table>

Source: The authors’ own calculations.

Table 3. Specification of some morphological features of the business cycles differentiated in the indicators of the variable basis of the volume of Poland’s GDP in the period quarter I 1990 to quarter II 1999.

<table>
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<tr>
<td></td>
<td>decline phase</td>
</tr>
<tr>
<td>Length:</td>
<td></td>
</tr>
<tr>
<td>- phases (in quarters)</td>
<td>5</td>
</tr>
<tr>
<td>- cycle (in quarters)</td>
<td></td>
</tr>
<tr>
<td>Amplitude:</td>
<td></td>
</tr>
<tr>
<td>- phases (in %)</td>
<td>10,55</td>
</tr>
<tr>
<td>- cycle (in %)</td>
<td></td>
</tr>
<tr>
<td>Intensity of fluctuations (in %)</td>
<td></td>
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</tbody>
</table>

Source: The authors' own calculations.

Finally it can be stated that in the Polish economy of the nineties there occurred a full business cycle whose length amounted to approximately 7.5 years out of which the phase of favourable business conditions was decidedly longer than the phase of unfavourable business conditions, as the former lasted for about 6 years and the latter – for about only 1.5 year. The amplitude of the growth phase was higher than the amplitude of the decline phase – thus the amplitude of the cycle was positive. Attention should be paid to a very big amplitude in the first of the differentiated phases of unfavourable business conditions (August 1990 – November 1991). The rate of decline was very rapid which was certainly connected with the initiation of economic transformation process.
Analysing the development of the GDP in the studied period, one can clearly observe that the occurrence of turning points virtually overlaps with the dates distinguished on the basis of fluctuations in the values of industrial production sold. Obviously, the series of monthly indicators makes the identification of the turning points more precise, however, the discrepancies observed are so insignificant that they can be neglected. The only significant difference is a decline in the GDP at the end of 1993. There was no considerable decline in the indicators of industrial production sold at that time. However, the points of inflection occurring in the GDP series shortly before and shortly after quarter IV of 1993, did not allow the authors to accept that moment as an actual turning point.

Accepting the extreme values of the GDP indicators presented in Table 3, one can again observe three business cycle phases in the period of Polish economic transformation. The first one, lasting from quarter III 1990 to quarter IV 1991 is a period of decline in the business conditions. The trough in the transformation recession appeared there as well. A subsequent period is a phase of rapid improvement in the economic activity ending in quarter III 1997. Undoubtedly the period of unfavourable business conditions starting from quarter IV of 1997 was caused by the phenomena linked with the crisis on the markets of the former USSR. On the basis of the results obtained a conclusion may be formulated that the decline phase was finished in quarter I 1999. However, this statement is not free from some uncertainty because the location the turning point near the end of the analysed series does not guarantee the precision of its identification.

It should be underlined that both of the observed phases of unfavourable business conditions had lower amplitudes than the growth phase. In the case of the last two phases which together formed the whole cycle this resulted in the positive amplitude of the cycle. It should also be noted that the GDP fluctuations after the Russian crisis were not as intensive as in the case of industrial production sold. Obviously, there was a clear decline, however, it was not as dynamic as the one observed in the first analysed measure of the economic activity. The more peaceful course of fluctuations in the GDP is also indicated by the lower value of variability coefficient. Therefore, it can be said that business fluctuations differentiated in the GDP indicator are less intensive than the oscillations observed in the series of industrial production sold.

**Final remarks**

The empirical analysis of some morphological features of the business cycles appearing in the studied time series of industrial production and GDP in the Polish economy under transformation fully confirms the existence of clearly shaped business fluctuations. The
morphological features of these fluctuations resemble to a large extent the properties of the growth cycle observed in a highly developed market economy because:

- the fluctuations occur both in the indicators of industrial production sold and in the indicators of the GDP, thus they illustrate acceleration or hindrance of the pace of growth of the analysed process;

- the differentiated cycles are slightly shorter than the classical cycle and the phase of favourable business conditions is longer than the phase of unfavourable business conditions;

- the amplitude of the growth phase is higher than that of the decline phase and the amplitude of the cycle is positive.

On the basis of the morphological features observed it can be stated that the business mechanisms occurring in Poland in the nineties bring about effects in the sphere of external symptoms of the fluctuations, similar to those which are observed in market economies of high level of economic development.

The empirical analyses carried out for the Polish economy also confirm the fact known in the highly developed countries, namely that the indicators of the value of industrial production sold are extremely sensitive to the business fluctuations. This sensitivity is higher than that of the GDP series which, as can be assumed, is caused by the fact that those indicators contain some consequences of stabilisation activities carried out by the state.

The above-formulated remarks on the features of business cycles occurring in the Polish economy under transformation are still of hypothetical character. This results from the fact that those properties were distinguished only on the basis of one business cycle differentiated in both of the analysed empirical indicators. However, it can be expected that the observed features will develop in a similar way in the following periods. If such a statement was true it would be very useful in the formulation of the objectives of stabilisation policy instruments. At the same time the above-mentioned conclusions prove that analytical research on the morphological features of business cycles in Poland should definitely be continued.
Notes and references:


9. Comp. *Konjunktura gospodarcza...*, op.cit., p.120.

10. In his definition H. Giersch uses the term business conditions instead of the concept of business cycle. More on the subject see: *Diagnose und Prognose...*, op.cit., p.490.


15. This criterion was formulated in: M. Gruszczyński, G. W. Kołodko, *Regularne wahań tempa wzrostu gospodarczego*, Gospodarka Planowa, No.7-8/1975, p.429.


   Official results of backwards estimates, however, can be found in: *Produkt krajowy brutto według kwartałów*, GUS, Warszawa 1996.


24. Zero hypothesis was the statement that the smoothed spectral density comes from the population of even distribution. If this were so it should be recognised that these are the


26. Figures in parentheses under subsequent parameters signify the empirical value of statistics t- Student for particular calculations.
