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Business Cycles Variability in Polish Regions in the Years 2000–2016

A b s t r a c t. The aim of this article is to study the morphology of regional business cycle in Poland. To do this, such parameters like: cycle length, coherence ratio, standard deviation ratio, mean delay, cross-correlation ratio, were calculated. The main conclusion is that regions have different sensitivity to economy "shocks", both positive and negative. The analysis of regional specialization appear varied level of it among individual regions. Despite a few exceptions, a correlation between the level of regional specialization and the degree of sensitivity to economic disturbances can be marked.

K e y w o r d s: business cycle; region; variability.

J E L Classification: E32; F21; R11; R12; R30.

Introduction

One of the most important policy conducted in the framework of the European Union is – except agricultural policy – the regional policy. Since turn of the 60s and 70s, we can observe the process of regions empowerment, perceived as an autonomous economic and social system. This involved promoted by the EU policy tendency to raise the rank of the region in the administrative and economic system. Regional policy supported by EU appeared a new problem – uneven dynamic of regional development, result-

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ing in a progressive economic divergence of European regions. One of the results of it was, among others, varied resistance to economic crises.

The issue of regional business cycles divergence is important by two reasons. First is the perspective of accessing Poland to European Monetary Union. It means that both polish national and regional economies will subject to common European monetary policy, conducted by European Central Bank. There are studies proving that common monetary policy doesn't fit all countries. The second reason deals with fiscal policy. In fact this macroeconomic tool of business cycles affecting is still in member states competence, however some of the fiscal policy parameters are regulated at the supranational level (limit of budget deficit or public debt in relation to GDP). Moreover, as a consequence of last world economic crisis, it is suggested that fiscal policies conducted by national governments should be more coordinated. In the face of that facts, we can conclude that countries may be deprived of ability to influence their economy through fiscal policies.

The purpose of this paper is to investigate the business cycles morphology in Poland on a regional perspective. The process of structural homogenization is, on one hand, an important feature of real convergence and on the other hand, one of the determinants of asymmetry shocks.

1. Regional Business Cycles in the Light of Literature

Most analysis concentrate on relations between regional and nationwide business cycles. Some researchers indicate that national business cycle is a kind of average variability of cyclical changes in the individual regions. However, this aggregated approach to the analysis of business cycles eliminates from the study characteristics of the different regions, and thus eliminates information about specific reactions of regional fluctuations on changing worldwide business activity. Carlino and Sill (2001, p. 16–17) state, analyzing cyclical changes in real income growth, that there is strong divergence of cycles run between the regional and national cycle. Relating to that, there are some indicators presented in the literature examining the convergence rate of individual regions components (Crone 2005, p. 13–15).

Regional business cycles convergence is also critical for proper European monetary union functioning. From the one side, the economic and monetary union may be an important tool to achieve economic and social cohesion. From the other side, economic convergence is also a prerequisite to accomplish an effective EMU. In the literature also exist an opinion, that real business cycle convergence stimulates proper functioning of economic and

monetary union and raises net benefits of the union (Artis, Zhang 1997, p. 26; Barrios et al. 2003, p. 31).

In general, there are two streams of views on international and interregional results of deepening economic integration in the literature. The first supports the idea that economic integration leads to symmetrical changes, which in turn causes more synchronized business cycles, both on national and regional levels (Marelli 2006, p. 38; Barrios, Lucio 2001, p. 13). The second concept comes from the Paul Krugman work (1991), who proves that economic integration leads to an increase of regional concentration of industrial production, which in turn will cause sectoral or even regional shocks, enhancing the probability of asymmetric shocks and divergent business cycles (Krugman 1993, p. 242–244; Krugman 1991, p. 483–498).

Regions appear individual business cycles characteristics for two reasons (Fatas 1997, p. 1):

- different production output, resulting from the individual regional specialization, industry-specific shocks, associated with different levels factors of production mobility;
- diversified economic policy in the particular regions.

The matter of economic shocks asymmetry, coming across the regions is also one of the optimum currency area (OCA) criterion. In the literature it is pointed, that business cycles across countries (regions), that belong to an optimum currency area, should be synchronized (McKinnon 2002, p. 343). The aspect of economic shocks asymmetry, after creating the euro-zone have been studied among the euro area member states. The issue of (a)symmetry business cycle fluctuations is crucial in the context of supra-regional (and national) monetary policy conducting. Moreover, if fiscal policy is subject to strict controls and harmonization at the supranational level, according to the theory of optimum currency areas, the effects of using such instruments should be predictable and similar to across the common currency area (Frenkel, Nickel 2002, p. 6).

From the theory and OCA criteria point of view, also important as the fact of shock, is the way of reacting to any disturbances determined by effectiveness of the union economic policy instruments. If in one country the shock will be positive, while in the other – negative, harmonization of economic policies would be senseless (Weimann 2003, p. 4).

Researches results show, that the effect of deepening international specialization in the EU is ambiguous. This is also confirmed by Montoya and de Haan's studies. In their paper from 2007, using the correlation coefficient of the regional cycles with the euro zone benchmark, they found that synchronization has increased on average for the period considered with some

exceptions. But the correlation of the business cycle in some regions with the reference cycle remained low or even decreased (Montoya, de Haan 2007, p. 15). Moreover, as Anagnostou, Panteladis and Tsiapa conclude, the EU business cycle benchmark has greater impact on the more developed regions, whereas, it has less or no effect on the less developed regions. Even though the transmitted values of the euro area shocks are very small, the values of shocks are greater for the higher developed regions rather than those to the lower developed regions (Anagnstou et al. 2014, p. 24).

Antonio Fatas states, that economic or commercial cooperation between cross border regions can cause high level of business cycle synchronization between them. However, in the same time, regional business fluctuations may appear cyclical desynchronization with national business cycles, to which they belong (Fatas 1997, p. 7). To similar results came Anagnostou, Panteladis and Tsiapa, revealing that the national impact–''the border effect''–is greater on the less developed regions rather than the higher developed ones (Anagnostou et al. 2014, p. 24).

Eliminating transaction costs between regions, as a result of tariff reduction, as well as transport costs and administrative barriers, causes different levels of economic development in the interregional scale. Consequently it leads to the geographical industry concentration. Reduction of transaction costs causes a divergence between regions in terms of industry structure and expand specialization of individual regions (Krugman 1993, p. 245).

The degree of regional business cycle synchronization also depends on such factors, as: the scope of historical ties, the level of economic and trade relations and cultural affinity among regions. As a result, some regions may appear higher degree of convergence, even without belonging to one country, and the other, in spite of administrative links will demonstrate rather diversified in this area.

In the literature there is also presented studies showing that the common monetary policy, facing with no business cycles convergence, is improper to all members of the common currency area. This is due to the presence in the national or regional scale "asymmetric shocks" (Correia, Gouveia 2013, p. 91). The conclusions of the literature study are two opposing theoretical concepts.

The first of these is the Paul Krugman specialization concept, who proves that economic integration in the regional dimension leads to a greater degree of development polarization, rather than to its unification. This is the result of externalities taking in the single currency area, economies of scale of dynamic production, in relation to the environment, as well as the development of metropolitan areas. The main conclusion arising from Krugman's

model is that the result of single currency area introduction, may be increase the business cycles convergence degree on the state level, while growing up the range of divergence at the regional level (Krugman 1991, p. 486–487).

The opposite concept, was proposed by Frankel and Rose. In their paper from 1996, they described results of economic barriers elimination among countries and regions in a single currency area, followed by intensification of trade. The effect of this process in opinion of the authors, is an increase in the synchronization of cyclical fluctuations. Another factor contributing to the going up synchronization of business cycle fluctuations is, according to the authors, the implementation of common economic policy on the integrating area. The difference in the approach to effects of the optimum currency area created here lies in the formulation of the idea that positive results in this concept reveals ex-post, i.e. as a result of conduct of the single monetary policy and single currency (Frankel, Rose 1996, p. 21). Similar conclusions resulted from Salvador Barrios and Juan Lucio's paper (2001). They provide evidence on the positive impact of economic integration on regional business cycles correlation, on two neighbouring economies: Spain and Portugal.

2. Methodology of Regional Business Cycles in Poland

The objectives of the study are the morphological features of regional business cycles in Poland, represented by 16 administratively separate local government units, i.e. voivodships. The time range of the analysis embraces a dynamics series of regional industry production in a monthly cross-section for the period from January 2000 to December 2016. The selection of such a range is dictated by the availability of comparable statistical data. The period of 17 years also offers the possibility of separating several complete business cycles, as well as possibility of evaluating differences in their morphological structure. The bases of research in this study are growth cycles (Drozdowicz-Bieć 2012, p. 15).

The first stage of business cycle fluctuations analysis is the elimination of seasonal fluctuations from raw time series. In order to level seasonality, the TRAMO/SEATS method was used, which is recommended by Eurostat (Grudkowska, Paśnicka 2007, pp. 8–9).

TRAMO/SEATS is an ARIMA model based on a seasonal adjustment method developed by Victor Gomez and Agustin Maravall. TRAMO/SEATS is a two-stage procedure. The first one pre-adjusts and removes the deterministic effects from the series by means of a regression model with ARIMA noises. The second program executes the decomposition

of the time series into components using an ARIMA model (Gomez, Maravall 2001, p. 9).

For the purpose of separating a cyclical factor from the previously deseasonalised empirical data with the use of the TRAMO/SEATS method, the Christiano-Fitzgerald asymmetrical filter was used, which enables the procurement of cycle evaluation at the beginning and at the end of a time series (Adamowicz *et al.* 2008, p. 12).

The Christiano-Fitzgerald random walk filter is a band pass filter and formulate the de-trending and smoothing problem in the frequency domain. In fact that the granularity and finiteness of real life time series do not allow for perfect frequency filtering, the Christiano-Fitzgerald filter approximate the ideal infinite band pass filter (Nilsson, Gyomai 2010, p. 7). In the opposite to other filters the Christiano-Fitzgerald random walk filter uses the whole time series for the calculation of each filtered data point. The advantage of the CF filter is that it is designed to work well on a larger class of time series, converges in the long run to the optimal filter (Christiano-Fitzgerald 1999, p. 3).

Finally, the process of business cycle turning points identification was based on the Bry-Boschan method (Adamowicz et al. 2008, p. 13). The main rules of this algorithm are as follows (Mazzi, Scocco 2003, p. 17):

1. Peaks and troughs must alternate.
2. Each phase (from peak to trough or trough to peak) must have a duration of at least six months.
3. A cycle (from peak to peak or from trough to trough) must have a duration of at least 15 months.
4. Turning points within six months of the beginning or end of the series are eliminated as are peaks or troughs within 24 months of the beginning or end of the series if any of the points after or before are higher (or lower) than the peak (trough).

Analysis of the morphological features of business cycles takes measures of variability and dispersion, i.e. the measure of the length of individual phases and cycles, standard deviation, the variability factor, amplitude and intensity factors, as well as analysis of cross correlations. On the basis of the obtained results, an analysis of the morphological features of industrial production was conducted in 16 voivodships of Poland.

3. An Empirical Analysis of Convergence in Polish Regions

The first view on regional GDP structure allows to assess the scale of the regional economies diversity. Typically agricultural regions, with more than

average agriculture share in GDP, are: Kujawy-Pomerania, Podlasie, Warmia-Mazury, Lublin, Lubuskie, Lodz, Opole, Swietokrzyskie and Wielkopolska. Podlasie, Lublin, Mazovia and West Pomerania are also the provinces with significantly smaller share of industry in GDP. For the contrast, regions with higher services share in GDP, what means remarkable higher than average development, are: Lublin, Malopolska, Mazovia, Pomerania and West Pomerania. Mentioned above regions are located in different parts of Poland, and also represent different level of GDP per capita. In the GDP structure Lublin dominated by mining and chemical, and in Podlasie – the agri-food, wood and machinery. The Swietokrzyskie share of agriculture is similar to the national average, but higher than the rest of regions is the share of it in construction. In turn, Podkarpacie has the smallest share of agriculture, while the share of industry – the largest of the Polish eastern provinces. Here major industries are: aviation, electrical engineering, chemical and food products. The above statement may be prompted to explain the varied course of fluctuations investigated regions. Analysis of the business cycles morphology will assess the sensitivity of individual Polish provinces to volatility both national and supranational economy. The regional GDP structure in Polish provinces is presented in Table 1.

Table 1. Regional GDP structure in Poland in 2000 and 2014 year (in %)

		Agriculture		Industry		Services		Total
	Voivodship\ Year	**2000**	**2014**	**2000**	**2014**	**2000**	**2014**	**2000–2014**
L.p.	**POLAND**	**3.7**	**4.0**	**24.2**	**33.6**	**72.1**	**62.4**	**100.0**
1.	Lower Silesia	2.7	2.1	26.2	43.9	71.1	54.0	100.0
2.	Kujawy-Pomerania	4.5	5.8	25.0	34.9	70.5	59.3	100.0
3.	Lublin	6.9	8.6	18.8	27.3	74.3	64.1	100.0
4.	Lubuskie	3.9	4.9	23.8	38.1	72.3	57.0	100.0
5.	Lodz	3.8	5.2	27.0	36.2	69.2	58.6	100.0
6.	Malopolska	2.3	2.2	23.2	33.4	74.5	64.4	100.0
7.	Mazovia	3.5	2.6	19.0	22.9	77,5	74.5	100.0
8.	Opole	4.9	5.7	27.4	38.2	67.7	56.1	100.0
9.	Podkarpacie	2.9	2.5	26.4	37.0	70.7	60.5	100.0
10.	Podlasie	6.9	10.9	18.9	27.8	74.2	61.3	100.0
11.	Pomerania	2.4	3.0	23.5	34.1	74.1	62.9	100.0
12.	Silesia	1.2	1.0	32.4	43.1	66.4	55.9	100.0
13.	Swietokrzyskie	4.9	5.9	23.4	36.4	71.7	57.7	100.0
14.	Warmia-Masuria	6.2	8.9	21.5	32.3	72.3	58.8	100.0
15.	Wielkopolska	6.6	5.6	25.5	36.1	67.9	58.3	100.0
16.	West Pomerania	4.2	4.1	20.1	28.9	75.7	67.0	100.0

Source: Statistical Yearbook of the Regions – Poland, http://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-wojewodztw-2015,4,10.html;http://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-wojewodztw-2000,4,10.html.

In period of 2000–2014 the regional GDP structure changed. In general the changes were related to industry share growth, while services and in seven regions agriculture share fell. The most remarkable production structure evolution was observed in Lower Silesia, Silesia, Malopolska, Mazovia, Podkarpacie, Wielkopolska and West Pomerania. In mentioned regions the share of agriculture and services decreased while industry increased.

Analyzing regional GDP time series in Poland, it can be marked serious difference from industry production time series, in morphological fluctuations characteristics[1]. The first is the average coherence level – higher in the case of industrial production. The most coherent GDP time series with the reference series appear in such regions, like: Lubuskie (0.66), Lodz (0.65), West Pomerania (0.52) and Silesia (0.57). The more dissimilar to the reference series were Malopolska (0.12) and Swietokrzyskie (0.18).

Table 2. Bivariate statistics with the Poland GDP reference series

Time series	Coherence Ratio	Mean Delay	Cross-correlation		
			r_0	r_{max}	t_{max}(1)
Lower Silesia	0.36	–0.64	0.59	0.65	–1
Kujawy-Pomerania	0.47	0.71	0.53	0.70	1
Lodz	0.65	–0.42	0.74	0.77	–1
Lublin	0.40	0.54	0.59	0.64	1
Lubuskie	0.66	–0.07	0.84	0.84	0
Malopolska	0.12	–0.58	0.23	0.27	–1
Mazovia	0.54	0.42	0.69	0.72	1
Opole	0.39	–0.23	0.53	0.53	0
Podkarpacie	0.31	0.56	0.50	0.54	1
Podlasie	0.28	0.13	0.51	0.51	0
Pomerania	0.53	–0.38	0.68	0.68	0
Silesia	0.57	–0.34	0.73	0.73	0
Swietokrzyskie	0.18	0.63	0.35	0.39	1
Warmia-Masuria	0.41	0.16	0.56	0.58	0
Wielkopolska	0.48	0.42	0.67	0.71	1
West Pomerania	0.52	–0.84	0.64	–0.75	4

(1) The + (–) sign refers to a lead (lag) in quarters with respect to the reference series; r_0 – cross correlation value with no shift; r_{max} – cross-correlation shift maximum value; t_{max} – shift dimension in quarters.

Source: own elaborations based on: "Monthly Reports on the socio-economic situation of Lower Silesia, Kujawy-Pomerania, Lublin, Lubuskie, Lodz, Malopolska, Mazovia, Opole, Podkarpacie, Podlasie, Pomerania, Silesia, Swietokrzyskie, Warmia-Masuria, Wielkopolska and West Pomerania voivodship", Local Data Bank, Regional Statistical Office.

[1] The industry production time series morphology was analysed in other work of author, i.e. Warżała R. (2016), Business Cycless in polish regions. An theoretic and empirical study, Publisher University of Warmia-Masuria, Olsztyn.

To describe the interdependence level between two time series, the coherence ratio was exploited. Coherence is a function of frequency showing what is the correlation coefficient level between two stochastic processes depending on the frequency. Some regions appear average leading of business cycles phases with respect to reference series (Kujawy-Pomerania, Lublin, Mazovia, Podkarpacie, Swietokrzyskie, Wielkopolska) and some of them are lagged (Lower Silesia, Lodz, Malopolska).

In the case of six of the polish regions, almost coincident fluctuations with respect to reference series were observed, i.e. Lubuskie, Opole, Podlasie, Pomerania, Silesia, Warmia-Masuria. The highest cross-correlation level was in the case of Lubuskie (0.84), Lodz (0.77), Silesia (0.73) and Mazovia (0.72). The West Pomerania voivodship appeared four months lag of average business cycle and the cross-correlation index relatively high, but negative (–0,75). This region can be perceived as one of the most dissimilar, with respect to the national business fluctuations.

Table 3. Analysis of regional GDP cycles with respect to the reference series

	Phases and cycles average duration			
Reference series	P – T	P – P	T – P	T – T
POLAND	4.74	9.35	5.37	9.46
Lower Silesia	4.81	9.40	5.41	9.60
Kujawy-Pomerania	5.70	10.30	5.25	10.20
Lodz	4.83	9.53	5.21	9.73
Lublin	6.14	11.30	6.40	10.40
Lubuskie	6.82	11.46	5.53	10.50
Malopolska	7.10	14.27	7.36	11.00
Mazovia	5.80	11.36	6.20	11.20
Opole	7.45	14.20	6.85	12.80
Podkarpacie	5.33	9.80	5.50	9.40
Podlasie	6.20	11.80	6.10	10.20
Pomerania	4.95	9.50	5.15	9.90
Silesia	5.45	10.70	6.20	10.90
Swietokrzyskie	4.88	12.30	6.70	10.50
Warmia-Masuria	4.80	9.90	5.80	9.10
Wielkopolska	6.40	11.20	5.30	9.90
West Pomerania	5.10	9.60	5.40	10.30

Explanation: P-P – a business cycle defined by upper turning points, T-T – a business cycle defined by bottom turning points, T-P – the upward phase of the cycle, P-T – the downward phase of the cycle.
Source: As in table 2.

Most of the regional business cycle length oscillated around ten quarters. The average longest business cycle were in Malopolska, Mazovia, Opole and Swietokrzyskie voivodship. By contrast – the shortest were marked in

Lower Silesia, Lodz, Podkarpacie, Pomerania, Warmia-Mazuria and Wielkopolska. In most of the regions the upward business cycle phases were longer than the downward one. The inverse relationship revealed Kujawy-Pomerania, Lubuskie, Opole and Wielkopolska.

Regarding this results to the GDP share changes, it can be concluded, that regions with falling share of agriculture and growing share of industry appear on average shorter duration of cycles. Moreover, this group of regions is also characterized by longer upward phase of the cycle. This finding goes in line with industry behavior in business cycle, described in literature.

Apart from length and coherence regional business cycle appear differences in the aspect of volatility and standard deviation. Analyzing the average standard deviation of particular regions, we can indicate the voivodships, that are characterized by more balanced business cycle, i.e. Kujawy-Pomerania (6.63), Silesia (6.85), Lublin (7,01), Lubuskie (7.06), Opole (7.14) and Podkarpacie (7.69). The situation is similar to the coefficient of variation index.

Table 4. The intensity of the Poland GDP time series and the individual voivodships in the years 2000–2016

TIME SERIES	standard deviation (in p.p.)	coefficient of variation (in%)	average amplitude (in %)		
			upward phases	downward phases	cycles
POLAND	7.73	7.08	2.3	2.4	–0.1
Lower Silesia	7.36	6.75	2.9	2.6	0.3
Kujawy-Pomerania	6.63	6.04	2.8	2.7	0.1
Lodz	7.24	6.58	2.4	2.7	–0.3
Lublin	7.01	6.37	2.8	3.1	–0.3
Lubuskie	7.06	6.42	2.7	2.8	–0.1
Malopolska	8.04	7.18	2.1	2.5	–0.4
Mazovia	10.20	9.08	2.9	2.8	0.1
Opole	7.14	6.56	2.9	2.4	0.5
Podkarpacie	7.69	7.03	2.0	2.0	0.0
Podlasie	8.47	7.74	2.9	2.9	0.0
Pomerania	7.59	6.93	2.9	2.7	0.2
Silesia	6.85	6.27	2.8	2.7	0.1
Swietokrzyskie	7.62	7.04	2.6	2.4	0.2
Warmia-Masuria	7.85	7.19	2.3	2.5	–0.2
Wielkopolska	8.75	7.96	2.7	2.9	–0.2
West Pomerania	8.03	7.26	2.7	2.8	–0.1

Source: As in table 2.

The opposite group were regions with relative high level of standard deviation. These are: Mazovia (10.20), Wielkopolska (8.75), Podlasie (8.47), Malopolska (8.04), West Pomerania (8.03), Warmia-Masuria (7.85) and

Swietokrzyskie (7.62). This can result from relative higher specialization level. Exeption is connected with Malopolska, Wielkopolska and Warmia-Masuria voivodships.

The difference in volatility is also visible in the average amplitude dimensions. The highest amplitude of upward and downward deviations are characterized by regions with relative high sensitivity to business fluctuations, i.e. regions with upper than average specialization level. Such features were observed in Lower Silesia, Kujawy-Pomerania, Lublin, Mazovia, Malopolska, Opole, Podlasie, Pomerania, Wielkopolska and West Pomerania. Part of them (Lublin, Opole, Pomerania) appear relative low standard deviation level, what can be interpreted as relative balanced average business cycle fluctuations. The others regional business cycles are characterized by more heterogeneous business fluctuations.

Conclusions

Business cycle analysis in regional dimension is crucial because of different regional development, and GDP structure. In the face of deepening regional divergence, it takes conducting adequate individual regional policy, stimulating balanced and sustainable development throughout the country. This is also important in the context of EU funds redistribution. If the process of economic policy decentralization will go on, knowledge about morphology and specificity of regional fluctuations enables to respond appropriately to regional changes in the economic situation.

As regards the GDP cyclical fluctuations in Polish regions in the 2000–2016 it can be concluded, that the research issues are not uniform and clear. Regions are in different extent susceptible to economy "shocks", both positive and negative. In comparison to industry production fluctuations elaborated in earlier papers, it can be concluded, that GDP fluctuations are more smooth. It is confirmed both by lower standard deviation and coefficient of variation. GDP fluctuations appear different turning points location, as well as the average upward, downward and cycle amplitude.

Despite a few exceptions it can be observed correlation between the level of regional specialization, and the degree of sensitivity to the economic disturbances. Regions, that are less specialized and more diversified production structure, show greater resistance to economic fluctuations. This is confirmed by cycles morphology analysis on a regional basis.

To sum up it can be stated, that the EU membership do not seem to have caused any negative effects on regional economies convergence. However,

appropriate economic policies must be designated and implemented whenever economic cohesion risk being affected.

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Zmienność cykli koniunkturalnych w polskich regionach w latach 2000–2016

Z a r y s t r e ś c i. Celem badawczym artykułu jest ocena różnic w budowie morfologicznej regionalnych cykli koniunkturalnych w Polsce. Wyodrębnione cykle zostały opisane za pomocą takich parametrów, jak: długość cyklu, współczynnik koherencji, odchylenie standardowe, współczynnik korelacji krzyżowej, średnie przesunięcie cyklu. Wyniki badań wskazują, że regiony cechują się różną podatnością na „szoki" ekonomiczne, zarówno pozytywne, jak i negatywne. Ponadto analiza poziomu specjalizacji regionalnej oraz stopnia wrażliwości na fluktuacje gospodarcze wykazała występowanie pozytywnej korelacji w tym zakresie.

S ł o w a k l u c z o w e: cykl koniunkturalny; region; zmienność.