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Specialization and business cycles fluctuations of Polish regions

1. Introduction

Most theoretical analysis tries to prove the similarities between regional and nationwide economic fluctuations. Some researchers indicate that an entire country's business cycle is the result of cyclical changes in the various regions. On the other hand, this aggregated approach to the analysis of business cycles can be eliminated from the study characteristics of the different regions of the country, and thus, limit the state of knowledge on the characteristics of the course of cyclical fluctuations in regional terms. Carlino and Sill (2000) show that there is a strong divergence of cycles run in the regional and national cycle (based on cyclical changes in real income growth). There are some indicators presented in the literature examining the convergence rate of individual region's components (Crone, 2003).

Economic development means social, territorial, and regional cohesion (among others). Taking this into consideration, Poland (as a relatively new member of the EU) carried out administrative reform, aiming at creating larger and less economically diverse administrative divisions. After accession to the EU, Poland has been acquired development programs operating within this union, among which one of the most important is the realization of regional policy.

The final goal of European integration to be achieved through the "common market" and the "economic and monetary union" also includes "economic and social cohesion", both the members and within themselves. This is testified by the weight given to regional policy and structural funds; and so, regional convergence is one of the most important objectives of the EU[1].

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[1] The art. 128 of The EU Treaty states, that: "The Community shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least-favored regions or islands, including rural areas".

The analysis of regional economies is also possible in the convention optimum currency area. As a defined region creates an optimum currency area (if using common currency with other regions) does not reduce the level of welfare. These are, therefore, areas with a common currency or fixed exchange rates relative to other regions and in relation to other regions – variable exchange rates (Borowiec, 2001).

As a member of the EU, Poland is also obligated to join the common currency – the euro. This implies questions about the impact of adopting the single currency on the level of real convergence, both at the regional level in individual countries and within the framework of integration groups (as the EU). The links between the economic and monetary union and economic and regional convergence is widely researched and described in the literature. The links are two-ways. On the one hand, the economic and monetary union may be an instrument to achieve economic and social cohesion. On the other hand, economic convergence is also a prerequisite to accomplish an effective EMU. It is believe, that real convergence helps the effective working of economic and monetary union and raises net benefits of the union (Artis, 2003; Barrios and Lucio, 2003).

The purpose of this paper is to investigate the relationship between the cyclical fluctuations in Poland on a regional perspective and the level of specialization of regional economies. This will determine the correlation between the morphology of regional business cycles and the level of their specialization. The process of structural homogenization is, on the one hand, an important feature of real convergence and, on the other hand, one of the determinants of the asymmetry of shocks. The evolution of economic structures is measured by the Krugman specialization index.

2. Theoretical basis of regional business cycles in the light of the literature

Generally, there are two streams of views on international and interregional effects of deepening economic integration in the literature. The first supports the idea that economic integration leads to symmetrical changes, which in turn leads to more synchronized business cycles in terms of both national and regional levels (Marelli, 2007; Barrios and Lucio, 2001). The second concept is derived from the work of Krugman (1991), who believes that economic integration causes an increase of regional concentration of industrial activity, which in turn will lead to sectoral or even regional shocks, increasing the likelihood of asymmetric shocks and divergent business cycles (Krugman, 1993; Krugman, 1991).

The regions are characterized by asymmetry of cyclical fluctuations when changing their economic activity in relation to other regions. This phenomenon has its cause in two sources (Fatas, 1997):

– regional-level diversification of production resulting from the specialization of the region in particular type of production and so-called industry-specific shocks, associated with different mobility levels of production factors;
– diversified economic policy in the regions.

The problem of asymmetry of economic shocks experienced by the regions is also one of the optimum currency area criteria. In the literature, it is pointed out that business cycles across countries (regions) within an "optimum" currency area should not be out of phase (McKinnon, 2002). The aspect of asymmetry of economic shocks since the creation of the euro-zone has been studied among euro-area member states. The issue of symmetry business cycle fluctuations is important in the context of supra-regional (and national) monetary policy. Moreover, if fiscal policy is subject to strict controls and harmonization at a supranational level, the effects of the use of such instruments should be predictable (according to the theory of optimum currency areas) and similar across the common currency area (Frenkel, Nickel, 2002).

From the point of view of the theory and criteria of the optimum currency area OCA (as important as the fact of shock), it is the way to respond to any disruption (as determined by the effectiveness of the union economic policy instruments). If in one country, the effects of the shock will be positive, and in the other one – negative, harmonization of economic policies within the EU would be senseless (Weimann, 2003).

Research shows that the effect of international specialization in the EU is ambiguous. This is also confirmed by Montoya and de Haan's research. In their paper from 2007, they found that synchronization has increased on average for the period considered with some exceptions during the eighties and the beginning of the nineties of the twentieth century (using the correlation coefficient of the regional cycles with the Euro Zone benchmark). But the correlation of the business cycle in some regions with the benchmark remained low or even decreased (Montoya and de Haan, 2007).

However, the lack of economic or commercial interdependence between countries can indicate the occurrence of such phenomena in the interregional scale. Being mutually convergent, regional business fluctuations may exhibit cyclical desynchronization with national business cycles that refer to countries to which they belong (Fatas, 1997).

As a result of tariff reduction as well as transport costs and administrative differences, a reduction of transaction costs between regions causes different

levels of economic development in the interregional scale. As a result, it leads to the geographical concentration of industries. Reduction of transaction costs leads to a divergence between regions in terms of industry structure and increase specialization of individual regions (Krugman, 1993).

The degree of synchronization of business cycles in the regional structure also depends on factors such as the scope of historical ties, the level of economic and trade relations, and cultural affinity between regions. As a result, some regions may appear to have a higher degree of convergence (even without belonging to one country) and the other – against the administrative linkages – will appear rather diversified in this area.

Due to the fact that studies are presented in the literature showing that the common monetary policy in the lack of business cycle convergence is not beneficial to all members of the currency area. This is due to the presence in national or regional scale "asymmetric shocks" (Correia and Gouveia, 2013). The conclusions of the study are the basis of two opposing theoretical concepts.

The first of these is the specialization concept by Paul Krugman, who has proven in his research that economic integration in the regional context 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 that comes from Krugman's model is that the result of the introduction of the single currency area may be to increase the degree of convergence of business cycles on the state level while increasing the range of divergence at the regional level (Krugman, 1991).

According to the second concept, proposed by Frankel and Rose (1996), as a result of the elimination of economic barriers among countries and regions within single currency area, the trade intensification is rising. In the opinion of the authors, the immediate effect of this process is an increase in the synchronization of cyclical fluctuations. Another factor contributing to the synchronization of business cycle fluctuations (according to the authors) is the implementation of a common economic policy on the integrating area. The difference in the approach to the 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 the single currency (Frankel and Rose 1996). Similar conclusions resulted from Salvador Barrios's and Juan Lucio's paper (2001). They provide evidence on the positive impact of economic integration on regional business cycle correlation. Their study is based on the special case of two neighboring economies: Spain and Portugal.

3. Methodological issues of regional study of business cycles in Poland in the years 1996–2013

In this article, the morphological characteristics of Polish regional business cycles is researched, represented by 16 separate administrative units of local government (i.e., voivodeships). The reference cycle is the business cycle morphology for the country as a whole. The time horizon of the analysis includes quarterly GDP time series growth data from 1st quarter 1996 to 4th quarter 2013. Such a period resulted from comparable data access from the Central Statistical Office.

Current economic analysis focuses on two types of cyclical fluctuations: the classic cycles and growth cycles. The basis of the above-mentioned types of cycles is the morphology and course of individual variation. The choice of individual business cycle concept involves specific business cycle turning point location, as well as duration of the phases. However, this does not mean that economic empirical studies are doomed to relativism. This requires the prior adoption of specific analytical assumptions, as well as formulating definitions, that would be applied (Drozdowicz-Bieć, 2012).

The bases of these analyses are growth cycles. This method allows for the identification of business cycles, even when there is a long period of continuous growth. Then, the absolute value analysis does not bring clear results. This is due to the relatively short time series with unified statistical data methodology. Short time series allow us to extract the growth cycles, while for observation, classic cycles are required for at least several years of the time series (From work on... 1997).

An important aspect of the empirical analysis of economic fluctuations is the optimal choice of indicators that are the basis for assessing the morphology of cycles. Therefore, in the literature, it is pointed out that two main criteria should be fulfilled by economic variables; i.e., the importance of variable and characteristics of statistical time series variable. Taking these conditions into account, the empirical analysis is based on quarterly regional GDP data.

The first step in the analysis of economic fluctuations is to eliminate the seasonality. The most comprehensive seasonal alignment methods are X-12-ARIMA and TRAMO/SEATS. As a result, the method of seasonal adjustment recommended by Eurostat was used in this paper; i.e., TRAMO / SEATS (Grudkowska and Paśnicka, 2007).

For the estimation of cyclical factor from the seasonally adjusted time series of empirical data, the Christiano-Fitzgerald band-pass filter was used, which allows us to obtain estimates of the cycle, both at the beginning and at the end of time series. The procedure for marking the turning points was based on the Bry-Boschan procedure (Adamowicz et al., 2012). For the analysis of morphological features of cyclical fluctuations, the measures of volatility and dispersion were

used. Additional measures embraced the length of the various phases and cycles, standard deviation, coefficient of variation, and the amplitude and intensity of cycles and cross-correlation analysis. On the basis of the results obtained, the morphological characteristics analysis of industrial production in the various regions of the country was conducted.

To quantify the degree of homogeneity of production structures of Polish regions, two different indicators were used for sensitivity analysis. The first is a specialization coefficient (defined as *Krugman specialization index*) that can be calculated for each region *r* (Marelli, 2007):

$$KSI_r = \sum_{i=1}^{n} \left| s_{i,r} - s_{i,0} \right|$$

Where $s_{i,r}$ is the share of sector i out of total employment in region (or country) r and $s_{i,0}$ is the corresponding share in the reference region. Its value can range from 0 (both regions have the same sector structure) to 2 (the sector structure is totally different). The second is the *dissimilarity index*, which is the complement to one of the sum of the minima of the sectoral shares of two regions (Marelli, 2007):

$$DIS_r = 1 - \sum_{i=1}^{n} \min(s_{i,r}, s_{i,0})$$

The value of the DIS index range from 0 to 1. The more different the structure, the closer value 1 is to the DIS index.

The subject of specialization analysis was employment. This is because employment data is less sensitive to valuation problems (as compared to value added data).

4. An empirical analysis of convergence in Polish regions

The empirical analysis refers to Polish regions over the period 1996–2013. The data on Polish regions was taken from Regional Statistical Offices from each of the 16 voivodeships (i.e., Statistical Bulletin).

The aim of this study was to evaluate the relationship between the level of specialization at the regional level and the so-called sensitivity of regions to asymmetric shocks. To assess the degree of regional specialization in Poland, a measure proposed by Krugman was used.

The Krugman index has been calculated for four years: 2000, 2004, 2008, and 2012. The calculations have been made for all 16 regions, and the reference

"region" was the country structure as a whole. The index has been calculated for regional *employment* structure, with shares referring to:

- agriculture, forestry, and fishing;
- industrial sector;
- construction sector;
- trade, repair of motor vehicles, transportation and storage, accommodation and catering, information and communication energy, and manufacturing;
- financial and insurance activities; real estate activities; other services.

Table 1

Krugman specialization index for Polish regions

Voivodeship	Index value			
	2000	2004	2008	2012
Dolnośląskie	0.30	0.28	0.17	0.17
Kujawsko-Pomorskie	0.11	0.14	0.06	0.05
Lubelskie	0.49	0.42	0.42	0.43
Lubuskie	0.27	0.27	0.18	0.14
Łódzkie	0.15	0.20	0.13	0.09
Małopolskie	0.20	0.11	0.06	0.11
Mazowieckie	0.21	0.25	0.18	0.23
Opolskie	0.11	0.12	0.07	0.11
Podkarpackie	0.37	0.24	0.17	0.32
Podlaskie	0.40	0.37	0.35	0.30
Pomorskie	0.31	0.27	0.15	0.16
Śląskie	0.38	0.37	0.23	0.22
Świętokrzyskie	0.41	0.33	0.30	0.31
Warmińsko-Mazurskie	0.10	0.12	0.09	0.08
Wielkopolskie	0.12	0.19	0.09	0.11
Zachodniopomorskie	0.31	0.26	0.18	0.17

Source: own elaborations based on: "Monthly Reports on the socio-economic situation of Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Lubuskie, Łódzkie, Małopolskie, Mazowieckie, Opolskie, Podkarpackie, Podlaskie, Pomorskie, Śląskie, Świętokrzyskie, Warmińsko-Mazurskie, Wielkopolskie and Zachodniopomorskie voivodeships", Local Data Bank, Regional Statistical Office

According to results showed in Table 1, it can be divided into 3 separate groups. Results of the first group range of 0 to 0.15. The scores of second group range of 0.16 to 0.30, and the third group includes regions with the value of Krugman specialization index exceeding 0.30. The first group includes five Polish regions that are the least specialized in comparison to the reference structure of Polish

economy; ie. Kujawsko-Pomorskie, Łódzkie, Opolskie, Warmińsko-Mazurskie, and Wielkopolskie. The second group is represented by Dolnośląskie, Lubuskie, Małopolskie, and Mazowieckie. The last group embraces the most specialized regions as compared to the reference structure. Regions that belong to this group are: Lubelskie, Podkarpackie, Podlaskie, Pomorskie, Śląskie, Świętokrzyskie, and Zachodniopomorskie.

As Table 1 shows, there is a falling specialization trend in most regions of Poland, especially in those regions where the structure was initially more dissimilar (Świętokrzyskie, Śląskie, Pomorskie, Podlaskie, Podkarpackie, Lubelskie, and Dolnośląskie), due to the heavy specialization in agriculture (Lubelskie, Podkarpackie, and Podlaskie), mining and quarrying (Śląskie and Świętokrzyskie), or trade and other services (Dolnośląskie, Zachodniopomorskie, and Pomorskie). One of the elaborated regions showed a slight increasing trend during the period researched (Mazowieckie), and in the last two cases, there was an approximately stable specialization index level during the research period (Opolskie and Wielkopolskie). This is probably related to the quickly expanding service sector, and so it explains the decreasing relative distance from the "average Polish employment structure".

The dissimilarity index presented in Table 2 shows a broadly similar picture. The most dissimilar (i.e., most specialized) regions over the research period were Lubelskie, Podkaprackie, Świętokrzyskie, and Podlaskie. Essential differences as compared to the reference structure show Dolnośląskie, Mazowieckie, and Śląskie. The less dissimilar are Kujawsko-Pomorskie and Łódzkie. Some of the elaborated regions appear to have a slight dissimilarity increase (Lubelskie, Mazowieckie, and Opolskie), and there is a decrease trend in some of them (Lubuskie, Małopolskie, and Zachodniopomorskie).

The analysis of the activity of the Polish economy in a regional dimension is determined in the range of operation of the country's current administrative division; i.e., since 1999. But the Central Statistical Office made a backward calculation of the regional GDP, so it was possible to analyze regional GDP in absolute values since 1995 and since 1996 as index of dynamics. The whole analyzed period started from the 1st quarter 1996 to the 4-th quarter 2013.

Table 3 presents bivariate statistics between individual voivodeships and Poland GDP reference series. In comparison to the analysis based on the industrial production time series, there are some essential differences in morphological fluctuation characteristics. 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 such regions as Lubuskie (0.70), Łódzkie (0.62), Zachodniopomorskie (0.54) and Śląskie (0.52). The more dissimilar to the reference series were Małopolskie (0.06) and Świętokrzyskie (0.14).

Table 2

Dissimilarity Index for Polish regions

Voivodeship	Index value			
	2000	2004	2008	2012
Dolnośląskie	0.124	0.107	0.083	0.084
Kujawsko-Pomorskie	0.029	0.038	0.030	0.027
Lubelskie	0.240	0.180	0.208	0.217
Lubuskie	0.108	0.100	0.090	0.071
Łódzkie	0.050	0.065	0.066	0.043
Małopolskie	0.074	0.020	0.030	0.057
Mazowieckie	0.075	0.074	0.092	0.114
Opolskie	0.029	0.027	0.036	0.054
Podkarpackie	0.177	0.085	0.086	0.159
Podlaskie	0.193	0.154	0.176	0.148
Pomorskie	0.130	0.101	0.073	0.082
Śląskie	0.163	0.152	0.114	0.110
Świętokrzyskie	0.194	0.123	0.150	0.156
Warmińsko-Mazurskie	0.023	0.026	0.043	0.040
Wielkopolskie	0.033	0.062	0.045	0.053
Zachodniopomorskie	0.130	0.097	0.090	0.084

Source: As in Table 1

Table 3

Bivariate statistics with the Poland GDP reference series

Time series	Coherence Ratio	Mean Delay	Cross-correlation		
			r_0	r_{max}	t_{max} [1]
Dolnośląskie	0.38	–0.67	0.57	0.63	–1
Kujawsko-Pomorskie	0.44	0.73	0.58	0.70	1
Lubelskie	0.62	–0.47	0.74	0.77	–1
Lubuskie	0.42	0.45	0.61	0.64	1
Łódzkie	0.70	–0.04	0.83	0.83	0
Małopolskie	0.06	–0.50	0.22	0.25	–1
Mazowieckie	0.50	0.34	0.68	0.69	1
Opolskie	0.34	–0.20	0.56	0.56	0
Podkarpackie	0.32	0.60	0.52	0.59	1
Podlaskie	0.31	0.10	0.55	0.55	0
Pomorskie	0.46	–0.36	0.65	0.65	0
Śląskie	0.52	–0.35	0.70	0.70	0
Świętokrzyskie	0.14	0.59	0.34	0.38	1
Warmińsko-Mazurskie	0.35	0.14	0.59	0.59	0
Wielkopolskie	0.46	0.49	0.64	0.67	1
Zachodniopomorskie	0.54	–0.92	0.62	–0.81	4

[1] The + (–) sign refers to a lead (lag) in quarters with respect to the reference series.

Source: As in Table 1

Some regions appear average leading of business cycles phases with respect to reference series (Kujawsko-Pomorskie, Lubelskie, Mazowieckie, Podkarpackie, Świętokrzyskie, and Wielkopolskie) and some of them are lagged (Dolnośląskie, Łódzkie, Małopolskie, Opolskie, Pomorskie, Śląskie, and Zachodniopomorskie). Three of the Polish regions appeared average almost coincident fluctuations with respect to reference series (Lubuskie, Podlaskie, and Warmińsko-Mazurskie). The highest cross-correlation level was in the cases of Lubuskie (0.83), Łódzkie (0.77), Kujawsko-Pomorskie, and Śląskie (0.70). In the case of the Zachodniopomorskie voivodeship, there was almost a quarter lag of average business cycle, and the cross-correlation index was high but negative (–0.81). This allows us to state that it is one of the most dissimilar Polish regions in the aspect of business cycle fluctuations.

As the table 4 shows, most of the regional business cycle length oscillated around ten quarters. The longest business cycles were in Małopolskie, Mazowieckie, and Opolskie voivodeships. By contrast – the shortest were marked in Dolnośląskie, Łódzkie, Podkarpackie, Pomorskie, Warmińsko-Mazurskie, and Wielkopolskie. In most of the regions, the upward business cycle phases were longer than the downward ones. Exceptions in that case were Kujawsko-Pomorskie, Lubuskie, Opolskie, and Wielkopolskie.

Table 4

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	4.86	9.67	5.50	9.50
Dolnośląskie	5.00	9.80	5.60	9.80
Kujawsko-Pomorskie	6.00	1.00	5.50	10.60
Lubelskie	4.71	9.33	5.33	9.33
Lubuskie	6.00	1.80	6.20	10.00
Łódzkie	6.80	1.40	5.40	10.00
Małopolskie	7.20	1.75	7.75	11.50
Mazowieckie	5.60	1.25	6.20	11.00
Opolskie	7.60	1.50	7.00	13.50
Podkarpackie	4.83	9.50	5.50	8.80
Podlaskie	6.40	1.00	6.40	10.75
Pomorskie	4.71	9.33	5.33	9.33
Śląskie	5.33	1.40	6.00	10.60
Świętokrzyskie	4.80	1.50	7.80	11.80
Warmińsko-Mazurskie	4.83	1.00	6.00	9.20
Wielkopolskie	6.60	1.40	5.60	9.75
Zachodniopomorskie	5.17	9.67	5.33	10.00

Explanation: PP – a business cycle defined by upper turning points, TT – a business cycle defined by bottom turning points, TP – the upward phase of the cycle, PT – the downward phase of the cycle.

Source: As in Table 1

According to theoretical issues made in the first part of the paper, there is a correlation between the level of regional specialization and sensibility to demand (supply) shocks. The higher the specialization, the more potential for vulnerability to business cycle fluctuations. So, the goal of the third part of research was to assess relationship between the level of specialization (or dissimilarity) and morphological features characteristics for particular Polish regions.

Analyzing the average standard deviation values of particular regions, which are presented in Table 5, we can point to the voivodeships, that have the least value of that index; i.e., Kujawsko-Pomorskie (6.82), Śląskie (7.07), Lubelskie (7.21), Lubuskie (7.26), Opolskie (7.33), and Podkarpackie (7.88). The same situation takes place in the coefficient of variation index. Comparing the issues with results obtained in the specialization level measured by the Krugman specialization index or dissimilarity index, for the above-mentioned regions, the correlation between the two issues can be proven. So, it can be concluded that the hypothesis of relationship between the level of specialization and business cycle fluctuation sensitivity was confirmed. All of the above-mentioned voivodeships belong to the group of less-specialized regions. The two exceptions were Lubelskie and Podkarpackie (but this can be due to their heavy specialization in agriculture).

Table 5

The intensity of the Poland GDP time series and the individual voivodeships in the years 1996–2013

Time series	Standard deviation (in p.p.)	Coefficient of variation (in%)	Average amplitude (in %)		
			upward phases	downward phases	cycles
POLAND	7.92	7.13	2.3	2.4	–0.1
Dolnośląskie	7.76	6.96	2.9	2.6	0.3
Kujawsko-Pomorskie	6.82	6.20	2.8	2.7	0.1
Lubelskie	7.45	6.73	2.4	2.7	–0.3
Lubuskie	7.21	6.54	2.8	3.1	–0.3
Łódzkie	7.26	6.60	2.7	2.8	–0.1
Małopolskie	8.21	7.37	2.1	2.5	–0.4
Mazowieckie	10.50	9.28	2.9	2.8	0.1
Opolskie	7.33	6.70	2.9	2.4	0.5
Podkarpackie	7.88	7.12	2.0	2.0	0.0
Podlaskie	8.76	7.91	2.9	2.9	0.0
Pomorskie	7.91	7.12	2.9	2.7	0.2
Śląskie	7.07	6.44	2.8	2.7	0.1
Świętokrzyskie	7.94	7.19	2.6	2.4	0.2
Warmińsko-Mazurskie	8.11	7.34	2.3	2.5	–0.2
Wielkopolskie	9.10	8.12	2.7	2.9	–0.2
Zachodniopomorskie	8.17	7.43	2.7	2.8	–0.1

Source: As in Table 1

The opposite group was regions with a relatively high level of standard deviation. These are: Mazowieckie (10.50), Wielkopolskie (9.10), Podlaskie (8.76), Małopolskie (8.21), Zachodniopomorskie (8.17), Warmińsko-Mazurskie (8.11), and Świętokrzyskie (7.94). Simultaneously, most of these regions are characterized by relatively higher specialization index levels. The exception is connected with Małopolskie, Wielkopolskie, and Warmińsko-Mazurskie voivodeships.

The difference in standard deviation is confirmed in average amplitude dimensions. The highest amplitude of upward and downward deviations have regions with relatively high sensitivity to business fluctuations; i.e., regions with a high specialization index. In the research results, we can observe Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Mazowieckie, Małopolskie, Opolskie, Podlaskie, Pomorskie, Wielkopolskie, and Zachodniopomorskie. Some of them (Lubelskie, Opolskie, and Pomorskie) show relatively low standard deviation levels, which can be interpreted as relatively balanced average business cycle fluctuations. The others business cycles are characterized by more heterogeneous business fluctuations.

5. Conclusions

Economic analysis of the variability of individual business cycles in regions is important in the context of carrying out adequate regional policy, stimulating balanced development throughout the country. This is also important in the context of the redistribution of EU funds. If the process of decentralization of economic policy will progress, knowledge of the course and specificity of fluctuations allows us to respond appropriately to regional changes in the economic situation.

Assessing the GDP cyclical fluctuations in the Polish regions during 1996–2013, it can be concluded that the research issues are not uniform and clear. Regions have different sensitivity 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 smoother. It is confirmed both by lower standard deviation and the coefficient of variation. GDP fluctuations appear to have different turning point location, as well as average upward, downward, and cycle amplitudes.

The results of the regional specialization measuring are ambiguous. Most of them appear falling specialization, and the others show stable specialization levels. Only one voivodeship – Mazowieckie – appeared to have a lightly growing specialization level during the analyzed period. Some of the regions are relatively heavily specialized in agriculture or mining, which makes them more stable in the business fluctuations analyses.

Despite a few exceptions, a correlation can be observed between the level of regional specialization and the degree of sensitivity to economic disturbances.

Regions that are less specialized and have more-diversified production structures show greater resistance to economic fluctuations. This is confirmed by the analysis of the morphology of cycles on a regional basis.

Concluding, it can be stated that EU membership does not seem to have caused any negative effects on regional economic convergence. However, appropriate economic policies must be designated and implemented whenever there is a risk of reversing the process of economic cohesion.

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