“The estimation of sectoral contribution to regional divergence in Poland and Ukraine”

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THE ESTIMATION OF SECTORAL CONTRIBUTION TO REGIONAL DIVERGENCE IN POLAND AND UKRAINE

Abstract

The research aims to identify industrial and other economic sectors' contribution to the regional divergence in Eastern European countries, particularly Poland and Ukraine. The ambiguity of the results of previous studies on the factors of regional convergence indicates the need for further research, considering the peculiarities of distinct economies' development. The countries selected for analysis – Ukraine and Poland – had similar starting conditions for market transformation, have a common border, and a comparable population. The analysis of regional inequality in Ukraine revealed a tendency of asymmetric regions' growth in 2010–2017. In Poland, divergent trends in regional development in 2009–2017 were significantly less pronounced. The statistical method to identify the impact of the industrial, agricultural, and service sectors on regional σ-convergence based on coefficients of variation measuring the differences in regional economies' sectoral structure was used. The analysis demonstrated that, in general, the uneven structure of regional economies does not significantly impact any of the analyzed countries, which confirmed the results of some other studies. Simultaneously, it highlighted that the industrial sector had the greatest impact on regional divergence in Poland. Despite the dominant role of services in regional divergence in Ukraine, most researchers emphasize the importance of the industrial sector for regional development. To consider this factor in the regional divergence of Ukrainian regions, some regional policy implications were considered.

Keywords region, convergence, industry, agriculture, services, gross value added, development, Europe

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INTRODUCTION

Regional divergence is considered as one of the main issues national states face, hampering the economic development and causing their socio-economic vulnerability and fragility. It affects both developed and developing countries. Differentiation of the regions' reproductive potential caused by the geographical, political, and socio-economic factors led to the domination of the "center-periphery" model of regional development in the transformational economies of Eastern Europe, including those of Poland and Ukraine. Comparison of these two countries and the search for the similarities in their development paths has long been a key element of numerous Ukrainian studies in economics, politics, culture, and other areas. Both countries had similar starting positions for the market transformation, analogous population, state, administrative structure, etc. Nevertheless, it must be noted that Poland is two times smaller than Ukraine, while the population density is twice as big. Other differences included institutional factors – historical and cultural heritage, elections organization, and governance form.

The problems of regional divergence in both these countries were a result of their historical heritage. The territorial fragmentation of Poland

till 1918 and the charges incurred due to the land "exchange" with the USSR in 1945 led to considerable disproportions in the development of eastern and western regions. Western regions partially consist of industrially developed regions of pre-war Germany. Less developed regions of the East received some momentum only after the fall of the Iron Curtain and during the European integration. Ukraine has also suffered from fragmentation through its history – its western parts were divided between different European countries and eastern – under the Russian Empire's dominion.

To overcome the regional disproportions and stimulate economic development, Poland implemented decentralization reform, though much earlier than Ukraine. Poland's experience has demonstrated the complexity, but at the same time, the success of the carefully planned decentralization reform. Moreover, the support of the European Union funds over time helped to equalize the level of development of the eastern and western regions of Poland.

Decentralization reform, which has been going on in Ukraine since 2014, is seen as one of the levers of convergence of the regions' socio-economic development in the future. However, the ambiguity of this reform's initial results calls for finding those areas of growth of regional economies that will provide a solid foundation for convergence. The vast potential of regional decentralization lies in the possibilities of reindustrialization, intensification of agricultural products, and services that should foster weak and depressive territories' economic development. One of the important aspects of the process is that the industrial sector, agriculture or services, or their combination, ensure harmonization of different regions' economic status. On the one hand, relevant research will allow for assessing their impact on regional development in the context of the European regionalization. On the other hand, this will help determine the keystones of regional policy formulation in Ukraine in the context of economic, political, and socio-cultural regional divergence.

The multiplicity of approaches to the study of regional divergence processes, their sources and factors confirm the need for further study of the economic components' role in different countries. It is impossible to assert the homogeneity of these processes in economies of different types – market and transformational; of different geographical locations; with different historical past; with different natural resource potential etc. However, it is possible to identify common factors and trends that will allow using best practices and developing regional economic equalization strategies.

1. LITERATURE REVIEW

Foreign experience has shown that the reason for the divergence is the weak realization of the regions' economic potential (House of Commons, 2003). This is caused by various factors, both objective (diversity of natural, historical, socio-economic factors; complexity and prospects of development; economic specialization; place and importance of the region in the territorial system labor division, etc.) and subjective (arising from incorrect political and economic decisions that lie in contradiction to the strategic goals of socio-economic development of a region; or due to the conflicting nature of such goals) (Fedolyak, 2019). The objective ones are mainly explained by the basic theories of the regional economy – cumulative causation of Myrdal (1972) and Richardson (1979); "innovation diffusion" model of Hägerstrand (1967), etc., neoclassical theories of growth (models of convergence of Barro and Sala-i-Martin (1990); Mankiw et al. (1992)); new theories that take into account the spatial factor – the model of J. von Thünen modified by Fujita et al. (2001), etc. Empirical confirmation of these theories and the search for hidden patterns are the subject of applied research, based on a methodological basis that uses mathematical and economic-statistical models.

The number of causes of regional divergence identified by these methods is quite large. Thus, Bartolini et al. (2016) tried to link regional disparities and fiscal decentralization in OECD countries. Based on econometric modeling, they have found that decentralization of budget revenues reduces regional divergence, but it is unknown to what ex-

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tent. Simultaneously, budget expenditures make the development of regions even more uneven in terms of socio-economic indicators.

Wishlade and Yuill (1997) drew a line between the factors that cause inequality in regional development in the EU countries and the measurement of such inequality. They also found that the relationship between regional policy and regional development disparities was not obvious (at least at the time of the study). They are divided into physical (climate, population, etc.), economic (gross regional product), and social (unemployment, quality of life). Because they are different, regional development policy cannot overcome them simultaneously and in the short term. Factors influencing divergent processes were determined by locational, infrastructural, human, intangible, amenity, and financial. Measuring their impact is also complicated by the lack of a single statistical calculation method, approaches to determining the weight of each of them, and the fact that some are difficult to measure qualitative indicators. Jakubowski (2018) studied the regional convergence of the EU regions in 2004–2014 based on the developed Regional Development Index and determined that β- and σ-convergence occurs in the EU regions, which may be due to the peculiarities of financing regional development projects in the EU countries from the EU funds. Kramar (2015) points to the radical transformation of institutions and the uneven distribution of production factors as the cause of the divergence of European regions.

From the standpoint of decomposition of regional disparities, it is interesting to analyze the approach of Žítek et al. (2011), according to which all disparities in EU countries have a quasi-hierarchical structure and are formed mainly at the meso-level, partially extending to the micro-level. At the micro-level, disparities are also formed, increasing regional divergence. The scholars consider the business environment's quality to be the main factor in the convergence of regions.

Additionally, the industrial sector is considered the driving force of regional area promotion policies (Kawato, 2008). Foreign studies on regional disparities in one way or another indicate the industry's certain contribution to the uneven development of regions, although their results are contradictory.

Historical evidence of this can be found in Enflo and Missiaia (2017), who analyzed regional divergence in Sweden between 1571 and 1850. The study found that the Swedish mining industry developed dynamically and generated a significant share of the national value added, and its regional concentration marked the beginning of regional disparities long before the industrial revolution. In their study of the convergence of Italian regions in 1891–2001, Daniele and Malanima (2014) found a significant impact of industrialization on the leveling of regional development.

In contrast, cross-country comparisons for the EU demonstrate the lack of significant impact of the sectoral structure of the economy on the divergence of regional development. An analysis of regional disparities in the European Union in retrospect (1977–1999) by Benito and Ezcurra (2005) showed that the industrial sector's sectoral structure in 23 years did little to promote regional dispersion, confirming the relevance of single-sector growth models. The same modeling results were obtained by Esteban (2000). It was found that gaps in the productivity of regions play a decisive role, and the impact of regional economies' sectoral structure is insignificant.

Puga (1998) suggested that the sectoral factor of regional disparity should be taken into account in combination with others, particularly labor migration: the relocation of workers to regions with larger industrial agglomerations can help equalize wages and income in the regions. The study claims that the model obtained can explain the movement of the Mexican industrial sector towards the states closer to the United States of America – its market; greater concentration of industry in the US than in the EU; and failure of Mezzogiorno in convergence with the northern regions of Italy, despite improved infrastructure. Martin (1999) identified a mechanism for the formation of regional inequality, according to which there is an impact of the quality of public infrastructure on the income gap between poor and prosperous regions and on the regional concentration of industry through the mechanism of transaction costs. Mason (2011), on the example of Australian regions, found a close relationship between the uneven distribution of unemployment and the levels of sectoral diversification in the regions. His main

recommendation for equalization policy was to focus on emerging industries, not declining ones.

Sabyasachi and Sakthivel (2006) studied the level of regional divergence in India and performed sectoral decomposition using coefficients of variation as indicators of divergence. Thus, it appeared that divergence in industrial and services development significantly contributed to the regional divergence. Khosla and Sharma (2012) also used indicators of variation in estimating regional development differences due to the industrial factor. They found that Indian better-developed regions attract more investment in industry, which in turn supports their development and exacerbates regional disparities.

Thus, the disproportion of industrial development in the world is more or less seen as a factor of regional divergence, on which regional policy should be focused, considering the specifics of local economic potential.

The issue of regional disproportion in Eastern European countries has not lost relevance for a long time. Overcoming it is one of the main tasks of transformational economies, particularly those that are part of the EU or are its associate members. The study of divergence processes is characterized by various approaches to measuring regional divergence and identifying its factors. The industry is considered to play an important role in reducing the disproportion of regional development.

Thus, several studies on the socio-economic development of Ukrainian regions emphasize that the reason for the divergence may be the uneven distribution of benefits from industrial development among the regions of Ukraine. These works include:

- Simkiv (2013) who demonstrates that the low level of industrial potential causes regional divergence, and it is based on the lack of structural changes in the regional economy;
- Radeke et al. (2014) who highlight the concentration of industrial activities in the East of the country (60%) and the downward trend of regional industrial production;
- Nosova (2017) who, based on econometric modeling, proved the importance of imbalances in industrial development in regional divergence;
- Shevchenko (2017) who, based on the ratio of maximum and minimum indicators of sales of industrial products, detected the trend of regional equalization in 2012–2016 in Ukraine;
- Shults and Lutskiv (2018) who also consider that accelerating regional convergence is possible through industrial development in economically backward regions of the country.

These features of divergent dynamics impacted by the industrial sector created the preconditions for seeking the ways of convergence of Ukrainian regions. Blagun and Savchyn (2018) proposed the concept of convergent regional development based on indicative planning and continuous monitoring of regional development by the national government.

These scientific studies reveal the role of subjective factors in the formation of divergent processes and indicate the miscalculations of state regional policy or the absence of any reforms in the field of industrial development.

2. AIMS

Given the results of studies in Europe and other countries, the paper aims to assess the dynamics of the divergent processes in Poland and Ukraine as Eastern European transformational economies and determine the industrial sector's contribution to regional convergence or divergence. This will increase the validity of regional policy measures aimed at industrial growth in peripheral regions, which have significant gaps in socio-economic development level compared to the leaders.

3. HYPOTHESES

The study hypothesized that industrial development in Eastern European countries can be a significant determinant of the dynamic of regional divergence – H_0. An alternative hypothesis (H_1)

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is that high variation of mining and manufacturing activities in the sectoral structure of regional economies is not a prevailing precondition for boosting divergence.

To confirm or refute the hypothesis, the study is organized as follows. Firstly, methods of identifying the degree of the disproportion of regional development in Ukraine were presented and those used to assess the role of three sectors of the economy – agriculture, industry, and services. Secondly, uneven regional development dynamics in Poland and Ukraine were analyzed based on coefficients of variation. Thirdly, based on the decomposition of the influence of the regions' sectoral structure, the contribution of each sector to the processes of convergence or divergence was identified. Finally, notations on policy implications were presented.

4. RESEARCH METHODOLOGY

In statistical methods of estimating territorial development unevenness, the coefficient of variation is the key statistical indicator. It is used in methods of differentiation of regions by the degree of divergence; in particular, Gubanova and Kleshch (2018) who assess the coefficients of variation of several statistical indicators reflecting the state of social, industrial, environmental, financial, regional development; Borsekova et al. (2016) in identifying regional disparities in the development of Slovak regions and Khosla and Sharma (2012) in the study of Indian regions.

For each region, the variation coefficient's value gives a distinction of three types of regional disparities – regional differentiation, asymmetry, or polarization as the highest level. Using this methodology, the graphical demonstration of the change in the unevenness of regional development in Ukraine in 2017 compared to 2010 is presented. For this purpose, 17 indicators representing the socio-economic and ecological situation in regions were selected – regional value added per capita, volumes of industrial product sales per capita, monthly average salary, foreign direct investments per capita, exports and imports per capita, etc. The data used in the analysis were obtained from the State Statistical Service of Ukraine (2020).

The contribution of the industrial sector, agriculture, and services to the acceleration of regional convergence or divergence is clarified in the study through the method proposed in the previously mentioned study of Sabyasachi and Sakthivel (2006). The hypothesis of their research concerns the three dimensions of each sector's impact on regional divergence – first, as a consequence of the divergence of sector development (variation of each sector's regional value added); second, through the disparities of sector shares in the regions; third, through the correlation between the sector and the economy of the region, which implies that a region may have a relatively high aggregate output if the sector also has a relatively high output and vice versa.

The approach anticipates the following steps:

1. 1. Identification of the rates of regional divergence (*D)* calculated as growth rates of the coefficient of variation $CV(Y_t)$ of regional output per capita Y_i over time; $i = 1…n$, where n is the number of regions:

$$D = \frac{CV(Y_i^*)}{CV(Y_i)}. \quad (1)$$

The sign * denotes the indicator for the estimated period.

Let us assume that $j = 1…m$, where m is the number of sectors. In this case, $m = 3$ (agricultural, industrial, and other (predominantly services)). So, each sector's output in a region is marked as Y_{ij}, and

$$Y_j = \sum_j Y_{ij}. \quad (2)$$

2. Definition of the ratio Pj between the average output per capita of the jth sector $\overline{Y}_j$, and the average output per capita of the economy $\overline{Y}$:

$$P_j = \frac{\overline{Y}_j}{\overline{Y}}. \quad (3)$$

3. Calculation of correlation coefficients $r_{ij,i}$. Let us assume that $\sigma(Y_i), Var(Y_i), Cov(Y_{ij}, Y_i)$ are, respectively, standard deviation, variation, and covariation of the variables. Using the decomposition of the divergence growth rate by the sources of income, regional inequality and its components derive from the following:

$$\sum_j \left(P_j \cdot r_{i,ij} \cdot \frac{CV(Y_i^*)}{CV(Y_i)} \right) = 1. \quad (4)$$

4. Definition of weights of each sector by the initial period of observation. These weights are each sector's contribution to the economy's initial levels of inequality:

$$w_j = \frac{CV(Y_{ij}) \cdot P_j \cdot r_{i,ij}}{CV(Y_i)}. \quad (5)$$

Thus, the regional divergence is equal to the weighted sum of growth rates of the three components – $CV(Y_{ij})$, P_j, $r_{ij,i}$:

$$\frac{CV(Y_i)^*}{CV(Y_i)} = \sum_j \left[\left(\frac{CV(Y_{ij})^*}{CV(Y_{ij})} + \frac{P_j^*}{P_j} + \frac{r_{ij.j}^*}{r_{ij,j}} \right) \cdot w_j \right]. \quad (6)$$

5. Identification of each sector's contribution to the regional divergence according to the three dimensions of impact and the aggregate contribution and estimation of decomposition errors.

This provides an understanding of the possible impact of the industrial sector on the regional convergence, the latter being one of the main regional policies' tasks.

Data from the Statistical publication "Regions of Ukraine" (Verner, 2019) for 2010–2018 for 25 regions of Ukraine (excluding the temporarily occupied Autonomous Republic of Crimea, Sevastopol, and the territories of Donetsk and Luhansk regions) and data from Główny Urząd Statystyczny (GUS, 2020) for 2009–2017 in 16 regions of Poland (including Warsaw in the Mazowiecki Voivodeship) were used for calculations. Polish regional data for 2018 sectoral value added are unavailable.

This approach is new for research in the countries of the Eastern European region; it is applied for the first time in this work as well. It allows for a more in-depth and comprehensive statistical analysis of the role of the regions' sectoral structure in ensuring their socio-economic convergence.

5. RESULTS AND DISCUSSIONS

In most respects, the stratification of regions has been the main reason for the intensification of regional policy in most countries in recent decades, especially in the European Union. Moreover, if the stratification of gross regional income per capita in Poland in the capital region (including Warsaw) compared to the poorest Lubelskie in 2017 differed 2.3 times, in Ukraine, this ratio between the Kyiv region (together with the city of Kyiv) compared to Luhansk in 2017 differed 13.3 times. Territorial disparities in Ukraine have long been part of the problem of national security: differences in the degree of competitiveness of local economies, quality of public goods, opportunities and life prospects of the population living in the capital, central and marginal regions, created threats to Ukraine's national integrity and increased risks of centrifugal tendencies. Zhalilo (2018) identifies "long-term disregard for regionally specific issues that make deformed regional communities easily prey for powerful external forces" as one reason for the regional divergence in Ukraine – and he had some rationale.

The fragmentation made a significant contribution to the modern regional differences between Poland and Ukraine of territories in different historical periods. However, in addition to deep historical roots, this problem has other causes – lack of significant structural transformations in the regions, uneven budget revenues, and support for the state and international institutions' regions.

Since the beginning of the second decade of the 21st century, the divergence processes in both countries have not stopped. However, in Poland, where financial support from EU funds was important, these processes slowed down, while in Ukraine, no money was allocated for regional development. For example, no funds were allocated for implementing the State Strategy for Regional Development until 2020, adopted in 2014, for the entire period of its validity.

To illustrate the processes of divergence, the visualization of the regions' disproportionate development in 2010 and 2017 is presented on the map of Ukraine (Figures 1, 2). The results allow

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Source: Authors.

Figure 1. Regional disparities in Ukraine in 2010

stating the deepening of regional differentiation, strengthening of asymmetry and polarization for the period 2010–2017: the number of asymmetric regions increased from 6 to 9; there is a significant gap in the level of development of the polarized region – the capital of Kyiv – from other regions of Ukraine. Accelerated development of the capital region compared to the peripheral is a characteristic feature of other countries.

To identify the economic sectors that are key factors in the regional divergence of Poland and Ukraine based on data on gross value added in the regions and its sectoral composition, and analysis of the factor impact of the agricultural, industrial, and service sectors was conducted. Based on the data on gross value added of the regions of Ukraine (in basic prices, 2010–2018) and the regions of Poland (in current prices, 2009–2017), the following results were obtained (Tables 1, 2, 3, 4, and 5).

Table 1 shows that the average annual rate of difference in the values of GVA per capita in Ukraine is 0.92% per year; in Poland, 0.55% per year. Divergence in Ukraine has increased in all

Source: Authors.

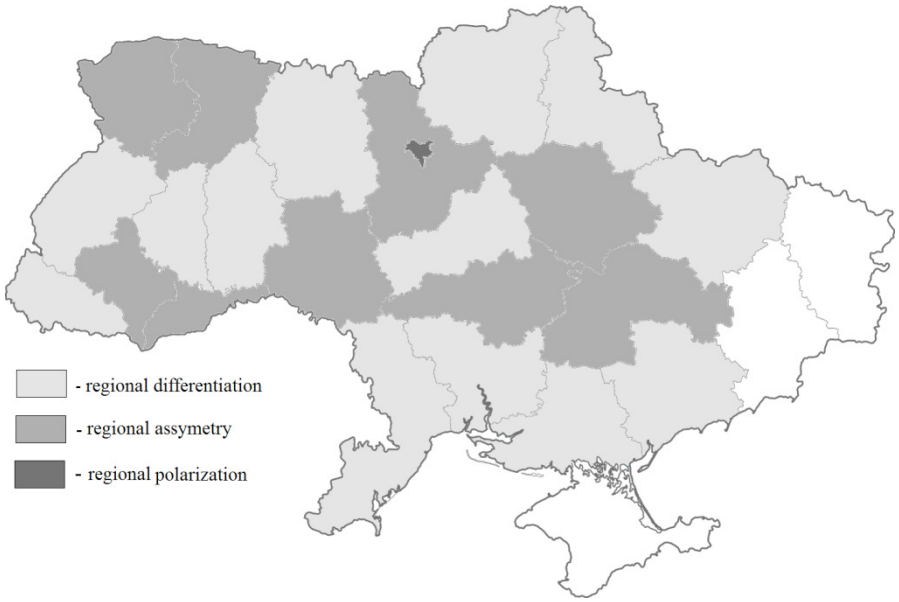

Figure 2. Regional disparities in Ukraine in 2017

Table 1. Evaluation of general and sectoral rates of regional divergence based on coefficients of variation

Source: Own calculations.

Year (Poland/Ukraine)	Coefficients of variation of value added per capita							
	Regional value added		Agriculture value added		Industry value added		Services value added	
	Poland	Ukraine	Poland	Ukraine	Poland	Ukraine	Poland	Ukraine
2009/2010	0.24	0.59	0.44	0.39	0.24	0.81	0.31	0.87
2010/2011	0.25	0.55	0.45	0.40	0.26	0.85	0.32	0.80
2011/2012	0.26	0.59	0.43	0.40	0.27	0.74	0.33	0.87
2012/2013	0.24	0.61	0.41	0.43	0.26	0.76	0.30	0.88
2013/2014	0.24	0.63	0.45	0.45	0.25	0.80	0.30	0.93
2014/2015	0.24	0.63	0.43	0.49	0.24	0.77	0.30	0.97
2015/2016	0.25	0.65	0.43	0.50	0.24	0.80	0.30	1.00
2016/2017	0.25	0.66	0.42	0.47	0.24	0.90	0.31	0.98
2017/2018	0.25	0.64	0.45	0.51	0.24	0.85	0.31	0.94
Divergence rate, %	0.55	0.92	0.32	3.48	–0.35	0.59	0.03	1.03
Weights	1.00	1.00	–0.003	–0.04	0.22	0.11	0.78	0.93
Sectoral impact	–	–	–0.001	–0.14	–0.08	0.06	0.02	0.96
Sectoral impact, %	–	–	–0.03	–4.57	–2.59	2.07	0.78	31.96

Note: "–" – no data.

sectors, especially in the agricultural sector. In Poland, the industrial sector's convergence can be observed, which is manifested in a negative rate (–0.35%). The impact is assessed considering the weights determined from the indicators at the beginning of the observation period. The weights by sectors in Ukraine show that the largest share of the impact falls on GVA from the services sector (0.93), then – on the industrial sector (0.11) and negative – on agriculture (–0.04), whose correlation with regional values Airborne forces are negative. Thus, other activities (0.96) and the industrial sector (0.06) have the greatest impact on divergence in this indicator; convergent impact is characterized by the agricultural sector (–0.14). Weights by sectors in Poland are also distributed towards the services sector (0.78), industry accounts for 0.22, and a negative value (0.003) for the agricultural sector. The highest sectoral impact on divergent processes considering the scales in Ukraine is demonstrated by the service sector (31.96%), in Poland – by the industrial sector (–2.59%), contributing to the convergence of regions.

Table 2. Evaluation of regional divergence rates based on changes in relative shares of sectors in the region's economy

Source: Own calculations.

Year (Poland/Ukraine)	Average sectoral value added per capita as a share of regional value added per capita					
	Agriculture value added		Industry value added		Services value added	
	Poland	Ukraine	Poland	Ukraine	Poland	Ukraine
2009/2010	0.04	0.12	0.33	0.22	0.63	0.67
2010/2011	0.04	0.13	0.33	0.20	0.62	0.67
2011/2012	0.05	0.12	0.34	0.20	0.61	0.68
2012/2013	0.04	0.13	0.35	0.18	0.62	0.69
2013/2014	0.04	0.15	0.34	0.19	0.62	0.66
2014/2015	0.03	0.18	0.35	0.19	0.62	0.63
2015/2016	0.03	0.18	0.36	0.20	0.61	0.62
2016/2017	0.03	0.16	0.35	0.20	0.62	0.64
2017/2018	0.04	0.16	0.34	0.20	0.62	0.65
Divergence rate, %	–2.05	3.96	0.45	–1.34	–0.12	–0.37
Weights	–0.003	–0.04	0.22	0.11	0.78	0.93
Sectoral impact	0.01	–0.16	0.10	–0.14	–0.09	–0.35
Sectoral impact, %	0.22	–5.19	3.28	–4.70	–3.02	–11.55

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The dynamics of the average shares of sectors in the gross value added of the region (Table 2) in Ukraine is characterized by a reduction in the GVA of industry and services in favor of agriculture. Poland is dominated by industrialization processes, as evidenced by the growing share of value added in the industrial sector, although regional economies' structure is relatively stable.

There was a slight equalization of the share of industry in the GVA of the regions and other activities in Ukraine. This factor, along with agricultural and other sectors of the economy, led to the convergence of regions. In Poland, there was a significant divergent effect of the share of industry in the regional economy, but the services sector's convergent effect balanced it.

The correlation coefficients between gross value added in the regions and individual sectors (Table 3) showed a strong relationship in both countries between the services sector and the region's economy. The connection between the agricultural sector and regional economies in Poland is absent (the values of the correlation coefficient fluctuate around zero), and in Ukraine, it has weakened during the period of concern to this study. The strength of the relationship between the industrial sector and the regional economies grew in both countries, in Poland – to a significant level (0.75).

Regional divergence in Ukraine intensified due to changes in the correlation between the industrial sector and the total regional economy (7.85%); however, the weakening relationships between the agricultural sector and the regional economy (16.84%) had become a determinant of divergent processes. In Poland, the largest contribution to divergence is evoked by the correlation between the value added in the industrial sector and the value added created in a region (13.25%).

The summary of the results of the impact of each sector and its significance are presented in Tables 4 and 5.

The total sectoral contribution to the regional divergence in Poland is almost 15%, mainly of industrial nature. Agriculture causes a weak convergent impact, as evidenced by the total sectoral impact being negative. However, the high level of error suggests that these factors are not decisive for explaining divergent processes in the country's regional development. Regional divergence is caused by many other factors – political, geographical, institutional, historical, social, etc.

In Ukraine, the analyzed factors have twice as much influence (31.77%), but the large error also indicates its insignificance in ensuring4 high regional divergence rates. The largest role is given to the service sector and the smallest – to industrial.

Table 3. Estimation of regional divergence rates based on changes in the correlation between the sectors and regional economy as a whole

Source: Own calculations.

Year (Poland/Ukraine)	Coefficients of correlation between the sectors and a regional economy					
	Agriculture value added		Industry value added		Services value added	
	Poland	Ukraine	Poland	Ukraine	Poland	Ukraine
2009/2010	–0.04	–0.52	0.65	0.35	0.96	0.96
2010/2011	–0.04	–0.50	0.67	0.35	0.96	0.95
2011/2012	–0.06	–0.51	0.69	0.33	0.96	0.97
2012/2013	–0.04	–0.42	0.74	0.31	0.96	0.97
2013/2014	0.02	–0.33	0.74	0.38	0.97	0.96
2014/2015	–0.01	–0.18	0.76	0.44	0.96	0.96
2015/2016	0.05	–0.17	0.77	0.44	0.96	0.95
2016/2017	–0.01	–0.25	0.75	0.44	0.97	0.95
2017/2018	0.03	–0.17	0.75	0.42	0.97	0.95
Divergence rate, %	4.81	–12.84	1.81	2.24	0.14	–0.03
Weights	–0.003	–0.04	0.22	0.11	0.78	0.93
Sectoral impact	–0.02	0.51	0.40	0.24	0.11	–0.03
Sectoral impact, %	–0.52	16.84	13.25	7.85	3.57	–0.94

Table 4. Aggregated regional divergence components (%) in Poland

Source: Own calculations.

Indicator	Agriculture	Industry	Services	Total	Error
Impact of sector' value added variations	–0.03	–2.59	0.78	–1.84	–
Impact of changes in sectors' value added shares in regional value added	0.22	3.28	–3.02	0.49	–
Impact of changes in linkages between sectors and regional economy	–0.52	13.25	3.57	16.30	–
Total sectoral impact	–0.34	13.95	1.33	14.94	85.06

Note: "–" – no data.

Table 5. Aggregated regional divergence components (%) in Ukraine

Source: Own calculations.

Indicator	Agriculture	Industry	Services	Total	Error
Impact of sector' value added variations	–4.57	2.07	31.96	29.46	–
Impact of changes in sectors' value added shares in regional value added	–5.19	–4.70	–11.55	–21.44	–
Impact of changes in linkages between sectors and regional economy	16.84	7.85	–0.94	23.75	–
Total sectoral impact	7.08	5.22	19.47	31.77	68.23

Note: "–" – no data.

High coefficients of variation confirm preliminary calculations of the growing disproportion of economic development of the regions. The correlation between the GVA of the sector and the GVA of the economy as a whole, particularly the agricultural sector, is also important as it develops in feedback with the region's economy, i.e., the higher the GVA of the region, the lower the GVA of agriculture.

These results suggest that the more significant the share of the industrial sector is in the regional value added, the greater its impact on the country's level of divergence or convergence, but this issue needs further study.

6. POLICY IMPLICATIONS

Although the role of regional divergence in slowing economic growth has not been unequivocally proven, researchers continue to develop recommendations for national and regional convergence policies based on their research results. Some of them are generalizing; some are specific to the specifics of a particular country. The general approach involves ensuring the validity and consistency of the implementation of regional policy measures, regardless of its subject area. For example, the House of Commons (2003) presents the main principles of this approach, namely:

1) the government must recognize the differences in the regional development and set priorities for the least prosperous regions (let us call it a "counterbalance system");

2) measures to address imbalances in a particular area of regional development should be based on the prevalence of the phenomenon in each region;

3) the foundations for regional growth – transport, investment in research and development, and universities – must be established during the implementation of regional policies;

4) decentralization of decision-making, when local communities independently determine the path of development of the territory, based on their real needs, opportunities, and goals;

5) revision of the distribution of state resources between regions, which, as noted above, significantly affects the divergence processes.

Simultaneously, some researchers suggest that regional authorities should focus on implementing infrastructure, innovation and education policies in local policies (O'Leary & Webber, 2014); establishment of new industrial enterprises in weak regions (Shults & Lutskiv, 2018); influence on the

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factors of productivity of regional production, in particular, on the development of human capital, growth of capital investments (Fang et al., 2016); regulation of labor migration (Mason, 2011), etc. The diversity of views indicates the lack of universal recipes for regional convergence policy. It requires an individual approach for each country and each historical period.

While taking into account that the industrial sector's role in the formation of regional disparities in Ukraine was insignificant, it should be noted that its uneven development is a factor. The data from Table 1 demonstrate that the slightly uneven distribution of value added to the industrial sector among the regions in Poland, on the contrary, causes a convergent impact on the economy. Industrially developed regions of Ukraine, as a rule, have a higher level of GRP per capita and are characterized by a higher level of average wages, lower unemployment, and so on. It is a matter of the multiplier effects that industry causes in such regions in the long run. Therefore, it can be assumed that some of the differences in regional development indicators are due to the weaker historical industrial base of the poorer regions. A "counterbalance system" should be applied to such regions, which provides for a focused policy to ensure the development of investment and business environment in these regions. Facilitating access to infrastructure networks, introducing local programs of financial support for small and medium-sized businesses, stimulating research and development, establishing priority specialties in regional training, local tax benefits, harmonization of the institutional environment can be regional convergence policies. Its strategic directions will be:

- development of indigenous enterprises, which can become "growth poles" in the regions and the basis for building new value chains;
- promotion of new highly productive industrial activity types – through the creation of clusters, technology parks, industrial parks, development of research centers, and other innovation infrastructure.

These should be implemented at the regional level, as economic policy at the national level (competitive, innovative, investment, etc.) is not aimed at spatial effects, although it may have certain sectoral effects.

CONCLUSION

The problem of eliminating disparities is an important component of regional policy, so the analysis of regional divergence has not lost its relevance for over a century. Its results can make a significant contribution to improving the management of regional development. These Eastern European economies are experiencing market transformations to varying degrees and have both common and distinctive features that determine the specifics of the manifestations of sectoral impact on regional divergence.

The performed factorial analysis based on the method of decomposition of the regional divergence rate by sectoral influence did not confirm the hypothesis. Structural changes in Ukraine and Poland have not yet become the driving force of convergence. Although the industrial sector's contribution in the two countries differed significantly, the overall contribution of the uneven structure of the economies was insignificant. Moreover, this was the common result for both countries.

However, the greatest impact on Polish divergence was from the changes in the connections between sectors and regional economics as a whole. The main determinant of the divergence was the industrial sector, with a much weaker impact from services and agriculture (the latter, though, playing a fledgling convergent effect).

In Ukraine, all three dimensions were almost equally represented. Value added variations and impact of changes in linkages between sectors and regional economy lead to regional divergence in the state, and the main factor is the services sector, then – agriculture. The convergent influence was, mostly, the

result of the changes in the share of the value added of services and, to a lesser extent, of value added in the agriculture and industrial sector.

Such results may be explained by the considerably higher development level of Poland, so the regional disproportions (see Table 1) become less and less influential on divergence. For less developed countries, like Ukraine, higher structural disproportions in regional economies still considerably influence regional divergence.

Nevertheless, the simple "equalization" of the sectoral economic structure is not enough. A structure must be developed that could ensure long-term economic and innovative growth of the country, and this is possible if industrialization, not agrarization, is happening. This increases the relevance of the study of subjective factors of divergence – measures of economic policy, the nature of institutional reforms, the quality of the business climate, and other yet undiscovered sources.

The outlining of general and specific regional policy areas will allow the national government and regional authorities to adjust the mechanism for promoting the growth of economically weak regional economies and thus promote the convergence of the regions of Eastern Europe.

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