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Diversity of Regional Labour Markets in Poland

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Abstract:

Purpose: *The aim of this article is to assess real changes taking place on regional labour markets in Poland over the last ten years. The starting point for the analysis was 2008 – the time of the economic crisis – and it was compared to 2018, a year marked by a significant improvement in the economy, including the labour market.*
Design/Methodology/Approach: *To assess the initial and current situation on regional labour markets, the authors use variables obtained from CSO resources, diagnosing the situation in individual Polish voivodships. The identified set of variables served to create a synthetic indicator reflecting the situation on regional labour markets in Poland as a derivative of the condition of the economy. In order to conduct a comparative analysis of regional labour markets, the authors made rankings of voivodships for the two analysed periods with the use of the Hellwig method. The next stage of the study involved an estimation of the multiple regression model, which explains how the identified factors (determinants) affect the position of voivodships in the context of their employment potential. The authors adopted a ratio of the employed per 1,000 inhabitants as a dependent variable, while the variables determining the demand for labour were considered as independent variables.*
Findings: *A ten-year comparison period adopted for the analyses showed that the economic crisis did not have a major impact on economic and labour market changes in Polish regions.*
Practical Implications: *The proposed research methodology is universal and can be used to assess regional labour markets in other countries.*
Originality/Value: *The conducted research allowed for the identification of factors influencing the situation on the labour market and the assessment of changes taking place on regional labour markets.*

Keywords: *Labour market, regional diversity, Hellwig method, multiple regression model.*

JEL codes: *J01, J20, R23.*
Paper type: *Research article.*

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1. Introduction

The situation on the labour market is mainly a derivative of the economic condition of the country in question. Sustainable economic growth and development, which are parts of the business cycle, indisputably stimulate changes and affect the labour market. It is important that the development in the economy in the long term to be based on the growing economic growth curve (considering fluctuations in economic measures), contributing to a lasting improvement in the labour market. A decrease in unemployment and an increase in salaries, the creation of new, attractive, and prospective jobs, the professional development of employees should, in principle, be the result of sustainable growth and economic development in spite of periodic imbalances.

However, regional labour markets, as components of the domestic and global market, subject to the influence of economic factors, as well as global socio-economic trends, react to changes in the environment to a different extent.

The aim of this article is to assess real changes taking place on regional labour markets in Poland over the last ten years, taking into account the economic crisis started in 2007. To assess the initial and current situation on regional labour markets, the authors used diagnostic variables obtained from CSO resources, including measures characterizing the economic situation and measures of the situation on the labour market diagnosing the situation in individual Polish voivodships. The identified set of variables was used to create a synthetic indicator reflecting the situation on regional labour markets in Poland as a derivative of the condition of the economy. The starting point for the analysis was 2008 – the time of the economic crisis – and it was compared to 2018, a year marked by a significant improvement in the economic situation in the country, including the labour market. In order to conduct a comparative analysis of regional labour markets, the authors made rankings of voivodships for the two analysed periods with the use of the Hellwig method. Based on the results obtained by means of this method, they presented diverse regional labour markets in a spatial arrangement.

The next stage of the study involved an estimation of the multiple regression model, which explains how the identified factors (determinants) affect the position of voivodships in the context of their employment potential. The employment rate was adopted as a dependent variable, while the variables describing the demand for labour were considered as independent variables.

The rest of the paper is organised as follows. In the next section, the authors discuss major theoretical concepts explaining the diversity of labour markets through a regional perspective. Then they present the procedure of presenting the diversity of regional labour markets using taxonomic methods. The results of the developed methodology are presented as a case study of Polish regional labour markets. The discussion part covers other approaches in literature

concerning the measurement of diversity of regional labour markets. The last section concludes with a summary of the main findings as well as micro and macroeconomic policy implications of the paper.

2. Theoretical Background

Regions continuously undergo structural changes. New activities emerge and grow, while old ones shrink or vanish. The ability to diversify into new fields crucially matters for regions' economic growth and resilience (Content and Frenken, 2016; Marcu *et al.*, 2018). Consequently, regional diversification is at the focus of policy makers (Mewes and Broekel, 2020).

The problem of diversifying the economic development of regions, and hence the diversification of regional labour markets, can be considered through the prism of various theories of regional development (Pietak, 2014). Among them there are concepts formulated in the so-called Keynesianism period (referring to the centre-periphery model). They include theories such as the concept of growth poles, the export base, uneven development and polarized development, structuralism theories (theory of product lifecycle), theories inspired by critical realism (theory of spatial division of labour), theories formed on the basis of system analysis (theory of spatial self-organization) and theories and institutional concepts (concept of learning regions, regional innovation systems, related diversity and the triple helix) (Kisiała and Stępiński, 2013).

Each of these concepts identifies one or more factors determining the development of the region and indicate mechanisms of inter-regional differences. Some of them refer to traditional factors of regional development, including natural resources, capital resources and labour resources. Other ones, in turn, are associated with factors of qualitative nature, including, inter alia, scientific, technical, and technological progress. Institutional theories, however, assign a significant role to the efficiency of public administration institutions in regional development (Glińska *et al.*, 2017). According to Pietak (2014), by emphasizing every new development factor, these groups of theories are not mutually exclusive. At the same time, however, they do not provide a single answer that explain the problem of regional divergence.

One of the theories explaining why economic development does not occur uniformly throughout the entire area is the concept of growth poles by Francois Perroux. It indicates a spatial concentration of regional development and its economic and political consequences. In accordance with its assumption, in metropolitan centres, business entities representing technologically advanced branches of industry are characterized by high competitiveness. In this way, these centres become nuclei of the region, gaining an advantage over smaller cities and surrounding areas. The most developed regions, in turn, gain their economic dominance over competing peripheral regions, making them dependent on their own industrial and commercial policy (Grosse, 2002).

Scholars link the heterogeneity of regional productivity with an uneven distribution of skills (Morris *et al*., 2019). The increase in aggregate productivity and income is connected with the presence of higher skill levels, pointing to the importance of human capital (Rosenthal and Strange, 2008; Marrocu and Paci, 2012; Abel *et al*., 2012; Melachroinos and Spence, 2014) and the tendency of more skilled workers to live in densely populated areas (Glaeser and Resseger, 2010; Di Giacinto *et al*., 2014; Noja and Cristea, 2018). Fernald and Wang (2016) add an explanation based on a softer response of employment to the cycle and to pro-cyclical factor utilization (physical capital, labour, and human capital). They contend that labour productivity in the neoclassical formulation depends on human capital, physical capital deepening and Total Factor Productivity (TFP). Although in the long term TFP reflects technological change, in the short term, it also includes factors utilization. They claim that the TFP result is countercyclical when factor utilization is considered. They argue that one of the possible causes of the reduction in variability in the use of factors is the change in the economic structure towards a greater weight of sectors where the utilization adjustment is less important (from industry to services) (Fernando and Wang, 2016).

Prompted by a place-based approach to development policy (Barca, 2009; OECD, 2009) and its increasing emphasis, scholars have thus shifted their attention from the evaluation of the "total" impact of cohesion policy to the understanding of the conditioning factors that explain where, when and how policy is effective (Fratesi and Wishlade, 2017), such as quality of government (Rodríguez-Pose and Garcilazo, 2015) and territorial capital (Fratesi and Perucca, 2019).

Political stability together with administrative capacity, supported by political entrepreneurship, give the necessary continuity to manage a cohesion policy that guarantees an effective development policy (Aiello *et al*., 2019). The example of Poland proves that regional labour markets are diversified (Rollnik-Sadowska *et al*., 2018). However, it is crucial to seek the reasons for that diversity and determinants of labour market situation in specific regions. Subject literature indicates the need for diagnosing and measuring the diversity of regional labour markets (Słomińska, 2009).

3. Research Methodology

With a view to achieving the research objective, which is assessing changes on regional labour markets in Poland in the years 2008-2018, the research method was adapted to the adopted assumptions. The research was conducted in two stages. The authors' aim was to compare changes on regional labour markets in Poland over 10 years. For the border years the authors assumed the first year of the economic crisis 2008-2009 and 2018, the year of economic prosperity, in which the Polish economy was at the peak of its economic growth, obtaining some of the best growth results in the EU. Comparisons were made by

constructing two rankings of voivodships. The first one concerned the situation on the labour market in the regions in 2008, the second – the situation on regional labour markets in 2018. The authors made comparisons with the use of the Hellwig method, which allowed for creating rankings of Polish regions in terms of labour market situation in the analysed years. The construction of voivodship rankings was preceded by a substantive and statistical selection of diagnostic features. In order to examine the diversity of labour market situation in Polish voivodships, the authors prepared an initial list of diagnostic features which included 15 variables. The list was prepared on the basis of expert analysis of available statistical data and the knowledge of factors determining the situation on the Polish labour market.

As part of the statistical selection of characteristics, a set of potential diagnostic variables developed by the authors was verified with regard to their informative value. Literature assumes that the set of criterion values should exclude those which are characterized by low discriminating ability or duplicate information carried by other features. The classic coefficient of variation was used to assess the discriminatory capacity of traits (Młodak, 2006). It was assumed that those for which the coefficient of variation is lower than 10% will be eliminated from the potential set of diagnostic traits. In order to eliminate traits strongly correlated with other ones, a correlation matrix was determined. Excessive correlation between the traits may indicate that they duplicate information.

Therefore, the threshold level of Pearson's linear correlation coefficient was assumed ($r^* = 0.9$) (Arrow and Przechlewski, 1994). Finally, six variables were adopted for analysis: X1 - unemployment rate according to the Survey of Economic Activity of the Population (Polish BAEL) (as a basic measure reflecting the situation on the labour market); X2 - jobs rate – the difference between jobs created and eliminated (as an assessment of job durability); X3 - percentage of employed in agriculture (as a factor indicating the level of development of a given labour market resulting from structural changes in the economy); X4 - the employed people (as a manifestation of the economy's ability to create jobs); X5 – the average salary in relation to the national average (as a factor reflecting the quality of jobs and the condition of the economy); X6 - employment indicator in the public sector (as an indicator of labour market development).

Next, on the basis of the values of selected factors characterising the analysed voivodships, the authors created rankings of voivodships. For this purpose, one of the linear ordering methods was used – Z. Hellwig's synthetic method of development (Hellwig, 1968), which allows to order the analysed objects by comparing them with the benchmark object. On the basis of the matrix of standardized diagnostic traits, the coordinates of the standard unit were determined, based on the formula:

$$z_{oj} = \begin{cases} \max\limits_{i}\{z_{ij}\} \text{ for } z_j^S \\ \min\limits_{i}\{z_{ij}\} \text{ for } z_j^D \end{cases} \quad (1)$$

where i = 1, …, n, j = 1, …, m. Then, with the use of the Euclidean metric

$$d_{i0} = [\sum_{j=1}^{m}(z_{ij} - z_{0j})^2]^{\frac{1}{2}}, \quad (2)$$

the distances of each province from the formula were calculated. After determining the synthetic measures defined as (Panek, 2009):

$$s_i = 1 - \frac{d_{i0}}{d_0}, \quad (3)$$

where: $d_0 = \bar{d}_0 + 2S(d_0)$, though: $\bar{d}_0 = \frac{1}{n}\sum_{i=1}^{n} d_{i0}$, $S(d_0) = \left[\frac{1}{n}\sum_{i=1}^{n}(d_{i0} - \bar{d}_0)^2\right]^{\frac{1}{2}}$, the authors created ranking lists.

In order to compare the rankings obtained in the survey of 2008 and 2018, the authors determined and interpreted changes in the positions of voivodships in the rankings over 10 years, and calculated the Spearman's Rank correlation coefficient between the results of the rankings. Then, an attempt was made to divide the analysed voivodships (the structure of their rating) into homogeneous groups in terms of labour market development. For this purpose, the authors used one of the methods of classification of linearly ordered objects which is based two parameters of a taxonomic into four groups, depending on the allocation of the value of their synthetic feature s_i:

group I, when: $s_i \geq \bar{s} + S_s$,
group II, when: $\bar{s} < s_i \leq \bar{s} + S_s$,
group III, when: $\bar{s} - S_s \leq s_i < \bar{s}$,
group IV, when: $s_i < \bar{s} - S_s$.

Among the voivodship groups created in this way, group I is characterised by the best situation on the labour market, and group IV by the worst situation on the labour market in terms of the analysed variables.

The second stage of the study involved the analysis of factors determining the situation on the labour market. For this purpose, a simple linear regression model was used. The applied method made it possible to observe which factors influence the labour market with what strength. The analysis was conducted for the year 2018. The authors of the study identified a set of potential variables – a dependent variable indicating the number of employees per a population of 1,000, and 15 independent variables potentially affecting the situation on the labour market. The variables for analysis were selected in an expert manner, taking into account the potential impact of such factors as the level of economic

development, the level of entrepreneurship, investment attractiveness expressed in terms of foreign investments, the level of development of enterprises expressed in innovation and which translates into investments and export activity, and the ability to generate profits. Taking these factors into account allowed for the selection of ten variables: Z1 – GDP per capita, Z2 – national economy entities per 1,000 inhabitants in total, Z3 – entities with foreign capital participation per 10,000 inhabitants in total, Z4 – investment rate (according to the latest available data for 2016), Z5 – investment expenditures per capita, Z6 – internal expenditures on R&D per capita, Z7 – average share of innovation-based enterprises in the total number of enterprises, Z8 – share of net revenues from sales of innovative products in total net revenues, Z9 – share of net revenues from sales of innovative products for export in total net revenues from sales, Z10 – net profit of enterprises per production-age person.

The construction of simple linear regression models was preceded by a statistical descriptive analysis and the analysis of Pearson's linear correlation coefficients, on the basis of which a final catalogue of eight variables independent of the model construction was determined: Z1, Z2, Z3, Z5, Z6, Z7, Z8, Z10. In order to investigate the relationships between the dependent variable and the adopted independent variables, 9 simple linear regression models were built with the use of Statistica software with its general form as follows:

$$Y = \beta 0 + \beta 1\ X + \varepsilon. \tag{4}$$

4. Research Results

The turmoil on the US financial market in 2007 and 2008 led to the most serious financial crisis since the Great Depression and serious consequences for the real economy. The rise in popularity of securitized products ultimately led to a flood of cheap loans and a fall in credit standards. The combination of cheap credits and low credit standards caused a housing frenzy that laid the foundations for the crisis (Brunnenmeier, 2008).

The crisis, ultimately triggered by the collapse of the US sub-prime mortgage market, had a negative impact on global and European economies. A direct effect of the crisis was the collapse of the American and the subsequent deterioration of the global financial situation.

This consequently brought a crisis on European financial markets that was so serious that undermined trust between institutions. The crisis-induced fragmentation of the financial market led to high credit costs, which effectively prevented growth in some EU countries (Kumari Selvarajan and Ab-Rahim, 2020). The American mortgage crisis quickly spread to the European continent as a result of the involvement of European banks in the securitization process (issue of securities, secured by selected assets). The significant reduction in

bank lending was suddenly felt by the heavily credit-dependent car industry. Earlier redundancies in the financial sector, followed by the automotive sector, had a broad impact on the labour market. The fall in consumption quickly translated into a crisis in other sectors and the economy as a whole.

The economic impact of the recession reflected changes in GDP per capita of individual countries. The reaction of individual countries' economies, reflected in the drop in GDP, depended on the financial and economic links of a given market with other countries in recession (the authors define recession as negative GDP dynamics). The first period of the crisis (2008), for most European economies, was characterized by a decline in GDP per capita. In EU-28 countries, economic growth slowed down by almost half, in Poland by 3 percentage points. At the same time, only some countries observed a positive correlation between the labour market situation and the decline in economic activity. An increase in unemployment was recorded in Lithuania (1.5 p.p.) and the United Kingdom (0.3 p.p.). In the remaining European countries, the situation on the labour market improved despite a slowdown in economic growth. In Poland, the unemployment rate fell by 2.5 p.p.

The reaction of the market at the centre of the crisis was completely different in the US and the Japanese market. The recession affected these markets already in the first year of the crisis, and their GDP per capita gained a negative growth. In these countries, a decrease in economic activity was accompanied by an increase in the unemployment rate, in the USA by 1.2 p.p. and in Japan by 0.2 p.p. For example, economic growth in the USA at the level of 4% translated into a decrease in unemployment by 0.5 p.p. On the other hand, the Polish economy, with growth at a level of 5%, generated a fall in unemployment by only 1.0 p.p.

The crisis culminated in 2009, when the global and European economy was hit by recession. The level of the recession also affected individual countries to varying degrees. EU-28 economies experienced a 5% recession. The German economy was similarly affected. But already in the UK the drop in GDP per capita reached -7%. At the same time, the recession of the American economy reached 5% and the Japanese economy 7%. Contrary to the turbulence experienced by global and European economies, Poland achieved economic growth of 1%. While in all countries struggling with the crisis unemployment grew on a par with recession (the highest growth was in Lithuania 8 p.p. and in the USA 3.5 p.p.), the Polish labour market recorded an increase in unemployment with a simultaneous positive economic growth.

In the light of often drastic drops in GDP per capita, 2010 brought a rapid rebound and high GDP growth. It is of note that the bigger the drop in GDP per capita accompanied the crisis, the higher growth characterised the economy in the first year after the crisis. In most cases, economic growth was accompanied by a slight increase in the unemployment rate (only the German labour market

reacted with a fall in unemployment by 0.6 p.p.). The Polish labour market, with economic growth of 9%, recorded a high increase in the unemployment rate by 1.6 p.p.

The analysis of the comparative year, 2018, shows that in many cases, the economies, after a period of spectacular post-crisis growth, shifted into a state of uniform development. In 2018, the EU average was 3% in terms of GDP per capita growth. The German economy achieved the same result. The economies of developing countries, Lithuania, and Poland achieved high growth, at a level of 6% and 5% respectively. The comparative year, so to say – free of crisis turmoil, was marked by a decrease in unemployment adequate to the economic growth observed in all analysed countries. What is significant, however, is that the relatively good dynamics of economic growth did not translate into similar dynamics of unemployment decline.

Although the economic crisis of 2008-2009 was not reflected in the Polish GDP, as in other EU countries and thriving world economies, the extraordinary situation in the Polish economy was characterized by labour market phenomena that were opposite of the expected (in terms of economic growth). The drop in GDP per capita dynamics in 2008 resulted in a drop in the unemployment rate from 9.6% (in 2007) to 7.1%. On the other hand, in 2009 the economic growth (despite the deep crisis in other economies) brought an increase in the unemployment rate in Poland to 8.1%. Similar phenomena were observed in the Polish economy and labour market in the following years. Still, after ten years, one of the lowest unemployment rates in Europe was observed on the Polish labour market, with GDP per capita lower by 40% than the EU average or 74% than the German GDP.

In 2018, the situation on the Polish labour market looked even more interesting. At the background of such economies as the Norwegian and American ones, characterized by twice as high GDP per capita, Poland obtained an identical unemployment rate. However, the national average does not reflect the situation in individual Polish regions, which, due to their own “mezzo” conditions and links in domestic and foreign trade with other regions and countries, reacted to the crisis situation in a differentiated manner. The conducted research indicates significant differences between individual Polish regions both in 2008 and 2018. The assessment of the diversity of Polish voivodships in terms of labour market development, carried out with the use of the Hellwig method, allowed for interregional comparisons and observations of changes over time. The variables accepted for analysis are: X1 - unemployment rate according to the Survey of Economic Activity of the Population (Polish BAEL), X2 - jobs rate, X3 - percentage of employed in agriculture, X4 - the employed people, X5 – the average salary in relation to the national average, X6 – the employment indicator in the public sector (Table 1).

Table 1. *Values of coefficients of variation and correlation matrix between diagnostic variables (2008, 2018)*

Year	**2008**					
Variable	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
Coefficient of variation	18%	17%	52%	14%	12%	13%
X1	1.000					
X2	-0.033	1.000				
X3	0.203	-0.273	1.000			
X4	-0.396	-0.216	-0.652	1.000		
X5	-0.348	-0.263	-0.391	0.749	1.000	
X6	0.239	0.164	0.516	-0.636	-0.175	1.000
Year	**2018**					
Variable	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
Coefficient of variation	32%	16%	48%	14%	10%	15%
X1	1,000					
X2	-0,288	1,000				
X3	0,521	-0,209	1,000			
X4	-0,568	-0,264	-0,653	1,000		
X5	-0,383	-0,278	-0,422	0,796	1,000	
X6	0,630	0,221	0,632	-0,748	-0,326	1,000

Source: *Own elaboration.*

The analysis of variability and interdependence shows that all analysed features are characterized by a high degree of diagnostics. In the situation of high degree of diagnostics, the values of coefficients of variation are greater than 10% (and therefore the variables sufficiently differentiate the examined voivodships) and no strongly correlated variables are observed (the highest absolute value of correlation coefficient is 0.796). On the basis of the adopted set of diagnostic features, rankings of voivodships were built with the use of the Hellwig method. The ranking lists obtained for 2008 and 2018 are presented in the below table (Table 2).

In 2008, the first year of the crisis, the best situation on the labour market characterized two regions, Mazovian and Dolnoslaskie. Six voivodships were in group II, five in III and three in group IV, characterized by the worst situation on the labour market. In the voivodships belonging to the last, fourth group, the worst or one of the worst values of all analysed variables were observed. For each of the analysed variables, a situation was observed in which in one or two voivodships classified in groups with a better situation on the labour market, the values of any of the variables were worse. The unemployment rate in these regions was one of the highest (8.8%, 8.2% and 8.8% respectively). Only in two regions: Dolnoslaskie and Kujawsko-Pomorskie the unemployment rate was slightly higher (by 0.3 pp). At the same time, the Pomeranian Voivodship had an unemployment rate of 5.5%. The jobs rate, understood as the difference between the newly created and eliminated jobs, was particularly low in these regions.

Table 2. *Rankings of Polish voivodships with regard to labour market situation in 2008 and 2018*

Position	Ranking 2008		Ranking 2018		Changing position in the ranking
	Voivodship	**Synthetic variable**	**Voivodship**	**Synthetic variable**	
1	Mazovian	0.67754	Mazovian	0.64300	0
2	Silesian	0.65498	Silesian	0.63451	0
3	Pomerania	0.49452	Dolnoslaskie	0.56886	-2
4	Malopolskie	0.40615	Malopolskie	0.52575	0
5	Wielkopolskie	0.40351	Pomorskie	0.50431	-1
6	Dolnoslaskie	0.40057	Wielkopolskie	0.43430	3
7	Opolskie	0.38091	Lubuskie	0.41441	-2
8	Lubuskie	0.37637	Zachodniopomorskie	0.40187	1
9	Lodzkie	0.31458	Opolskie	0.40157	-1
10	Zachodniopomorskie	0.27922	Lodzkie	0.36154	2
11	Warminsko-mazurskie	0.27358	Kujawsko-pomorskie	0.31617	-2
12	Kujawsko-pomorskie	0.24619	Podlaskie	0.20254	1
13	Podlaskie	0.19503	Warminsko-mazurskie	0.19963	1
14	Podkarpackie	0.15313	Podkarpackie	0.14378	0
15	Swietokrzyskie	0.11411	Swietokrzyskie	0.09494	0
16	Lubelskie	0.05217	Lubelskie	0.02663	0

Legend:

1st rating group of voivodships
2nd rating group of voivodships
3rd rating group of voivodships
4th rating group of voivodships

Source: *Own elaboration.*

Such was the case of Swietokrzyskie Voivodship, where only 3.7 thousand more jobs were created than eliminated, as compared to e.g. 82.1 thousand jobs in Mazovian Voivodship. In case of Swietokrzyskie, even the other two regions classified together with it in the worst group had almost two- or three-times higher values. A characteristic feature of the three regions belonging to group IV was a high share of people employed in agriculture (respectively: 23%, 25%, 30%) with e.g. 2.5% of people employed in agriculture in Silesian or 6.2% in Zachodniopomorskie Voivodships. The difficult situation on the labour market was accompanied in those voivodships by a high level of employment in public administration (34%, 35% and 40% respectively). Still, the group of two voivodships with the best situation on the labour market was characterized by the occurrence of a large number of total jobs, expressed in terms of the number of people employed in the economy, and very high annual growth of the number of new jobs, expressed in terms of a high jobs rate.

After 10 years since the beginning of the crisis, the situation of particular Polish regions did not change significantly. This is evidenced by a high value of

Spearman's Rank correlation coefficient between the ranking results, which is at the level of 0.96. It is of note that the situation on the labour market remained the best in two best regions and the worst in three worst regions. Changes occurred within the regions classified in group II and III. A far-reaching improvement in the labour market situation was characteristic of Dolnoslaskie Voivodship, which moved from the sixth position to the third, and moving from group II to group I – regions with the best labour market situation.

The almost threefold fall in unemployment (in relation to 2008), which amounted to 3.3%, was not accompanied in this region by any spectacular changes in the values of the remaining variables. The jobs rate increased here only by 1.4 thousand (compared to e.g. 22 thousand jobs in the Malopolskie Voivodship or 14 thousand jobs in Mazovian Voivodship). At that time, the number of people working in agriculture decreased by 2 percentage points (compared to e.g. 8 p.p. in Lubelskie Voivodship or 11 p.p. in Podkarpackie Voivodship), and in public administration by 3.2 p.p. (compared to e.g. 6.6 p.p. in Lodzkie Voivodship). Although 155 thousand jobs were created in the Dolnoslaskie region, similar increases were achieved by Silesian and Pomeranian Voivodships (152 thousand and 137 thousand respectively), and Malopolskie or Mazovian Voivodships reached approximate and more than twofold growth (293 thousand and 361 thousand respectively).

In order to examine the strength of the influence of particular diagnostic features on the ranking result, Pearson's linear correlation coefficients were calculated between the values of the synthetic variable (2018) and diagnostic features. Their values are presented in Table 3.

Table 3. *Pearson's linear correlation coefficients between synthetic variable values (2018) and diagnostic features*

Diagnostic features	**Correlation coefficient**
X1	-0.752
X2	0.108
X3	-0.833
X4	0.871
X5	0.762
X6	-0.669

Source: *Own elaboration.*

Based on the values of correlation coefficients presented in Table 3, it can be claimed that there is a strong linear correlation between the ranking index and such features as: employed per 1,000 inhabitants (r=0.87) and percentage of employed in agriculture (r=-0.83). Therefore, it can be concluded that it is precisely these variables that have the greatest impact on a voivodship's position in the ranking.

The aim of the second stage of analyses was to capture the relationship between the labour market situation expressed in terms of the number of employed (dependent variable) and potential factors on which it depends (independent variables). The statistical descriptive analysis of variables selected in an expert way confirmed the validity of adopting 10 indicators to the analyses, but in the course of further research two indicators were eliminated after determining Pearson's linear correlation coefficients between the dependent variable and other variables. The values of correlation coefficients are presented in Table 4.

Table 4. *Values of correlation coefficients between dependent and independent variables*

Variable	Correlation coefficient value
Z1	**0.922193**
Z2	**0.757765**
Z3	**0.763024**
Z4	0.121047
Z5	**0.819177**
Z6	**0.687851**
Z7	**0.595428**
Z8	**0.530799**
Z9	0.290989
Z10	**0.877716**

Source: *Own elaboration.*

The obtained values of Pearson's linear correlation coefficients confirmed the occurrence of statistically significant correlations between the dependent variable and variables Z1, Z2, Z3, Z5, Z6, Z7, Z8 and Z10 (the correlation coefficients assumed absolute values of at least 0.53). In the remaining cases there was no significant correlation between the analysed variables.

The strongest correlation was observed between the number of employed per 1,000 inhabitants and the amount of GDP per capita (r=0.922), the net profit of companies per working-age person (r=0.878) and investment expenditures per capita (r=0.819). However, all the variables for which significant links with the dependent variable were found were adopted for modelling of the studied links. For this purpose, 8 simple linear regression models were built with the use of Statistica software. Table 5 presents the results of regression analyses: estimations of structural parameters of the estimated models, values of Student's t-test statistics with corresponding probability levels p and the values of determination coefficients and statistics F.

On the basis of the results of the analysis it can be concluded that the first of the regression models considering the independent variable GDP per capita explains for more than 85% of the variable variance employed per 1,000 inhabitants. The statistical value t, used to assess the significance of the estimated parameters, and the corresponding values of probability level p

confirm that both the parameter of the independent variable and the intercept significantly differ from zero. In addition, the high value of statistics F confirms the statistical significance of the linear model. It can therefore be concluded that the increase in value GDP per capita by PLN 10,000 will increase the number of the employed per 1,000 inhabitants by 25 persons.

Table 5. *Results of linear regression analysis*

No.	Parameter	b	Std.Err of b	t(14)	p-value	R^2	F(1.14)
1	Intercept	112.0425	14.33208	7.817604	0.000002	0.8504	79.608
	Z1	0.0025	0.00028	8.922309	0.000000		
2	Intercept	92.74021	33.50122	2.768263	0.015094	0.5742	18.880
	Z2	1.32771	0.30556	4.345101	0.000672		
3	Intercept	203.0619	9.499005	21.37718	0.000000	0.5822	19.509
	Z3	5.8492	1.324257	4.41694	0.000585		
4	Intercept	126.2935	21.18192	5.962326	0.000035	0.6710	28.560
	Z5	0.0152	0.00284	5.344135	0.000104		
5	Intercept	205.6822	10.80595	19.03416	0.000000	0.4731	12.572
	Z6	0.0594	0.01674	3.54577	0.003228		
6	Intercept	79.88388	56.77077	1.407130	0.181201	0.3545	7.6898
	Z7	11.49497	4.14525	2.773045	0.014952		
7	Intercept	178.3210	25.79365	6.913367	0.000007	0.2817	5.4918
	Z8	7.0180	2.99472	2.343450	0.034390		
8	Intercept	190.5877	7.932970	24.02476	0.000000	0.7703	46.972
	Z10	9.8650	1.439398	6.85358	0.00008		

Source: *Own elaboration.*

A high value of the coefficient of determination was also obtained for the regression model 4 and 8. Therefore, it can be concluded that an increase in investment expenditures per capita by PLN 100 results in an increase in the number of employees per 1000 population by 1.5 people on average. In the case of an increase in net profit per person of working age by 1 PLN, one may expect an increase in the number of people employed per 1000 population by almost 10 people.

5. Discussion

The multidimensional nature of labour markets entails the use of synthetic indicators to present its diversity. The heterogeneity of Polish regional and local labour markets has already been analysed in literature. However, those studies did not represent a comprehensive approach to the situation on the labour market and they concerned general socio-economic development, where the labour market was one of its components (Milek, 2018) or there were analysed different labour market issues – e.g. labour market situation of young people (Tatarczak and Boichuk, 2018; Murawska, 2016; Rollnik-Sadowska, 2016), female unemployment (Lewandowska-Gwarda, 2018) or wage differences (Arendt and Grabowski, 2019).

For the analysis of regional diversity the authors used both taxonomic methods such as the Hellwig's measure, cluster analysis (Wanat *et al*., 2019; Bartkowiak-Bakun, 2017; Karelina, 2016) as well as econometric modelling (Arendt and Grabowski, 2019; Di Caro, 2017).

The research findings generally indicate a dominant position of Mazovian Voivodship, followed by Silesia and Dolnoslaskie. This result stems from the leading role of Warsaw, the capital city, which accumulates the economic and social potential of the country (Arendt and Grabowski, 2019). Moreover, the best labour market satiation is determined by the location close to Polish big cities (Lewandowska-Gwarda, 2018; Rollnik-Sadowska *et al*., 2018). The worst situation is expected for those regions which are classified as the least developed Polish regions with low innovation potential. These results are in line with the New Economic Geography approach (Cieślik and Rokicki, 2016). Literature points out different determinants of the labour market situation at a regional level, i.e. the importance of workers' human capital in accounting for productivity differences (Syverson, 2010).

Demographic problems and the willingness to maintain workforce output, make the ability of regions to attract immigrants a crucial determinant of labour market's situation since they aim to overcome the shortages of labour. Simultaneously, immigration lowers the wages of competing workers (Borjas, 2003). The efficient wages theory assumes that workers' effort depends on their salary. As wages are procyclical, so is the effort, and this boosts procyclical labour productivity (Borja and Aymerich, 2020). Changes in minimum wages are an important factor affecting the regional labour market, especially in disadvantaged areas. In case of more developed regions, the gender gap plays a significant role, whereas, in case of less developed markets, it is real wages (Woźniak-Jęchorek, 2015).

There is little doubt that technology has a powerful impact on the labour market both on the state and regional level. Skill-biased technical change (SBTC) presents the idea that technology is biased in favour of skilled workers and against unskilled workers (Goos and Manning, 2003). Hence, the regional ability to provide access to education for its human capital is a crucial determinant of the labour market situation.

An undeniable factor influencing the regional labour market is connected with the spatial concentration of enterprises and their specificity. Frenken et al. (2007) specifically hypothesized that the related variety of regional companies would spur employment growth, as new combinations lead to new products or services and, consequently, new jobs. Still, localization economies, stemming from the spatial concentration of enterprises in exactly the same industry, would enhance process innovation as a specialized knowledge issue to optimize production processes in existing value chains. Such innovations spur labour productivity and do not necessarily lead to more jobs (Content and Frenken,

2016). The related variety thesis is thus consistent with the product lifecycle theory, which claims that young industries with high rates of product innovation create jobs in diverse urban areas, while mature industries with high rates of process innovation spur productivity in specialized peripheral areas (Capasso *et al.,* 2016).

6. Conclusion

The conducted research allowed for the identification of factors influencing the situation on the labour market and the assessment of changes taking place on regional labour markets. The diversity of regional labour markets was assessed in the context of economic change and the identification of Polish voivodships with the best and worst situation on the labour market in terms of both crisis and economic recovery. The analysis allowed for assessing the relationship between the factors of economic change and the position taken by the region in the context of the situation on the labour market.

The conducted analyses indicated a high level of stagnation of the economic situation and, consequently, the situation on the labour markets in Polish regions. A ten-year comparison period adopted for the analyses showed that the 2008-2009 economic crisis did not have a major impact on economic and labour market changes in Polish regions. The economically strongest regions, with the best situation on the labour market (Mazovian and Silesian Voivodships) remained the strongest and the weak ones (Podkarpackie, Lubelskie and Swietokrzyskie) the weakest. The observed changes in the situation of regional labour markets took place within two intermediate groups (II and III). The region with undeniably strong positive changes was Dolnoslaskie Voivodship. The change in the labour market situation resulted in its advancement by three places and promotion from group II to the group of regions with the best labour market situation. It is worth noting that according to the results of the regression analysis, the greatest influence on the improvement of the labour market situation in the region of Dolnoslaskie had an extremely high growth of GDP per capita.

The conducted theoretical analysis allows to inscribe the changes observed on the labour markets of the Polish regions into the concept of growth poles. The analyses clearly indicate that regions with strong metropolitan centres and technologically advanced economic entities are characterized by high competitiveness. At the same time, these regions (Mazovian and Silesian) gain considerable economic advantage and beat competition in terms labour market maturity against the weakest regions in Poland. At the same time, the regions with the worst situation on the labour market are characterized by strong developmental backwardness and these voivodships also remain peripheral regions. It can be observed that the polarisation of the development of economies and labour markets between the strongest and weakest regions persists, and differences between them deepen.

The proposed research methodology is universal and can be used to assess regional labour markets in other countries. Monitoring of regional labour markets according to the proposed procedure is important from the point of view of enterprise management as it identifies the potential of regions in terms of demand for goods and services.

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