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Ireneusz Dąbrowski, Adriana Politaj, Joanna Wicher, Łukasz Mach*, Paweł Frącz

Spatial-temporal assessment of regional labor market differentiation

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Abstract: The purpose of this article is a comparative analysis of regional and temporal labor market differentiation. In the study, the following voivodeships were taken as comparative objects. In accordance, following the administrative division, the voivodeships were adopted, while the research period was taken as the years 2011–2021. To study the differentiation of the voivodeship labor markets, the classical method of share shifts and the analysis of share shifts were used. The number of employed people and the registered unemployed by gender were chosen as the measures of differentiation on which the study was based. The results of the analyses made it possible to examine changes in the structure and assess the development of regional labor markets over time.

Keywords: geographic effect, regional competitiveness, labor markets, shift-share analysis
JEL Classification: J21, J60, C38, C40

1 Introduction

The labor market is one of the most important markets that make up the modern economy. It is mentioned as one of the research areas of socio-economic development. Labor resources are a component of the basic factors of regional development [Roszkowska and Lašakevič, 2017]. This means that the particular phenomena and processes that take place in voivodeship labor markets affect the level of socioeconomic development of individual regions and, as a result, the country as a whole [Malina, 2020]. The labor market situation affects many aspects, including the level of unemployment, wage levels, productivity, and competitiveness of the economy. Therefore, labor market analyses are an important tool for monitoring the changes taking place in the economy [Das and Hilgenstock, 2022]. They make it possible to assess whether changes are taking place as expected and at an appropriate pace [Jewczak and Twardowska, 2011]. The literature on the subject indicates that the labor market can be considered from the point of view of labor demand and supply, as well as in terms of their relationship to each other. Labor supply is shaped by the behavior of households, while labor demand depends on the actions of businesses. Labor supply is therefore expressed in terms of the number of workers willing to work for a given labor wage, while labor demand is the reported demand for labor measured by the number of jobs offered. Labor demand thus determines the number of people who can find employment. The magnitude of demand therefore has a

***Corresponding author: Łukasz Mach,** Department of Economics, Opole Univesity, Opole, Poland.
E-mail: lmach@uni.opole.pl
Ireneusz Dąbrowski, Department of Monetary Economics, SGH Warsaw School of Economics, Warsaw, Poland.
Adriana Politaj, Department of Economics and Economic Policy, Wroclaw University of Economics and Business, Jelenia Góra, Poland.
Joanna Wicher and Paweł Frącz, Narodowy Bank Polski, Regional Branch in Opole, Opole, Poland; Departament of Economics, Opole University, Opole, Poland.

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direct impact on the level of unemployment and can also affect the income level of the employed and their standard of living. When researching and analyzing labor markets, variables representing both the demand and supply faces of the labor market should be taken into account, since the labor market does not belong to a homogeneous category [Buchwald, 2009; Gawrycka and Szymczak, 2010, 2013]. Taking the above into account, this article analyzes the spatial differentiation of the labor market, with the assumption that the demand side and supply side will be represented by such variables as job offers and the unemployment rate, respectively. Thus, the purpose of the study is to assess the differentiation of regional labor markets, their development, and structural changes and also to identify the most attractive regional labor market in Poland. The study will be carried out using the classic method of shift-share analysis (SSA) and its extension to include spatial dependencies, i.e., spatial shift-share analysis (SSSA), which will make it possible to examine how neighboring voivodeships interact with each other. The obtained results of the research can serve as a premise in the decision-making process both in the strategic and operational time horizons.

2 Literature analysis of labor market

2.1 The labor market in regional terms

A regional labor market is a geographic area characterized by spatially defined job opportunities without the need for workers to relocate [Fischer and Nijkamp, 1987]. The specificity of employment opportunities for each region is usually the result of the regions' specialization in certain fields and the high share of these specializations in their economies. In addition, each region should have jobs available to its residents. These two characteristics make it possible to identify regional labor markets with voivodeship labor markets [Kryńska and Kwiatkowski, 2013]. The regional labor market operates on analogous principles to the national labor market, but it takes into account beyond-national realities, its specific characteristics distinguishing it from other markets. Thus, the main components of regional labor markets will be unemployment representing the supply side and employment representing the demand side of the labor market [Socha-Sachalin, 1998]. Due to the diversity of Poland's regions, the country's voivodeship labor markets also differ. Situations in individual markets will be different depending on the geographic location of the voivodeship, their surroundings (voivodeships and neighboring countries), and the potential of labor resources (including age, skill level of residents). Thus, the labor market situation in a region may differ significantly from that of the national labor market [Buchwald, 2009; Hartmann and Pinheiro, 2022]. It follows that studies of regional labor markets, in particular, should be relevant to the conduct of both regional and national policies.

2.2 Labor market analysis methods

Studies of regional labor markets are very often based on comparative analyses of specific measures indicating the situation in the labor market such as, among others: unemployment rate, employment rate, number of employed, and labor force participation rate between voivodeships or in relation to the country as a whole, as well as analysis of changes in the size of indicators over time, e.g., surveys [Kryńska et al., 2011; Gajdos, 2013; Knapińska, 2016; Antoszak, 2017; Zieliński, 2017]. To make in-depth regional analyses that take into account many aspects of the labor market, multivariate comparative analyses, spatial analysis methods, and econometric models are increasingly being used [Laskowska and Zóltaszek, 2021]. Spatial relationships exist in all regional markets including voivodeship labor markets. Therefore, it is important to take them into account in the analyses of the formation of various socio-economic phenomena, including analyses of labor markets. For example, an increase in the average level of wages in one region may be the cause of labor migration in the other surrounding regions and thus result in a decrease in labor supply in them. On the other hand, a favorable situation in the income aspect in a particular voivodeship may

contribute to an improvement in the labor market in a nearby, poorer voivodeship, which will attract wealthy customers due to its attractiveness [Dańska-Borsiak and Olejnik, 2021].

2.3 Previous research of regional labor markets in the world

Analyses of regional labor markets are carried out by many researchers around the world. Jones [2012] examined changes in UK regional employment during the period of the New Labor administration during the period 1997–2010. In his research, he analyzed the shift-share of workplace employment data by industry and subregion. His research has indirectly allowed the regional competitiveness of labor markets to be examined, but above all changing spatial distribution of employment.

Mayor and López [2009] have carried out a spatial analysis of regional employment in Spain. In their research, they used spatial shift-share models based on previously defined spatial weights matrix, which made it possible to identify and estimate spatial effects in the evolution of regional employment in Spain. The method used in the study considered each sector separately, and thus made it possible to examine changes in the structure of employment and also between the initial and final periods.

On the other hand, in Canada, analyses were conducted directed at examining the impact of the energy sector development on employment rates in various occupations and industries in eight regions across Alberta [Brox et al., 2010]. In that study, the SSA was extended beyond its conventional application of assessing regional industrial performance by accounting for the impact of regional economic growth or decline in particular occupational categories.

2.4 Labor market competitiveness

The study of the diversity of regional labor markets will make it possible to compare and evaluate their competitiveness against the country. The aspect of competitiveness can be considered from various perspectives, including the worker's point of view. For employees, the important features will be mainly the level of wages and conditions of employment. There should be no doubt that employees are looking for jobs that will give them the opportunity to earn attractive wages. Therefore, the competitiveness of regional labor markets largely depends on the level of wages offered in the region. If a region is characterized by high average wages, the likelihood of attracting a skilled labor force increases, and well-qualified workers bring opportunities for increased regional development of the economy [Gora and Sztanderska, 2006]. The competitiveness of the labor markets is not only limited to employment conditions and wage levels, but also to the possibility of getting a job in the region, which can be expressed by the number of job offers in a given voivodeship. When the number of offers is relatively large, workers have more room for maneuver in choosing the most suitable and attractive job possible for them, and this in turn forces employers to offer and provide favorable working conditions. The analysis of employment in the regions is important because of the income generated by the employed, which translates into the competitiveness and economic development of the regions, and thus the development of the country as a whole [Jewczak and Twardowska, 2011]. The competitiveness of voivodeship labor markets is a very important issue from the point of view of investors. Regions with a high level of employment and a favorable situation in the labor market make it possible to achieve higher levels of production [(Salimova at all 2022, Kwiatkowski and Kucharski, 2011], which results in them becoming more attractive to investors, due to the greater likelihood of success in the investments undertaken in these regions. The investment attractiveness of voivodeships, and then of Poland as a whole, is therefore the result of well-functioning regional labor markets [Michalski, 2014].

3 Research assumptions and methodology

The main determinants of the creation of the database were both the substantive rationale and the availability of data at the time of the survey. The analysis of regional labor markets carried out is based on the following variables: unemployment representing the supply side and employment representing

the demand side expressed in turn by the number of unemployed[1] and employed[2] in all voivodeships of Poland ($r = 1, 2, \ldots, 16$) broken down by gender ($i = 1, 2$). The data were taken from the Local Data Bank of the Central Statistical Office. The temporal scope of the study was assumed to cover the years 2011–2021. Spatial-temporal analyses of the regional labor market differentiation were calculated using the classical SSA method and the SSSA method that is an extension of the classical SSA to include spatial dependencies in the model. Both SSA and SSSA belong to the group of structural–geographical methods [Suchecki, 2010; Szewczyk and Łobos, 2011, Knudsen, 2000, Mitchell at all 2005].

The classical method of SSA can be defined as "a tool for studying structural changes in economic and social phenomena that may occur in geographic space over a certain period of time" [Suchecki, 2010]. Thus, SSA is an appropriate tool for studying variations in the dynamics of regional labor markets and their assessments, due to the fact that it describes the nature of changes in the regional labor market in relation to the changes taking place in the country [Zajdel, 2003]. The model of classical share shift analysis allows analysis and evaluation of the level of development of regional labor markets, comparisons between them, and analysis of changes over time [Gibas, 2017]. It should be noted that the disadvantage of SSA is that it does not take into account the fact that each unit does not appear as a separate geographic area, which can affect the precision of the analysis in the context of interactions between areas. The use of the SSSA model makes it possible to study the rate of change in the growth of regions in Poland taking into account spatial interactions [Suchecki, 2010; Jewczak and Twardowska, 2011], which is important due to the fact that the development of many phenomena can be affected by spatial ties with neighboring regions [Tłuczak, 2015]. In the classical SSA method, the formation of the *TX* variable quantified in the compound form of absolute growth or the rate of change of the *X* variable is studied [Suchecki, 2010].

The SSA procedure implies the following steps [Suchecki, 2010; Mach, 2016; Gibas, 2017]:

1. Determination of regional ($w_{r\cdot(i)}$), sectoral ($w_{\cdot i(r)}$), and individual (w_{ri}) weights for the initial period data;
2. Determination of individual growth rate and the following aggregate measures: average growth rate in the *r*-th region $tx_{r\cdot}$, *i*-th sector $tx._i$, and total for the whole country ($tx..$);
3. Calculation of structural–geographic equality (I), i.e., the net total effect, which is formed by geographic (II) and structural (III) effects.

$$tx_{r\cdot} - tx_{\cdot\cdot} = \sum\nolimits_i w_{r\cdot(i)}\left(tx_{\cdot i} - tx_{\cdot\cdot}\right) + \sum\nolimits_i w_{r\cdot(i)}(tx_{ri} - tx_{\cdot i}) \tag{I}$$

$$\sum\nolimits_i w_{r\cdot(i)}(tx_{ri} - tx_{\cdot i}) \tag{II}$$

$$\sum\nolimits_i w_{r\cdot(i)}\left(tx_{\cdot i} - tx_{\cdot\cdot}\right) \tag{III}$$

The total net effect is the excess of average regional growth over national growth. The net effect is decomposed into a geographic effect and a structural effect. The geographic effect, also called the regional or competitive effect, can be defined as the weighted average of regional deviations assigning categories of the cross-cutting qualitative criterion to the corresponding regions. It is the effect of average internal changes occurring in a region. The structural effect, on the other hand, is a weighted average of deviations between average growth rates in sectors and the national growth rate. The structural effect indicates that regions are differentiated by deviations in distribution [Sobczak, 2013]. Due to some limitations of the classical SSA, some researchers have made modifications to it. In 2004, S. Nazara o G.J.D. Hewings presented their variant of SSA, in which to introduce a matrix of spatial weights *W* to the structural–geographical equation

1 Registered unemployed. Persons who are 18 years of age or older and have not reached retirement age, not employed and not engaged in other gainful employment, able and ready to take up full-time employment, according to the classification of the Central Statistical Office.

2 Persons doing work that earns them money or income, according to the CSO classification.

(I), so that spatial dependencies between areas are taken into account. In this variant, the equation looks as follows [Suchecki, 2010]:

$$tx_{r\cdot} - tx_{\cdot\cdot} = \sum_i w_{r\cdot(i)}\left(\boldsymbol{W}tx_i - tx_{\cdot\cdot}\right) + \sum_i w_{r\cdot(i)}(tx_{ri} - \boldsymbol{W}tx_i) \quad \text{(IV)}$$

where $\boldsymbol{W}$ is the row standardized matrix of weights.[3]

Positive values of indicators of the rate of structural change $\left(\mathbf{W}tx_i - tx_{\cdot\cdot}\right)$ inform that the rate of change in the *i*-th sector is faster in locations neighboring the *r*-th observed region, while negative values of the local competitiveness index $(tx_{ri} - \boldsymbol{W}tx_i)$ informs about the negative impact of neighboring areas on the development of the *r*-th region in terms of economic activity in the *i*-th sector, which indicates that the region is not competitive in the *i*-th sector for neighboring areas. The situation in the national labor market is determined by the functioning of individual regional labor markets, so the level of employment and the unemployment rate in the country is the result of the labor activity of the population in the voivodeships. For this reason, this study analyzes the situation in regional labor markets by examining the rate of change in the number of the employed and unemployed in the voivodeships of Poland. Since the development of regional labor markets is determined by both changes in the number of employed and unemployed women and men in a given period, in addition, the study takes into account changes in the gender structure in the context of changes in the structure of factors determining the development of individual labor markets.

4 Spatial-temporal differentiation of the labor market–analysis and interpretation of the obtained research results

The spatial-temporal variation in the labor market was described in four research steps. In the first, using SSA and SSSA analysis, structural, geographic, and total effects were calculated for the number of employed. In the second, it was done for the unemployment variable. In the third step, taking into account the gender criterion, an analysis of structural growth factors was carried out. In the final step, the fourth, a ranking summary of the attractiveness of the voivodeships was presented. Each of the steps described includes the results of the calculations carried out, their analysis, and interpretation.

4.1 Spatial-temporal differentiation of those working in the labor market

The survey made it possible to distinguish local regional growth factors in Poland's voivodeships. In most of them, the rates of growth (or decline) in the number of employed men and women were at similar levels and in the same direction (Table 1). The exceptions were Lubuskie and Małopolskie Voivodeships, in which positive growth rates in the number of employed men and negative growth rates in the number of employed women were recorded simultaneously, while the opposite situation occurred in Śląskie Voivodeship. The largest difference between the rates of change in the number of employed men and women occurred in the Wielkopolskie Voivodeship, where the regional growth rate of women exceeded the growth rate of the number of employed men by 9.07 p.p.

The rate of change in the number of employed people covering the period 2011–2021 was 5.37%, indicating a 5.37% increase in the number of employed in Poland in the present period. Comparing the regional growth rates in Poland, one can see a very high degree of their differentiation (S = 10.39%, V_s = 547.14%). The highest growth rate in the number of employees was recorded in the Wielkopolska Voivodeship, the value of which is almost four times the average national growth rate. In addition to the Wielkopolskie Voivodeship, growth rates exceeding the value of national growth took place in the Pomorskie, Mazowieckie, Dolnośląskie, and Zachodniopomorskie Voivodeships (Table 1). In the period under review, as many as seven voivodeships recorded a negative regional growth rate, i.e., Lubelskie,

3 In the present study, the W matrix was assumed to be a row-standardized to unity direct neighborhood (common boundary) matrix, cf. Suchecki [2010, pp. 105–107, 195].

Table 1. Local drivers of regional employment growth

Voivodeship	Local regional growth factor (uri)		Average regional growth rate (txr.)	Average rate of change in the country (tx..)
	Women	Men		
Dolnośląskie	2.49%	4.34%	8.82%	5.37%
Kujawsko-pomorskie	−5.21%	−4.24%	0.68%	
Lubelskie	−23.1%	−18.36%	−15.27%	
Lubuskie	−5.54%	1.02%	3.3%	
Łódzkie	−7.71%	−7.29%	−2.12%	
Małopolskie	−4.30%	2.90%	4.77%	
Mazowieckie	10.51%	10.08%	15.65%	
Opolskie	−6.8%	−4.18%	−0.02%	
Podkarpackie	−23.06%	−16.23%	−14.11%	
Podlaskie	−10.64%	−6.22%	−2.92%	
Pomorskie	16.15%	10.33%	18.36%	
Śląskie	0.57%	−5.13%	2.69%	
Świętokrzyskie	−20.26%	−18.08%	−13.74%	
Warmińsko-mazurskie	−7%	−7.48%	−1.89%	
Wielkopolskie	19.73%	10.66%	20.23%	
Zachodniopomorskie	0.77%	0.4%	5.94%	

Podkarpackie, Świętokrzyskie, Podlaskie, Łódzkie, Warmińsko-Mazurskie, and Opole Voivodeships, which indicates a decline in the number of working people in the above voivodeships. The largest decline in the period under review was recorded in Lubelskie Voivodeship.

The SSA procedure makes it possible to determine pure regional growth for each surveyed unit (in this study, for each voivodeship) and to isolate the structural effect and the geographic effect in each unit, making it possible to determine which effect has the main impact on the changes taking place in the regions. The results of this study show that in the classical approach, changes in the structures of the number of employees in the voivodeships in relation to the national trend did not affect the growth rates of the voivodeships, and the rates of structural change of the regions ran in them at a similar level to the Polish average. Instead, the growth rates of the regions were determined by internal changes related to competitiveness with other regions. A positive competitive effect in the classical method of share shifts was observed in five voivodeships, i.e., the Wielkopolska, Pomorskie, Mazowieckie, Dolnośląskie, and Zachodniopomorskie voivodeships (Table 2), which means that the growth of the number of employees in the above-mentioned voivodeships is stronger compared to other Polish voivodeships.

A study that took into account spatial interactions between regions, i.e., the inclusion of a neighborhood weighting matrix procedure between voivodeships, however, yielded different results. In contrast to the insignificant values of SSA structural effects, the structural effects obtained using SSSA indicated the existence of seven voivodeships in which there were favorable changes in the structure of the number of employees in relation to neighboring voivodeships. The highest rate of such changes was recorded in the Zachodniopomorskie Voivodeship (8.51%), while the lowest value (–13.59%) was recorded in the Małopolskie Voivodeship, indicating that its neighboring regions show better results than it in terms of the structure of the employed. In this study, the analysis of competitiveness is of the greatest importance, because it is the one that allows us to assess the impact of neighboring voivodeships on each other. Determining the values of geographic effects in the SSSA method for six voivodeships of Poland (i.e., dolnośląskiego, małopolskiego, mazowieckiego, pomorskiego, śląskiego i wielkopolskiego), the values of the geographic

Table 2. Structural-geographical analysis of changes in the number of employees

Voivodeship	Total effect	Classic effects (SSA)		Modified effects (SSSA)	
		Structural	Geographic	Structural	Geographic
Dolnośląskie	3.46%	0%	3.45%	2.41%	1.05%
Kujawsko-pomorskie	−4.69%	−0.01%	−4.68%	4.66%	−9.35%
Lubelskie	−20.64%	0.01%	−20.64%	−9.17%	−11.46%
Lubuskie	−2.07%	0%	−2.07%	6.21%	−8.28%
Łódzkie	−7.49%	0%	−7.49%	−0.97%	−6.51%
Małopolskie	−0.59%	0.01%	−0.6%	−13.59%	13%
Mazowieckie	10.28%	0%	10.28%	−11.36%	21.65%
Opolskie	−5.38%	0%	−5.38%	2.07%	−7.46%
Podkarpackie	−19.48%	0%	−19.49%	−13.34%	−6.14%
Podlaskie	−8.29%	0%	−8.29%	−5.85%	−2.44%
Pomorskie	12.99%	0%	13%	0.86%	12.14%
Śląskie	−2.68%	−0.01%	−2.66%	−8.02%	5.34%
Świętokrzyskie	−19.11%	0%	−19.11%	−6.72%	−12.38%
Warmińsko-mazurskie	−7.26%	0%	−7.26%	2.59%	−9.84%
Wielkopolskie	14.86%	0%	14.86%	−0.46%	15.32%
Zachodniopomorskie	0.58%	0%	0.57%	8.51%	−7.93%

SSA, shift-share analysis; SSSA, spatial shift-share analysis.

effect were positive, which indicates the positive influence of the surrounding regions on the growth of the number of employed people. It should be noted here that the above-mentioned voivodeships are the voivodeships with the largest number of employed people in Poland (in 2021, they were among the top seven voivodeships in Poland in terms of the number of employed people), and the positive value of the geographic effect may be the result of people migrating from neighboring voivodeships to take up employment. When analyzing the differences in the results of the SSA and SSSA geographic effects, attention should be paid to the Zachodniopomorskie Voivodeship, which, despite a relatively good situation regarding the number of people employed (positive total effect), recorded a low geographic effect with the SSSA method (–7.93%), which may be due to its neighborhood with the Wielkopolskie and Pomorskie Voivodeships.

4.2 Spatial-temporal differentiation of the unemployed in the labor market

The results of the obtained surveys of the number of the unemployed in 2011–2021 take into account the destimulating effect of the feature, on the situation in the national and regional labor markets.

Analogous to the case of the number of employed people, the growth rate of the number of unemployed women and men was at a similar level and in the same direction in most voivodeships, with the exception of Kujawsko-Pomorskie, Pomorskie, and Opolskie Voivodeships, where positive growth rates were recorded for the regional number of unemployed women with a negative growth rate for the number of unemployed men, and with the exception of Łódzkie Voivodeship, where the situation was the opposite (Table 3). The largest differences in the growth rate of unemployed men and women occurred in the Pomorskie (5.21 p.p.) and Podlaskie (5.06 p.p.) voivodeships. The average national rate of change in the number of the unemployed in the 2011–2021 period was –54.85%, which indicates a positive phenomenon in the national labor market, i.e., a decrease in the number of the unemployed in the period under review by about 54.85%. Regional growth rates in Poland are characterized by low variability (V_s = 10.97%, S = 6.10%).

Table 3. Local factors of regional growth in the number of unemployed people

Voivodeship	Local regional growth factor (uri)		Average regional growth rate (txr.)	Average rate of change in the country (tx..)
	Women	Men		
Dolnośląskie	−4.73%	−3.68%	−59.09%	−54.85%
Kujawsko-pomorskie	1.3%	−3.62%	−55.69%	
Lubelskie	8.13%	9.83%	−45.9%	
Lubuskie	−13.9%	−15.15%	−69.29%	
Łódzkie	−2.41%	0.05%	−56.08%	
Małopolskie	2.85%	3.29%	−51.79%	
Mazowieckie	7.96%	6.56%	−47.62%	
Opolskie	1.22%	−2.17%	−55.16%	
Podkarpackie	7.63%	7.81%	−47.14%	
Podlaskie	2.89%	7.95%	−49.37%	
Pomorskie	1.78%	−3.43%	−55.30%	
Śląskie	−5.42%	−2.58%	−59.01%	
Świętokrzyskie	0.38%	0.76%	−54.29%	
Warmińsko-mazurskie	−4.35%	−6.87%	−60.34%	
Wielkopolskie	−7.69%	−9.01%	−63.06%	
Zachodniopomorskie	−3.99%	−6.74%	−60.11%	

All voivodeships in Poland in the present period recorded negative regional growth rates in the number of the unemployed (Table 3), which indicates positive changes in each voivodeship of Poland during the present period. The strongest change was recorded in Lubuskie Voivodeship (−69.29%) and the weakest in Lubelskie Voivodeship (−45.9%).

The total effect of the structural–geographical analysis of changes in the number of the unemployed took positive values for six voivodeships (Table 4), which means that the rate of decline in the number of the unemployed in the Lubelskie, Małopolskie, Mazowieckie, Podkarpackie, Podlaskie, and Świętokrzyskie voivodeships was lower than the average for Poland. The rate of change in the number of the unemployed in the present period was most similar to the national one in the Opolskie Voivodeship, for which the total effect was −0.31%. The calculation of the structural effect of the classical SSA for the number of unemployed gave a similar result as for the number of employed, i.e., changes in the structures of the number of unemployed in voivodeships in relation to the national trend did not affect or had a negligible effect on voivodeship growth rates and ran at a similar level to the Polish average. The rates of change in the regions were mainly determined by internal changes associated that were related to competitiveness with other regions. In the second variant of the study, i.e., taking into account the neighborhood between regions, the rates of change in the number of the unemployed in voivodeships were caused by both structural changes and changes related to the competitiveness of the area. The results of the SSSA indicate that half of the voivodeships show favorable changes in the structure of the number of the unemployed (in relation to neighboring regions), i.e., the voivodeships of dolnośląskim, kujawsko-pomorskim, lubuskim, łódzkim, opolskim, pomorskim, and wielkopolskim i zachodniopomorskim, with changes being strongest in the dolnośląskim Voivodeship and Zachodniopomorskie. Turning to the analysis of competitiveness on the basis of the SSSA, attention should be paid to the Mazowieckie Voivodeship, which took the largest value of the geographic effect (7.16%), indicating the relatively strong influence of neighboring voivodeships on the change in the number of the unemployed in the region. A positive geographic effect outside of the Mazowieckie Voivodeship also occurred in ten other voivodeships. In contrast, the smallest effect occurred in the Lubuskie Voivodeship.

4.3 Structural drivers of regional growth

The procedure for analyzing share shifts makes it possible to conduct a detailed analysis of structural change. The study calculated the structural shift factor for each component, i.e., for women and for men, both when determining the structural factors of the number of the employed and the unemployed (Table 5).

The values of the structural factors of regional growth were at low levels for both the number of the employed and the unemployed for both genders. The rate of growth in the number of employed women during the period under review was slightly higher than the average national growth in the number of total employed. Analyzing the structural factors for the unemployed, it should be noted that a higher rate of decline in the number of unemployed occurred in the male group.

4.4 Ranking of attractiveness of voivodeships

To achieve the research objective, i.e., to identify the most attractive voivodeships in terms of the labor market, an attempt was made to create a ranking of voivodeships taking into account both total effects for the number of employed and unemployed. Due to the fact that in this study, it is desirable to achieve the highest total effect for the employed with the lowest possible effect for the unemployed, a ranking was

Table 4. Structural and geographic analysis of changes in the number of unemployed people

Voivodeship	Total effect	Classic effects (SSA)		Modified effects (SSSA)	
		Structural	Geographic	Structural	Geographic
Dolnośląskie	−4.24%	0%	−4.24%	−7.09%	2.85%
Kujawsko-pomorskie	−0.85%	0.02%	−0.86%	−1.63%	0.78%
Lubelskie	8.95%	−0.02%	8.97%	5.22%	3.73%
Lubuskie	−14.44%	0.01%	−14.46%	−5.3%	−9.15%
Łódzkie	−1.23%	−0.01%	−1.21%	−2.14%	0.91%
Małopolskie	3.06%	0.01%	3.05%	1.92%	1.14%
Mazowieckie	7.23%	−0.03%	7.26%	0.07%	7.16%
Opolskie	−0.31%	0.01%	−0.32%	−4.48%	4.17%
Podkarpackie	7.71%	0%	7.72%	4.69%	3.03%
Podlaskie	5.48%	−0.04%	5.51%	4.01%	1.47%
Pomorskie	−0.45%	0.02%	−0.47%	−4.90%	4.45%
Śląskie	−4.16%	0.02%	−4.18%	0.52%	−4.67%
Świętokrzyskie	0.55%	−0.01%	0.57%	2.59%	−2.03%
Warmińsko-mazurskie	−5.49%	0.01%	−5.50%	2.75%	−8.24%
Wielkopolskie	−8.21%	0.03%	−8.24%	−2.60%	−5.62%
Zachodniopomorskie	−5.26%	0%	−5.26%	−7.17%	1.92%

SSA, shift-share analysis; SSSA, spatial shift-share analysis.

Table 5. Structural drivers of regional grow

Characteristics studied	Women	Men
Number of employees	0.21%	−0.19%
Number of unemployed	0.31%	−0.35%

Table 6. Ranking of voivodeship labor markets - Differences between total effects for the employed and unemployed

Voivodeship	*ECz	*ECb	ECz-ECb
Wielkopolskie	14,86%	−8,21%	23,07%
Pomorskie	12,99%	−0,45%	13,44%
Lubuskie	−2,07%	−14,44%	12,37%
Dolnośląskie	3,46%	−4,24%	7,70%
Zachodniopomorskie	0,58%	−5,26%	5,84%
Mazowieckie	10,28%	7,23%	3,05%
Śląskie	−2,68%	−4,16%	1,48%
Warmińsko-mazurskie	−7,26%	−5,49%	−1,77%
Małopolskie	−0,59%	3,06%	−3,65%
Kujawsko-pomorskie	−4,69%	−0,85%	−3,84%
Opolskie	−5,38%	−0,31%	−5,07%
Łódzkie	−7,49%	−1,23%	−6,26%
Podlaskie	−8,29%	5,48%	−13,77%
Świętokrzyskie	−19,11%	0,55%	−19,66%
Podkarpackie	−19,48%	7,71%	−27,19%
Lubelskie	−20,64%	8,95%	−29,59%

*ECz- total effect of the number of employees

*ECb- total effect of the number of unemployed

prepared indicating the differences in these values. Table 6 presents the results of measuring the differences in the obtained effects for each voivodeship studied.

5 Summary

The study identified structural, geographic, and total effects, which formed the basis in the process of evaluating and ranking Polish voivodeships from the point of view of two factors describing the labor market, i.e., the employed and the unemployed. Local growth factors and the average national rate of change were also calculated in the research process. Spatial econometrics tools, i.e., SSA and SSSA, were used to carry out the research, so the study additionally used the method of the classical transfer method, which in its assumptions takes into account the neighborhoods between regions. This turned out to be crucial for the study of interactions occurring in the labor market. Summarizing the research carried out, the detailed results are described in Chapter 3. While generalizing them, it can be said that there is a decrease in the number of the unemployed in each voivodeship, and that there was a slight increase in the number of employed people in the country during the period under study (5.37%), with a high variation between voivodeships.

The results obtained from the study allowed to conduct structural and spatial analyses of the development potential of the regional labor market. This precisely showed the level of development of the labor market in each voivodeship while taking into account structural and geographic effects. Based on the presented detailed results using SSA and SSSA analyses, local government units, labor offices, government administration, and enterprises can plan their development strategies in the area of the labor market or human resources.

Thus, the obtained results of the research can have utilitarian significance for the economic processes taking place, both at the level of enterprises, as well as local government units and government administration.

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