Impact of Changes in the Employment Structure on Labour Productivity in the Subregions of Lower Silesia and Greater Poland

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Abstract: The paper discusses changes in the employment structure as a measure of evaluating the ability of a territorial unit to adapt to changes dictated by its close and distant surrounding. In the article, we also address the relation between the ability to change and labour productivity in a given territorial unit. The aim of the paper is to identify, assess and compare processes of the transformation of employment structures, and to analyse the influence of these processes on workforce productivity in the subregions of Lower Silesia and Greater Poland voivodeships. We discuss changes in the employment structure from 2010 to 2014 according to section groups. We also examine the intensity, pace and monotonicity of structure transformations and compare these results against the measure of labour productivity.

1. Introduction

Economists have shown a lot of interest in the structural changes of the Polish economy, because they could observe the results of its transformation and its adaptation to new challenges. Regardless of the scale of the examined territorial unit, it must be remembered that the economic sphere consists of a number of functionally and spatially interrelated elements (enterprises or

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public entities), which are particularly vulnerable to changes occurring in their close and distant surrounding (Gaczek, 2014: 9). What is one of the implications of economic transformations are changes in the employment structure, which derive from internal factors, such as: globalisation, internationalisation or servitisation. Changes in the structure of employment are also accompanied by changes in the overall performance of particular territorial units, which allow us to compare these units with one another.

The aim of the paper is to identify, assess and compare processes of the transformation of employment structures, and to analyse the influence of these processes on workforce productivity in the subregions of Lower Silesia and Greater Poland voivodeships. To this end, we gathered data concerning employment available in public statistics. After that, we built a structure of employment according to section groups, evaluating these structures in terms of the intensity, pace and monotonicity of changes. From the same source, we also obtained information on labour productivity reflected by the gross value added (GVA) per one employee.

2. Changes in the employment structure in the process of social-economic development

Socio-economic development might be said to be an outcome of a number of complicated activities and relations between single entities functioning in the economy, and between groups of entities configured in different ways. These relations usually remain constant only in relatively short periods; that is why apart from the complexity of relations between economic entities, we also deal with the complexity of change processes, which are observable only in the long term. The structure of the economy does not remain the same for ever.

The transformation of the industry structure of the economy is a response to globalisation and integration processes, which are a factor that makes it necessary for economic structures to adapt to new conditions. Markowska et al. (2014: 47) write that the main causes of changes include: "changes in the structure of demand, differences in the speed with which labour productivity increases in different industries, relative changes of prices, the development of global trade (globalisation processes) and the policy of economic liberalisation." According to other authors, what is one of the most important determinants of changes in the economic structure is technological advancement, which makes the industrial civilisation transform into the service civilisation. The classical division of economy into three sectors is becoming vague – material

production and services are merging. The functions which have been fulfilled by manufacturing sectors are being taken over by service units specialised in supporting specific industries (Lichniak, 2010). The merging of industry and service is both the cause and effect of the processes of the servitisation and industrialisation of services (Szukalski, 2004).

The existing body of economic literature on structural changes predominantly includes works concerning the variability of the structure of the production of goods, inputs, and the role of individual sectors in the generation of GDP, as well as on the structure of employment. In most cases, studies on the employment structure in Poland focus on the observation of changes occurring in Polish regions against the background of transformations taking place in highly developed countries, especially European Union member states (Kwiatkowska et al., 1993; Strahl and Panasiewicz, 1997; Puzio-Wacławik, 2007; Zioło, 2010, 2012; Markowska, 2012; Markowska et al., 2014, Jankowska and Majka, 2015).

In general, the observed trends show that as the transfer of technology grows, which usually leads to an increase in the efficiency of the production of traditional goods, the supply of jobs decreases, and the number of workplaces generated by the service sector, especially knowledge-based services, increases (Zakrzewski, 2002: 73; Woźniak, 2009: 41). After the accession to the European Union, we observed changes in the employment structure in Poland, which were similar to changes in the other member states, but their direction and pace were not fully accepted by the society (Godlewska-Dzioboń, 2011).

There is no doubt that the observed changes do not occur at the same pace in all locations – there is the time and spatial differentiation of employment structure transformations. Employment structures in territorial units show differences in their reactions to changes determined by external factors, implying territorial units' ability and tendency to transform under the influence of the conditions in their environment. The ability of the economy of a territorial unit to generate a new value is estimted on the basis of gross value added calculated yearly. By referring this ability to the number of employees we are able to estimate labour productivity in this unit. It thus seems justifiable to ask a question whether the ability of territorial units' employment structures to quickly adapt to the conditions dictated by their environment affects workforce productivity in these units in any way. In order to answer this question, we compared the processes of changes in the employment structures in the subregions of Lower Silesia and Greater Poland voivodeships in the

years 2010-2014, and confronted them with the measure of labour productivity in the form of gross value added (GVA) per one worker.

3. The employment structure in the subregions of Lower Silesia and Greater Poland voivodeships in the years 2010-2014

Using data available in the Local Data Bank of the Main Statistical Office, we created the employment structure in the subregions of Lower Silesia and Greater Poland. The structure was based on section groups, organised into the following sets: 1) agriculture, forestry, hunting, fishery, 2) industry and construction, 3) trade, car repair, transport, warehouse inventory management, hotel and catering industry, information and communication, 4) financial and insurance services, real estate services, 5) other services.

Both in Lower Silesia and Greater Poland, the structure of employment according to section groups in urban subregions was different from that in the other subregions (table 1). In Wrocław and Poznań, it was the group of the other services that had the largest proportion of employees. In 2014, it increased by 2-3% as compared to 2010 at the cost of people employed in industry and construction, and it amounted to 42% in Wrocław and 41% in Poznań. In the other regions, both in 2010 and 2014, we observed that people working in industry and construction represented the largest group in the structure of employment. The analysis of the changes that occurred from 2010 to 2014 shows that the proportion of people employed in industry and construction increased in three subregions (Jeleniogórski, Legnicko-Głogowski, Kaliski) and remained constant in two subregions (Wałbrzyski, Koniński). The proportion of employees in industry and construction dropped by 3% in Poznań, and by 2% in Wrocławski, Poznański and Poznań subregions.

Table 1. The employment structures according to section groups (1-5) in the subregions of Lower Silesia and Greater Poland voivodeships in 2010 and 2014 in %

Subregions	2010					2014				
	1	2	3	4	5	1	2	3	4	5
Jeleniogórski	13	32	24	3	28	13	33	23	3	29
Legnicko-głogowski	9	37	22	3	28	9	38	22	3	28
Wałbrzyski	10	34	24	3	28	10	34	23	3	29
Wrocławski	17	41	22	2	19	15	39	23	2	21
City of Wrocław	1	21	31	8	39	1	19	30	8	42
Kaliski	24	34	21	2	19	23	35	21	2	20
Koniński	25	31	22	2	21	24	31	21	2	22
Leszczyński	22	35	21	3	19	22	34	22	3	20
Pilski	20	33	22	2	23	20	32	24	2	23
Poznański	11	40	30	2	17	10	38	31	2	19
City of Poznań	1	23	32	6	39	1	20	32	6	41

Legend: 1 - agriculture, forestry, hunting, fishery, 2 - industry and construction, 3 - trade, car repair, transport, warehouse inventory management, hotel and catering industry, information and communication, 4 - financial and insurance services, real estate services, 5 - other services.
Source: Author's own elaboration based on: Central Statistical Office of Poland.

4. The processes of changes in the employment structure and labour productivity in the subregions of Lower Silesia and Greater Poland voivodeships in the years 2010-2014

In the subregions under analysis, we identified the processes of changes in the employment structure according to section groups, which is characteristic of highly developed countries. This observation makes us pose a question whether, given the decreasing proportion of people employed in industry and construction and the growing number of employees in broadly defined services, the intensity of transformations in the employment structure affects labour productivity in the subregions under study. To answer this question, we studied and evaluated the process of transformations in the structure of employment.

To examine the employment structure in subregions, we analysed the intensity, pace and monotonicity of structural changes in employment observed between 2010 and 2014. The five-component structure was determined in a five-year period for each of the subregions and the intensity of structural changes was examined. A measure applied in the studies of the intensity of structural changes is angle θ or the cosine of angle θ. Its construction is not based on the pace of the growth of structure elements, and thanks to its quality of attributing a different weight to the

same shifts in the structure depending on the size of proportion that has changed, it seems to be the most plausible measure reflecting the essence of structural changes (Wyżnikiewicz, 1978: 69). The indicator is represented by the following formula:

$$\cos\theta = \frac{\sum_{i=1}^{n} f_i^0 f_i^1}{\sqrt{\sum_{i=1}^{n}(f_i^0)^2}\sqrt{\sum_{i=1}^{n}(f_i^1)^2}},$$

where:

f_i – proportion of i-element in the population (i = 1, 2, …, n),

f^1–proportion of the element in the examined structure,

f^0– proportion of the element in the base structure.

Having examined the intensity of changes in the structure of employment in subregions, we analysed the evolution of these structures. We determined the average speed of structural changes and diagnosed the stability of these changes (Kukuła, 1996). Measure v describes the value of the average speed of structural transformations in the dynamic approach and is expressed by the average value of chain indices of the differentiation of structures of a given subregion.

$$v = \frac{\sum_{t=0}^{n=1}\sum_{i=1}^{k}|\alpha_{it} - \alpha_{i(t+1)}|}{2n},$$

where:

$\alpha_i = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \dots \\ \alpha_k \end{bmatrix}$ – vector of the structure of object A, so $\sum_{i=1}^{k}\alpha_i = 100$,

k – number of components,

t = (0, 1, …, t).

This measure describes the pace of transformations. The values of this measure, as well as of the next presented measure - η, describe the process of the transformation of these structures. Measure η depicts the monotonicity of structural changes:

$$\eta = \frac{v_{m,0}}{\sum_{t=0}^{m-1} v_{t,t+1}},$$

where:

$v_{m,0}$ – the average pace of structural transformations in the examined m-period compared to the base structures with subscript 0 affixed,

v_t – the degree of structural changes in time t.

This measure allows us to discover whether the evolution of the structure maintains a relatively stable direction of changes. The value of the monotonicity of structural changes is in the range <0;1>. The higher the degree of monotonicity (closer to 1), the more often the structures evolve in a consistent way and the more resistant they are to instability, which may be caused by chaotic transformations of components. In the long run, these components are not a cause of changes in the initial structure at the beginning of the period anyway.

Table 2. Labour productivity and the measures of intensity, pace and monotonicity of changes in the employment structure in the years 2010-2014

Subregions	Labour productivity (gross value added per one employee in zlotys)			Moore's indicator (intensity of changes, cosine of angle θ)					Pace of changes (v)	Monotonicity of structural changes (η)
	2011	2014	zmiana w %	2011	2012	2013	2014	średnia		
Jeleniogórski	100 462	118 285	17.74	1.129	1.158	0.521	1.143	0.987	0.631	0.348
Legnicko-głogowski	186 413	168 744	-9.48	0.735	0.703	0.277	0.615	0.583	0.386	0.448
Wałbrzyski	95 628	106 574	11.45	0.705	0.651	1.525	0.697	0.894	0.571	0.558
Wrocławski	98 403	113 105	14.94	0.654	1.774	2.090	1.476	1.499	0.932	0.684
City of Wrocław	110 437	126 017	14.11	0.668	0.756	1.397	1.639	1.115	0.754	0.741
Kaliski	79 562	90 715	14.02	1.247	0.532	0,524	1.000	0.826	0.531	0.668
Koniński	82 816	90 652	9.46	1.015	0.783	0.512	0.604	0.729	0.439	0.539
Leszczyński	81 456	93 915	15.30	0.715	0.892	1.116	0.954	0.919	0.579	0.537
Pilski	83 908	93 099	10.95	0.608	1.560	0.892	1.095	1.038	0.649	0.556
Poznański	106 311	119 027	11.96	0.438	1.265	1.349	0.553	0.902	0.627	0.855
City of Poznań	120 535	135 003	12.00	1.371	0.625	1.242	1.211	1.112	0.763	0.755

Source: Author's own elaboration based on: Central Statistical Office of Poland.

Labour productivity, as measured by gross value added per one employee, had different values for the particular subregions of both voivodeships. In all the years under study, i.e. from 2010 to 2014, GVA per one employee had higher values in Lower Silesia Voivodeship. In 2014, this indicator stood at the level of over 125 thousand zlotys per an employee in Lower Silesia, while it was over 106 thousand in Greater Poland (table 2). In Lower Silesia, the highest labour productivity was observed, both in 2011 and 2014, in Legnicko-Głogowski subregion, where it reached the value of

186,413 zlotys in 2011 and 168,744 zlotys in 2014, which was much above the average for the voivodeship. In Greater Poland Voivodeship, it was the Poznański subregion and the city of Poznań that had the highest labour productivity, which amounted to, respectively, over 119 thousand and over 135 thousand zlotys per one employee per one employee in 2014. In the other subregions, the value of labour productivity did not exceed 94 thousand zlotys. In almost all subregions, except for Legnicko-Głogowski one, we observed positive growth rates of workforce productivity, reaching approximately 14-15% (Leszczyński, Wrocławski, Kaliski, the City of Wrocław), and even 17% in Jeleniogórski subregion.

For the analysis of the intensity of structural changes, we used a measure of the cosine of angle θ, which expresses a change of the angle between the vectors of shares in an n-1 dimensional space. It is a standardised measure and it reaches value 1 for identical structures (angle $\theta = 0°$) and zero for the highest possible structure change (angle $\theta = 90°$). In the case of empirical analyses, it is more convenient to use the value of angle θ rather than the cosine of angle θ, because this measure is very sensitive to small changes of about 10°, which are quite frequent. In the literature, this measure is referred to as Moore's Q indicator (Moore, 1978).

The value of the measure of angle θ may fluctuate from 0° to 90°; that is why the study we conducted shows that the average transformations of structures were rather low. The values of this measure for the subregions of Lower Silesia in the years under analysis ranged from 0.277° to 2.090°, so there was not much difference in structures between the particular years (table 2). Among the subregions of the highest intensity of changes in the employment structure are Wrocławski subregion (1.499° on average) and the city of Wrocław (1.115° on average). It was Legnicko-Głogowski subregion that exhibited the lowest intensity of changes (0.583° on average), while the moderate level of intensity was identified in Jeleniogórski and Wałbrzyski subregions (about 0.900° on average). The level of the intensity of changes in the employment structure in subregions showed low variability, given the average measure of 1.532° for Lower Silesia Voivodeship.
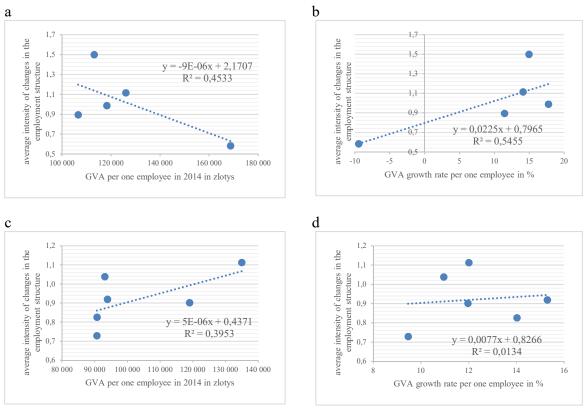
The situation in Greater Poland Voivodeship was quite similar. In the study of regions, this voivodeship had, on average, 1.000° of the intensity of changes in the employment structure. The analysis for subregions showed the indicators of intensity from 0.438° to 1.560°. The subregions of the highest level of the intensity of changes included the city of Poznań (1.112°) and Pilski subregion (1.038°). The lowest indicators were observed in Koniński and Kaliski subregions.

The intensity of the transformations of the employment structures in the subregions of Lower Silesia and Greater Poland was – in terms of the established regularities – identical to the results of the analysis of the pace of changes, which was in turn a part of the procedure of the study of the monotonicity of changes. It may be observed that changes of the most stable character took place in the city of Wrocław and in Wrocławski subregion in Lower Silesia, and in the city of Poznań and Poznański subregion in Greater Poland.

In the course of our study, we were unable to discover whether the subregions of a high degree of intensity and pace of changes in the employment structure in the years 2010-2014 also displayed a high level of labour productivity, expressed as gross value added per one employee. Diagrams of dispersion for the subregions of both voivodeships do not enable us to identify a clear relation between the average intensity of changes in the employment structure and labour productivity, shown as gross value added per one employee, and the growth rate of gross value added per one employee in the years 2011-2014.

Figure 1. Diagrams of the dispersion of labour productivity and the intensity of changes in the employment structure in the years 2010-2014 in the subregions of Lower Silesia Voivodeship (a and b) and Greater Poland Voivodeship (c and d)

Source: Author's own elaboration based on: Central Statistical Office of Poland.

5. Conclusion

Changes observed in the employment structure in the years 2010-2014 in the subregions of Lower Silesia and Greater Poland voivodeships coincide with the trends typical of countries with a high degree of socio-economic development. The increasing servitisation of economy leads to a decrease in the number of employees in industry and construction, while employment is increasing in the service sector. In three out of five subregions of Lower Silesia Voivodeship, the proportion of people employed in industry and construction in relation to the total number of employees did not increase from 2010 to 2014. Nonetheless, in the subregions of both voivodeships, except for Legnicko-Głogowski subregion, we observed an increase in labour productivity, measured with gross value added per one employee.

Our research has shown that the average intensity of transformations of the employment structure in both voivodeships was not very high, although it must be mentioned that subregions in Lower Silesia Voivodeship displayed slightly higher intensity. The average intensity of changes in the employment structure was almost identical in Poznań and Wrocław. We did not manage to clearly recognise the nature of the relation between the intensity of changes in the employment structure and labour productivity in the subregions of Lower Silesia and Greater Poland in the years 2010-2014.

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Wpływ zmian struktury zatrudnienia na produktywność pracy w podregionach województwa dolnośląskiego i wielkopolskiego

Streszczenie

Problematyka badawcza artykułu dotyczy zmian strukturalnych zatrudnienia jako sposobu oceny zdolności jednostki terytorialnej do dostosowania się do zmian dyktowanych przez dalsze i bliższe otoczenie. W artykule odniesiono się także do relacji, która zdolność do zmian konfrontuje z wydajnością pracy w danej jednostce terytorialnej. Celem artykułu jest identyfikacja, ocena i porównanie procesów przeobrażania się struktur zatrudnienia, a także rozpoznanie wpływu tych procesów na wydajność pracy w podregionach województwa dolnośląskiego i wielkopolskiego. W artykule opisano zmiany w strukturze zatrudnienia według grup sekcji, jakie zaszły w podregionach od 2010 do 2014 r. Następnie analizie poddano intensywność, szybkość, a także monotoniczność przeobrażeń struktur i zestawiono te wyniki z miernikiem wydajności pracy.

Słowa kluczowe: podregiony, struktura zatrudnienia, wydajność pracy, zmiany struktury.