



CHANGES IN THE SECTOR EMPLOYMENT STRUCTURE OF THE SILESIAN VOIVODESHIP BETWEEN 2009 AND 2017

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JEL Classification: E2, E24.

Key words: sectors, employment structure, Silesia Voivodeship.

Abstract

Transformations of employment structures reflect changes in the economic structure. This structure is closely related to economic development. The importance and complexity of this field make structural changes one of the most important areas of scientific research. Detailed recognition and deepening of knowledge about sectoral transformations of employment structures, as well as current and future trends in this area, are necessary for finding optimal solutions that will accelerate changes in the economy. The purpose of the study is to identify and evaluate changes in the sectoral employment structure in the Silesian Voivodeship in the years 2009-2017, with particular emphasis on intra-sectoral changes in the service sector. In connection with this, an analysis of structural changes was carried out in the Silesian Voivodeship in the examined period. The research was based on data obtained from the Local Data Bank. The analysis of structural changes in employment was conducted using structure and dynamics indicators as well as one of the known measures of structure diversity. The results of the analysis allowed this study to recognize and assess changes within the sectoral employment structure within the studied region.

ZMIANY SEKTOROWEJ STRUKTURY ZATRUDNIENIA W WOJEWÓDZTWIE ŚLĄSKIM W LATACH 2009-2017

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Kody JEL: E2, E24.

Słowa kluczowe: sektory, struktura zatrudnienia, województwo śląskie.

Abstrakt

Przeobrażenia struktur zatrudnienia odzwierciedlają zmiany, jakie zachodzą w strukturze gospodarki. Struktura ta jest ściśle związana z rozwojem gospodarczym. Waga i wielowątkowość tej problematyki sprawiają, że przemiany strukturalne są jednym z najważniejszych obszarów badań naukowych. Szczegółowe rozpoznanie i zgłębienie wiedzy na temat sektorowych przeobrażeń struktur zatrudnienia oraz obecnych i przyszłych tendencji w tym zakresie jest niezbędne do szukania rozwiązań przyspieszających zmiany strukturalne w gospodarce. Celem opracowania jest rozpoznanie i ocena zmian w sektorowej strukturze zatrudnienia w woj. śląskim w latach 2009-2017, ze szczególnym uwzględnieniem zmian wewnątrz sektora usług. W związku z tym przeprowadzono analizę przemian strukturalnych w woj. śląskim w badanym okresie. Badania oparto na danych pozyskanych z Banku Danych Lokalnych. Analizę zmian strukturalnych zatrudnienia przeprowadzono z wykorzystaniem wskaźników struktury i dynamiki oraz jednego ze znanych mierników zróżnicowania struktur. Wyniki analizy pozwoliły rozpoznać i ocenić zmiany w sektorowej strukturze zatrudnienia w badanym regionie.

Introduction

The structure of the economy is of key importance to the fostering of the national or regional development and its stability. The structure of the economy depends on many factors, among which global megatrends play a special role. Progressing globalisation processes, the universal character of methods guiding contemporary economies, and above all new information and communication technologies define the direction and rate of structural changes in the economy. These in turn cause changes in the structure of employment viewed according to sectors, divisions, branches and qualifications. The role of particular sectors in the economic development is changing as well.

The traditional division of economy into three sectors (according to C. Clark, A. Fisher and J. Fourastie) is losing importance (Łukaszewicz & Karpiński, 2001), as borderlines between the three sectors are becoming increasingly difficult to define (sectors overlap), and structural modifications as well as new phenomena appear in all sectors. In highly developed countries, the sector of services has become the dominant one in terms of employment (70%-80%). There are also

fundamental shifts in its internal structure (both with respect to employment and regarding its contribution to GDP) towards more modern types of services.

Although the sector-wise transformation of the Polish economy has induced significant alternations in its structure (which has been manifested by the direction of changes in the employment in individual sectors), and although transformations in the sector-related structures of employment in Poland demonstrate the features of the worldwide structural changes – they are still far from the level seen in contemporary developed economies.

Despite the ongoing discussions about the theory of three sectors, this concept is still broadly applied in analyses of transformations in employment structures, which aim to demonstrate any regularity occurring in them.

This article undertakes to discuss the problem of structural transformations in the Province of Silesia (województwo śląskie), which for years has been dominated by heavy industry and is therefore now under strong pressure to undergo structural transformations.

The aim of this study has been to uncover and evaluate changes in the sectoral structure of employment in the Province of Silesia which occurred in the years 2009-2017, and to assess the development stage of individual sectors, with special attention paid to intrasectoral changes within the sector of services. To this purpose, an analysis of structural transformations in the Province of Silesia during the mentioned time period has been made.

The first part of the paper contains a general description of the economic structure of the province, making numerous references to the results of our analyses, presented in the second part of the article, where transformations in the structure of employment according to sections were investigated. The authors decided that this would be a more readable presentation of the research considering the large number of tables and graphs contained in the article.

General characteristics of structural changes in the province of Silesia in 2009-2017

The Province of Silesia is Poland's most industrialised region. There are all branches of mining and processing industries located in this province. The dominance of industrial structures in the region was a consequence of the dynamic growth of coal mining, smelting, power generation and other sectors. This structure of industries, with the prevalence of heavy industry (especially the fuel and energy segment) was the key factor in turning the region into Poland's industrial backbone. The state transformation in Poland activated processes of structural changes. The restructuring of industries, especially some traditional branches (coal mining, smelting, textile industry), initiated the process of transformations in the employment structure in the Province

of Silesia, a process that is bound to continue for many years to come (Kotlorz, 2004; Tkocz & Pukowska-Mitka, 2008).

The Province of Silesia will undergo the largest transformations in the structure of industries, the links between production and development of modern services, and the intensification of research and development activities (Bukowski *et al.*, 2015). This will be accompanied by the gradual abandonment of old segments of industry (coal mining, coke industry, steel industry, manufacture of machinery and equipment for coal mining, smelting and power generation) for modern, technologically advanced segments. These include the motor industry, which is now thriving in Poland (GIG 2009).

The number of employed people in the Province of Silesia in 2017 was 500,854. In the same year, the number of persons employed in the sector of 'coal mining and excavation' was 84,833, which corresponded to 16.95% of all people employed in industry in this province. In 2017, the 'industrial processing' sector employed 378,672 people, which made up 75.61% of the total workforce in industry in the Province of Silesia. Relative to data in 2009, when this section employed 327,644 people, which equalled 65.42% of total employment in industry, this meant a rise of 10.99 percentage points. The share of employment in industrial processing relative to total employment in the Province of Silesia is high. Unfortunately, the structure of industries is not very modern.

The sector of services in the Province of Silesia is developing dynamically. In each year throughout the time period analysed, the percentage of persons employed in services in the Province of Silesia was maintained at around 60%. In 2017, those employed in services made up 59.34% of the total number of employees in the Province of Silesia. During the entire time period analysed, the percentage of people working in services remained higher.

The intrasectoral structure of employment in the sector of services points to considerable differentiation in the percentage of employees in particular services.

It is worth underlining that modern business services (modern structure of employment) play a significant role in regional development, and such services are developing rapidly in the Province of Silesia (ABSL Report 2019). For example, there are 102 centres of modern business services, with a total workforce of 23.5 thousand people, seated in Katowice and elsewhere in the whole metropolitan area of Upper Silesia and Zagłębie. They are among the major centres of this type in Poland, with the labour force representing 8% of the total population working in the sector of modern business services in Poland. The services they offer most frequently belong to the IT sector, available in 54 out of 102 operating centres. They generate more than half (51%) of the employment in this branch. Over the past three years, the employment rate in service centres in the metropolitan area of Silesia and Zagłębie has reached 43% (i.e. over 7,000 new places of work).

It has been implicated that specialisation in the provision of services for industry is among the most highly valued industries. The demand for business services (assumed engineering works) will continue to grow as technology progresses. This will occur as specialisation of the services for industry and the technological aspect of industries is acknowledged. A visible trend in the development of services is the specialisation in services for financial institutions (Górecki *et al.*, 2013).

Analysis of changes in the structure of employment divided into sectors in the province of Silesia in 2009-2017

The analysis of structural changes in employment was performed with the help of one of the known measures of the differentiation of structures (Kukuła, 1996), in addition to measures of the structure and indicators of dynamics.

The research was based on data from the Local Data Bank. A detailed analysis of changes in the structure of employment in the Province of Silesia was carried out in line with the division into sectors/sections:

- agriculture, forestry and fisheries,
- industry and construction industry,
- commerce, repair of motor vehicles, transport and warehousing, accommodation and catering, information and communication,
- finances and insurance, servicing the real estate market,
- other services.

The sector of industry and construction industry comprises:

- mining and excavation of minerals,
- industrial processing,
- generation and transmission of electric power, gas, water steam, hot water and air for air conditioning,
- water supply, wastewater and sewage management, environmental rehabilitation,
- construction industry.

The sector of other services includes:

- professional, research and technical activities,
- administrative and support activities,
- public administration, national defence, mandatory social insurance,
- education,
- health care and social welfare,
- activities connected with culture, entertainment and recreation.

Statistics illustrating the number of employed persons are presented in Figure 1 and Table 1.

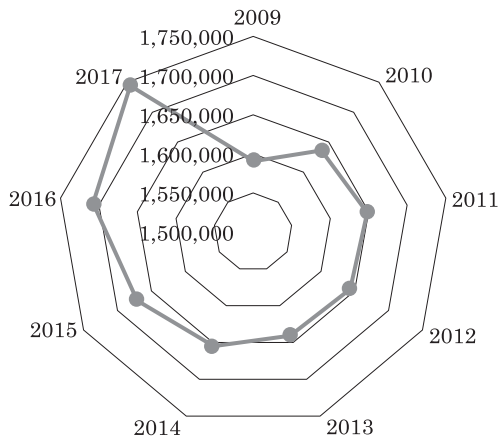


Fig. 1. Number of employed persons in the Province of Silesia in 2009-2017
Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

The number of the employed in the Province of Silesia in 2009-2017 increased on average by 1.15% yearly. Figure 2 illustrates detailed dynamics of change in employment in each year relative to the base year.

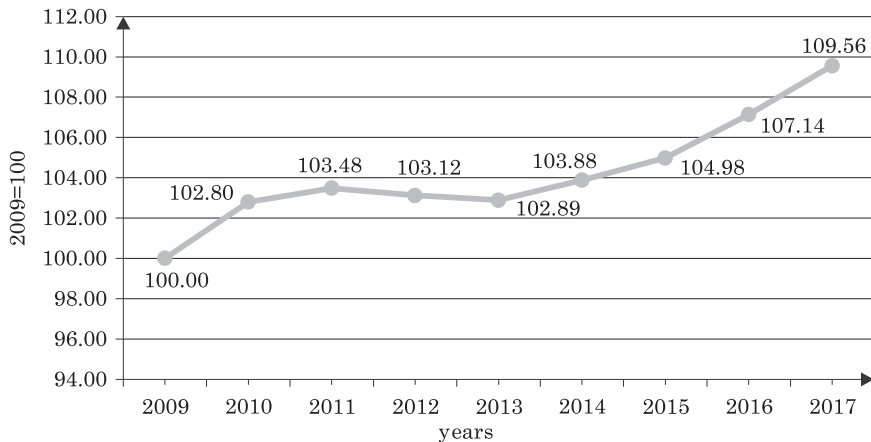


Fig. 2. Dynamics of changes in employment in the years 2009-2017
Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

In order to demonstrate changes in the structure of employment over the analysed time period, simple dynamic measures were applied. First, indicators of the structure of employment according to the division applied in the Polish Classification of Activities (PKD) in 2007 were calculated (cf. Tab. 2, 3).

Table 1
 Number of employed persons in the Province of Silesia in total (actual place of work),
 divided into sections

Sector	Year										
	2009	2010	2011	2012	2013	2014	2015	2016	2017		
Agriculture, forestry and fisheries	69,032	102,514	102,537	102,104	101,963	102,324	102,191	102,363	102,554		
Industry and construction industry	603,598	600,781	608,505	602,182	586,968	587,234	586,668	593,945	606,962		
Services, including: Commerce, repair of motor vehicles, transport and warehousing, accommodation and catering, information and communication; finances and insurance; services in the real estate market; other services.	920,038	933,980	937,073	938,141	949,726	964,948	983,119	1,010,035	1,035,381		
In total for the Province of Silesia	1,592,668	1,637,275	1,648,115	1,642,427	1,638,657	1,654,506	1,671,978	1,706,343	1,744,897		

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

Table 2

Structure of employment in 2009-2017 according to the PKD
(Polish Classification of Business Activities) division of 2007

Sectors	Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Agriculture, forestry and fisheries [%]	4.33	6.26	6.22	6.22	6.22	6.18	6.11	6.00	5.88
Industry and construction industry [%]	37.90	36.69	36.92	36.66	35.82	35.49	35.09	34.8	34.78
Services in total [%]	57.69	57.05	56.86	57.12	57.96	58.33	58.80	59.20	59.34
including: – commerce, repair of motor vehicles, transport and warehousing, accommodation and catering, information and communication [%]	26.28	25.72	25.60	25.58	25.59	25.65	25.85	26.16	26.24
– finances and insurance; services in the real estate market [%]	3.91	3.85	3.84	3.89	3.97	3.88	3.78	3.72	3.62
– other services [%]	27.58	27.48	27.42	27.65	28.40	28.80	29.17	29.32	29.48
Total of the columns [%]	100	100	100	100	100	100	100	100	100

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

The data collated in Table 3 show that the highest share of the employed in the sector ‘agriculture, forestry and fisheries’ occurred in 2010, in the sector ‘industry and construction industry’ – in 2009, and the highest share of employment in the sector of services (in the following sections: ‘commerce, repair of motor vehicles, transport and warehousing, accommodation and catering, information and communication’ and ‘other services’) was reached in 2017, while the section ‘finances and insurance, service of real estate market’ achieved the highest share of employment in 2013. There is a distinct shift in the number of employed persons from the sector ‘industry and construction industry’ to the sector ‘services’.

Having gained a more detailed insight into the employment within the services sector, and distinguishing two separate sections: industry and construction industry, it was then possible to observe evident changes in the structure of the employed population, i.e. a shift from industry to services, especially to the subsequent sections:

- professional, scientific and technical activity,
- activity in administration and support activity,
- health care and social welfare,
- transport and warehousing,
- information and communication.

Table 3

Structure of employment in 2009-2017 inclusive of a detailed breakdown into sections in the services sector

Specification	2009	2010	2011	2012	2013	2014	2015	2016	2017
Agriculture, forestry and fisheries [%]	4.33	6.26	6.22	6.22	6.22	6.18	6.11	6.00	5.88
Industry [%]	30.81	29.85	29.81	29.75	29.37	29.23	28.98	28.76	28.70
Construction industry [%]	7.09	6.85	7.11	6.91	6.45	6.26	6.11	6.05	6.08
Professional, scientific and technical activities [%]	3.49	3.45	3.65	3.69	3.93	4.14	4.15	4.19	4.24
Activities in administrative and support services [%]	3.52	3.88	3.70	3.66	3.86	3.93	4.26	4.32	4.56
Public administration, national defence; mandatory social security [%]	3.86	3.82	3.77	3.81	3.85	3.86	3.82	3.76	3.68
Education [%]	7.87	7.66	7.58	7.61	7.68	7.72	7.72	7.65	7.65
Health care and social welfare [%]	5.99	5.90	5.88	6.07	6.14	6.22	6.26	6.31	6.31
Culture, entertainment and recreational activities [%]	1.30	1.28	1.29	1.24	1.12	1.14	1.13	1.14	1.11
Activities in the financial and insurance sector [%]	2.32	2.27	2.28	2.32	2.36	2.28	2.21	2.12	2.02
Provision of services to the real estate [%]	1.59	1.58	1.57	1.56	1.61	1.59	1.58	1.60	1.60
Wholesale and retail commerce; repair of motor vehicles, including motorcycles [%]	17.01	16.82	16.54	16.36	16.33	16.39	16.47	16.37	16.01
Transport and warehousing [%]	5.72	5.68	5.82	5.80	5.75	5.65	5.71	5.91	6.20
Activities connected with accommodation and catering [%]	2.03	1.75	1.71	1.81	1.80	1.77	1.73	1.77	1.86
Information and communication [%]	1.52	1.47	1.53	1.62	1.71	1.83	1.94	2.11	2.17
Other services [%]	1.55	1.48	1.54	1.57	1.82	1.79	1.83	1.93	1.93
Total of columns [%]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

Table 4

Intrasectoral structure of employment in services

Specification	2009	2010	2011	2012	2013	2014	2015	2016	2017
Professional, scientific and technical activity [%]	6.04	6.04	6.42	6.47	6.77	7.10	7.05	7.09	7.15
Activity in the scope of administration and support activities [%]	6.10	6.81	6.50	6.41	6.65	6.73	7.24	7.30	7.69
Public administration and national defence; mandatory social security [%]	6.68	6.70	6.64	6.67	6.65	6.61	6.49	6.35	6.20
Education [%]	13.62	13.43	13.33	13.33	13.25	13.24	13.13	12.93	12.89
Health care and social welfare [%]	10.36	10.35	10.35	10.62	10.60	10.67	10.65	10.67	10.63
Culture, entertainment and recreational activities [%]	2.26	2.25	2.27	2.17	1.93	1.96	1.93	1.93	1.87
Activities in the financial and insurance sector [%]	4.01	3.98	4.00	4.07	4.07	3.91	3.75	3.58	3.40
Provision of services to the real estate [%]	2.76	2.77	2.76	2.73	2.78	2.73	2.68	2.70	2.70
Wholesale and retail commerce; repair of motor vehicles, including motorcycles [%]	29.45	29.49	29.10	28.64	28.18	28.10	28.01	27.66	26.98
Transport and warehousing [%]	9.90	9.96	10.23	10.15	9.91	9.69	9.71	9.98	10.44
Activities connected with accommodation and catering [%]	3.51	3.06	3.01	3.16	3.11	3.04	2.94	2.99	3.14
Information and communication [%]	2.63	2.58	2.68	2.83	2.95	3.14	3.30	3.57	3.66
Other services [%]	2.69	2.59	2.72	2.75	3.14	3.07	3.12	3.27	3.26
SUM OF COLUMNS [%]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Market services – in total [%]	52.26	51.84	51.78	51.59	51.00	50.62	50.39	50.48	50.32
Non-market services – in total [%]	47.74	48.16	48.22	48.41	49.00	49.38	49.61	49.52	49.68

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

The share of employees in industry was decreasing during the analysed time period (Tab. 3). There was a shift from industry to services, which can be clearly seen in Figure 3.

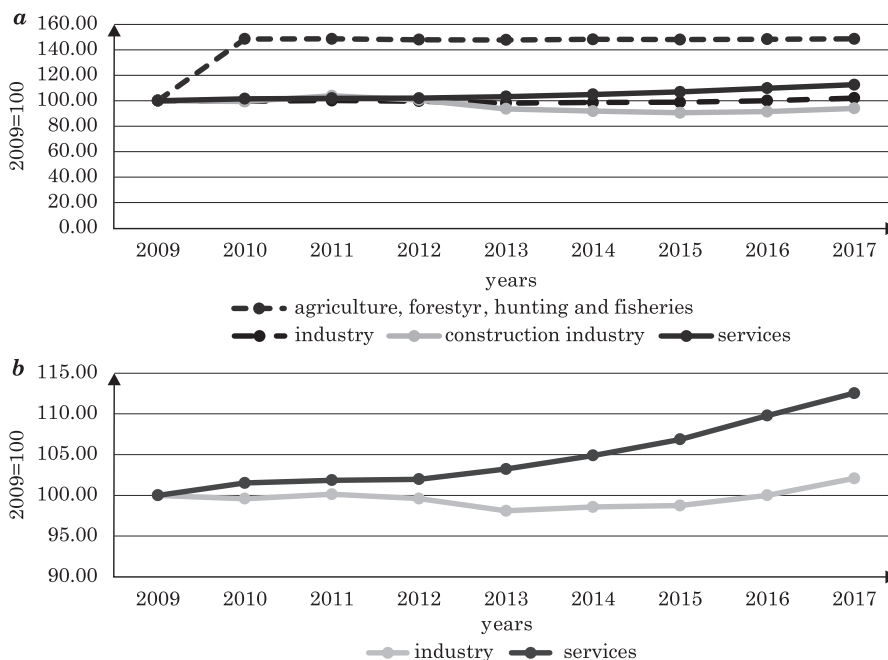


Fig. 3. Dynamics in the sectoral structure of employment in 2009-2017

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

Figures 4 and 5 show comparative analyses of the dynamics in the share of persons employed in industry with the dynamics of those working in selected sections of the services sector. The choice of the sections of the services sector presented in this study was not incidental but it was dictated by the results discussed above, which demonstrated the biggest flow of the employed from industry is to the services depicted in Figures 4 and 5.

It needs to be mentioned that the number of persons employed in the selected sections of the services sector in 2017 was as follows (cf. Tab. 1-5):

- in the section of professional, scientific and technical activity, the employment in 2017 equalled 133.36% of the employment in this section of the services sector in 2009. The average annual increase was 3.46%;

- in the section of administrative and support services, it constituted 141.83% of the number of persons hired in this services sector section in 2009. The number of employees in this section increased by an annual average of 2.85%;

- in the section of health care and social welfare, it equalled 115.47% of the employed in this section of the services sector in 2009. The number of persons employed in this services section increased by an annual average of 1.64%.

– in the section of transport and warehousing, the number of persons employed in 2017 corresponded to 118.9% of the employees in this section in 2009. The number of persons employed in this section increased by an annual average of 1.90%;

– in the section of information and communication, the number of employees in 2017 equalled 156.73% of the analogous number of employees in 2009; the number of employees in this section increased by an annual average of 5.84%.

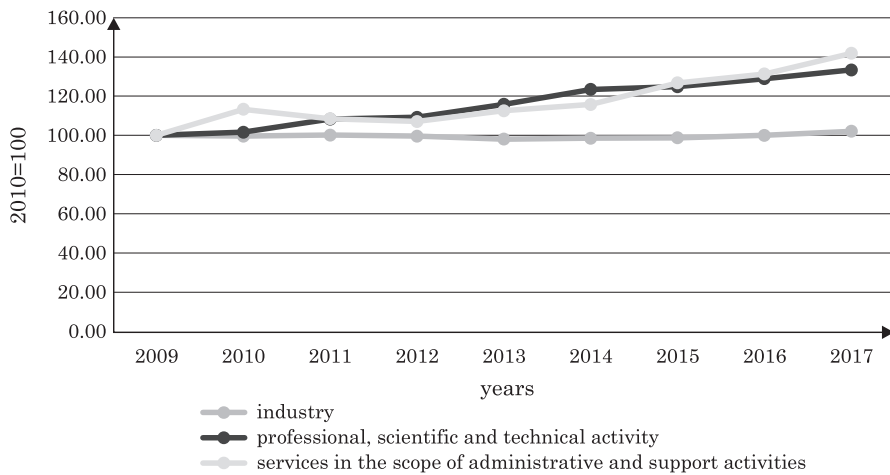


Fig. 4. Dynamics in the structure of numbers of employees in industry and in the sections: professional, scientific and technical activities, activities in administration and support services in 2009-2017

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

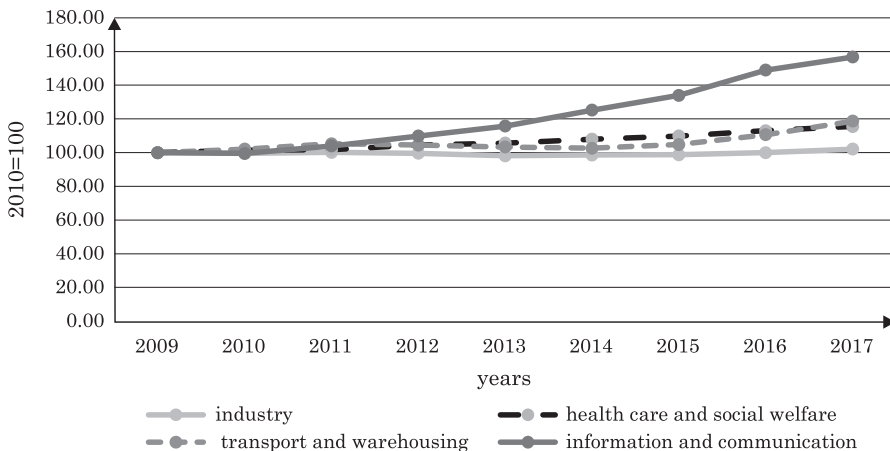


Fig. 5. Dynamics of the structure of employees in industry and in the sections: health care and social welfare; transport and warehousing; and information and communication in 2009-2017

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

Table 5

Dynamics of changes in employment in 2010-2017 in some sections
of the services sector Base year 2009

Year	Professional, scientific and technical activity [%]	Administration and support services [%]	Health care and social welfare [%]	Transport and warehousing [%]	Information and communication [%]
2009	100.00	100.00	100.00	100.00	100.00
2010	101.59	113.27	101.38	102.08	99.52
2011	108.25	108.50	101.74	105.24	103.93
2012	109.24	107.09	104.55	104.50	109.82
2013	115.83	112.56	105.60	103.33	115.74
2014	123.40	115.75	107.99	102.61	125.20
2015	124.85	126.78	109.82	104.74	133.93
2016	128.88	131.31	113.01	110.61	148.95
2017	133.36	141.83	115.47	118.64	156.73

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

The analyses and calculations made in this research suggest that the rate of change in the structure of employment changed by an annual average of 0.15%, which means that the number of employed persons increased by an annual average of 0.15%.

However, the number of persons employed in the services sector increased by an annual average of 1.49% (by 1.13% in the section: commerce; repair of motor vehicles including motorcycles; transport and warehousing; accommodation and catering; information and communication; by 0.18% in the section: finances and insurance; real estate market services; and by 1.99% in the other services). In the sector: industry and construction industry, the number of persons employed increased by an annual average of 0.07%, compared to an annual average increase of 0.26% in the section of industry (cf. Tab. 6).

Table 6

Rate of changes in number of employed persons

Sector	Agriculture, forestry and fisheries [%]	Industry [%]	Construction industry [%]	Services [%]
Rate of changes in 2009-2017	5.07	0.26	-0.77	1.49
Rate of changes in 2010-2017	0.01	0.35	-0.79	1.48

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

Evaluation of structural changes in the workforce in the province of Silesia in 2009-2017

The traditional mode of comparative analysis applied to the structure of employment, which relies on statistical data, enables one to gain only a superficial understanding of the extent and direction of changes. When comparing changes in the structure over some time period, it is impossible to identify unambiguously at what point of time these changes were more intensive and when they were relatively small.

Below, we present an analysis of structural changes in the workforce in 2009-2017, based on the measure of differentiation among structures (Kukuła, 1996; Kotlorz, 2004). The structure differentiation measure applied to assess the degree of structural changes is calculated from the following equation:

$$V_{t,t+\tau} = \frac{\sum_{i=1}^k |\alpha_{it} - \alpha_{i,t+\tau}|}{2},$$

where:

$$\alpha_{it} = \begin{pmatrix} \alpha_{10} & \alpha_{11} & \dots & \alpha_{1n} \\ \alpha_{20} & \alpha_{21} & \dots & \alpha_{2n} \\ \vdots & \vdots & & \vdots \\ \alpha_{k0} & \alpha_{k1} & \dots & \alpha_{kn} \end{pmatrix},$$

$$\tau = 1, 2, 3, \dots, n-1, \quad i = 1, 2, 3, \dots, k, \quad t = 1, 2, 3, \dots, n.$$

The differentiation measure $V_{t,t+\tau}$ equals zero when the compared structures are identical. In turn, the greater the difference between structures, the higher the value of the measure will be, i.e. it will be closer to the value of 1.

Analysis 1

The structure analysed in our case is composed of $k = 6$ component elements, i.e.

- agriculture, forestry and fisheries;
- industry;
- construction industry;
- commerce; repair of motor vehicles; transport and warehousing; accommodation and catering; information and communication;
- finances and insurance; services provided in the real estate market;
- other services.

The matrix column vectors α_{it} represent the structure of the workforce in individual years.

Values of the measure of differentiation among structures of employment calculated for two years indicate that differences between the structures intensify (cf. Fig. 6-9, Tab. 7). Thus, structures tend to be increasingly more distant from

Table 7

Values of the differentiation measure describing changes in the structures of employment

Period	2009/2010	2009/2011	2009/2012	2009/2013	2009/2014	2009/2015	2009/2016	2009/2017
Value of the measure	0.0374	0.0372	0.0386	0.0550	0.0610	0.0669	0.0676	0.0684
Period	-	2010/2011	2010/2012	2010/2013	2010/2014	2010/2015	2010/2016	2010/2017
Value of the measure	-	0.0053	0.0055	0.0210	0.0271	0.0364	0.0455	0.0504
Period	-	-	2011/2012	2011/2013	2011/2014	2011/2015	2011/2016	2011/2017
Value of the measure	-	-	0.0055	0.0222	0.0293	0.0401	0.0492	0.0540
Period	-	-	-	2012/2013	2012/2014	2012/2015	2012/2016	2012/2017
Value of the measure	-	-	-	0.0169	0.0243	0.0357	0.0448	0.0497
Period	-	-	-	-	2013/2014	2013/2015	2013/2016	2013/2017
Value of the measure	-	-	-	-	0.0091	0.0206	0.0297	0.0345
Period	-	-	-	-	-	2014/2015	2014/2016	2014/2017
Value of the measure	-	-	-	-	-	0.0114	0.0205	0.0254
Period	-	-	-	-	-	-	2015/2016	2015/2017
Value of the measure	-	-	-	-	-	-	0.0091	0.0140
Period	-	-	-	-	-	-	-	2016/2017
Value of the measure	-	-	-	-	-	-	-	0.0054

Source: developed by the authors, based on Bank Danych Lokalnych (2019).

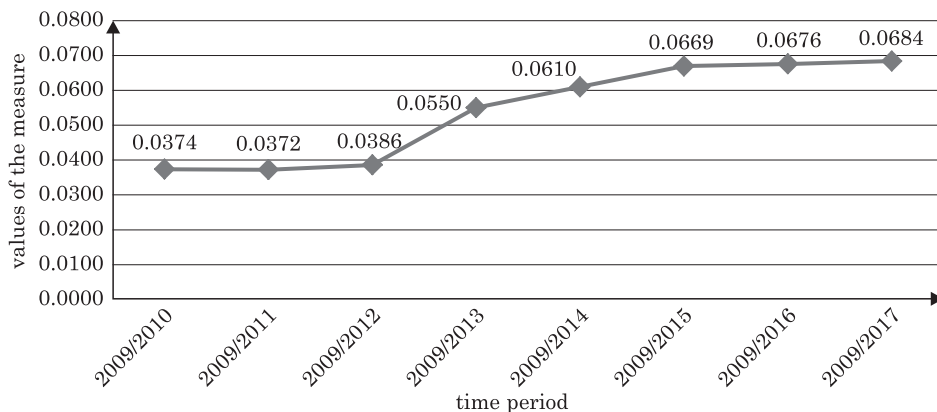


Fig. 6. Values of the differentiation measure revealing the course of changes in structures of employment relative to the base structure in 2009

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

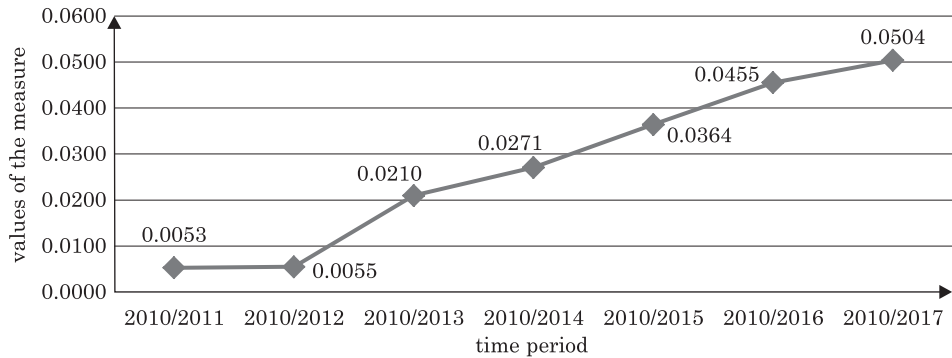


Fig. 7. Values of the differentiation measure revealing the course of changes in structures of employment relative to the base structure in 2010

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

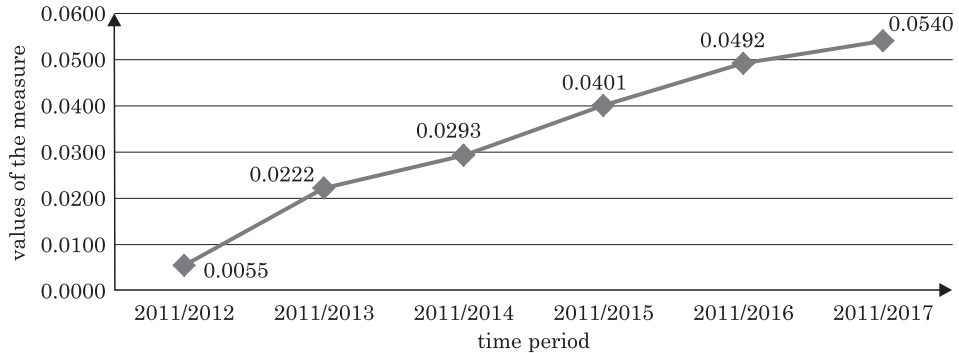


Fig. 8. Values of the differentiation measure revealing the course of changes in structures of employment relative to the base structure in 2011

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

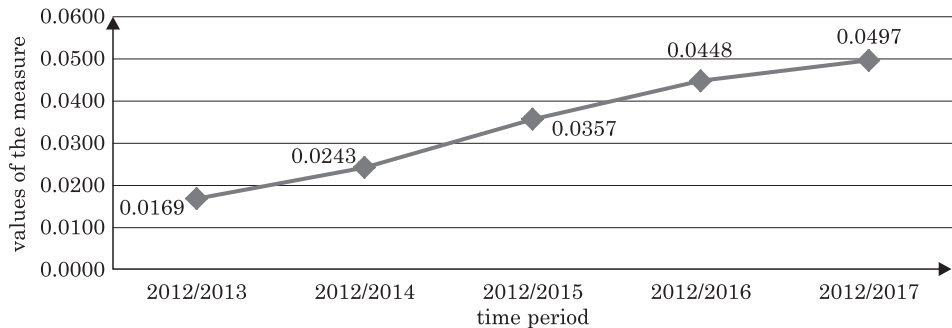


Fig. 9. Values of the differentiation measure revealing the course of changes in structures of employment relative to the base structure in 2012

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

one another. The closer the compared structures are to each other, the less differentiation there is between them, and with time the differences in structures grow deeper. These changes are illustrated in Figures 6-9. The results confirm our previous analyses.

Analysis 2

The analysed structure in this case is composed of $k = 6$ component elements, i.e.:

- industry,
- professional, scientific, and technical activity,
- administration and support activities,
- health care and social welfare,
- transport and warehousing,
- information and communication.

Values of the structure differentiation measure calculated for two years indicate that differences between the structures grew larger (cf. Fig. 10, Tab. 8). Thus, there is an ongoing process of structures becoming more distant from one another. This means that there is a flow of employees from industry to the services included in the model. The results confirm previously conducted analyses.

Recapitulating, the performed analyses clearly reveal a gradual flow of workforce from the industrial sector to the sector of services. When calculating chain indices for the sectors of industry and of services, increasingly larger differences are manifested (Fig. 11).

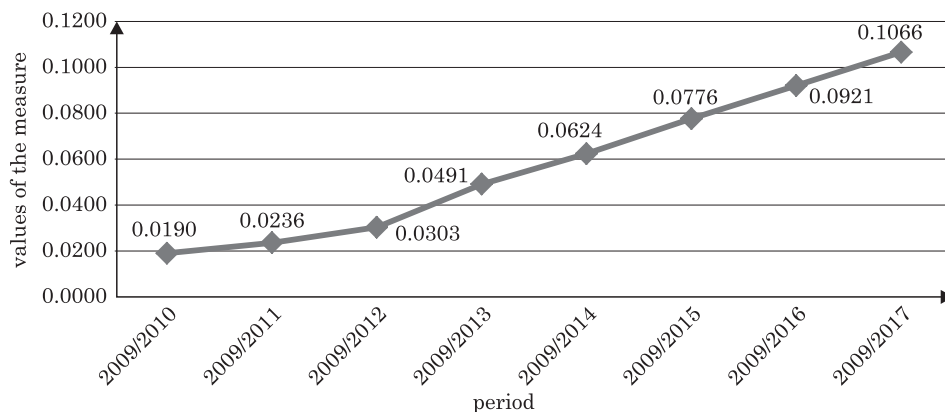


Fig. 10. Values of the differentiation measure describing the course of changes in the structure of employment versus the base structure of 2009

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

Table 8

Values of the differentiation measure describing the course of changes in the structure of employment

Period	2009/2010	2009/2011	2009/2012	2009/2013	2009/2014	2009/2015	2009/2016	2009/2017
Value of the measure	0.0190	0.0236	0.0303	0.0491	0.0624	0.0776	0.0921	0.1066
Period	-	2010/2011	2010/2012	2010/2013	2010/2014	2010/2015	2010/2016	2010/2017
Value of the measure	-	0.0144	0.0221	0.0336	0.0474	0.0620	0.0739	0.0884
Period	-	-	2011/2012	2011/2013	2011/2014	2011/2015	2011/2016	2011/2017
Value of the measure	-	-	0.0109	0.0304	0.0465	0.0617	0.0709	0.0833
Period	-	-	-	2012/2013	2012/2014	2012/2015	2012/2016	2012/2017
Value of the measure	-	-	-	0.0215	0.0376	0.0529	0.0620	0.0763
Period	-	-	-	-	2013/2014	2013/2015	2013/2016	2013/2017
Value of the measure	-	-	-	-	0.0161	0.0313	0.0430	0.0578
Period	-	-	-	-	-	2014/2015	2014/2016	2014/2017
Value of the measure	-	-	-	-	-	0.0170	0.0317	0.0484
Period	-	-	-	-	-	-	2015/2016	2015/2017
Value of the measure	-	-	-	-	-	-	0.0155	0.0324
Period	-	-	-	-	-	-	-	2016/2017
Value of the measure	-	-	-	-	-	-	-	0.0175

Source: developed by the authors, based on data from Bank Danych Lokalnych (2019).

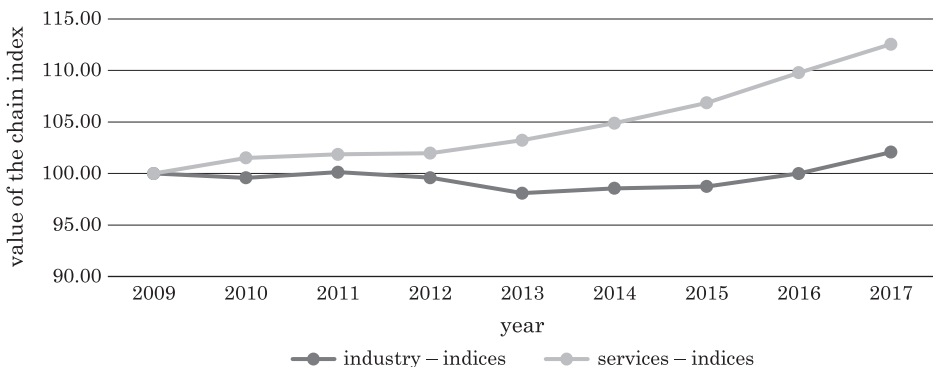


Fig. 11. Values of the measure of differentiation describing the course of changes in the structure of employment versus the base structure of 2009

Source: plotted by the authors, based on data from Bank Danych Lokalnych (2019).

Conclusion

The research justifies several detailed conclusions concerning the specific research problem. These are discussed alongside the tables and diagrams presented above.

However, the entire research and overall considerations raised in this article lead to several more general conclusions, such as:

1. Changes occurred in the Province of Silesia over the analysed time period in the sectoral structure of employment. Most importantly, the employment in the services sector increased significantly, while decreasing in industry, where since the year 2010 it remained at the same level as in agriculture.

2. There were no significant changes in the employment structure in industry during the analysed years. The section 'mining and excavation of minerals' continues to make a large contribution, as it corresponds to nearly 17% of the total number of employed persons in the province's industry. The structure of employment in industry is not modern and continues to reflect the outdated structure of industry and the slow rate at which it is being restructured.

3. The economy of the Province of Silesia needs more rapid transformations in the industrial sector, and more widespread implementation of modern technologies. The economy needs to be more innovative and the research and development sector should develop more intensively.

4. The Province of Silesia should accelerate the development of the services sector, as the employment in this sector, rather than being a mere consequence, can act as a stimulant for socio-economic growth.

5. The notion of a three-sectorial economy is being exhausted, and new alternative divisions are being searched for, including new classifications, while different directions and dynamics in intrasectoral changes suggest that it is necessary to conduct research and analyses on lower levels of aggregation, with special attention paid to market services.

Translated by Jolanta Idźkowska

Proofreading by Michael Thoene

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