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Fluctuations in the seasonality of employment in Poland

Abstract

Seasonality concerns relatively regular changes in economic variables in the short-term perspective. In empirical studies, seasonality tends to be omitted or eliminated from time series. The aim of the study is to analyze the variation in seasonality of the average number of employees in the enterprise sector in Poland. An attempt is made to determine the size and tendency of changes in the seasonality of average employment in the enterprise sector and their distribution throughout the year. The analysis also concerns a comparison of seasonal fluctuations in the average employment estimated for Poland with seasonal fluctuations in the average employment in the regional markets of Polish provinces (*voivodships*). The study uses quarterly data on the average number of employees in the enterprise sector for Poland and for regional markets. The period of analysis spanned from 2008 to 2016. The data comes from the Central Statistical Office (GUS) in Poland. The Census X-12 ARIMA model was used to derive the seasonal component. Obtained results indicate that the seasonality of average employment in the enterprise sector in Poland is small, albeit showing an upward trend. The distribution of fluctuations in seasonal employment in the enterprise sector throughout the year in Poland and in selected provinces is similar. In some provinces, there is no seasonality of average employment in the enterprise sector.

Key words: employment, seasonality, labor market

JEL CODE: E24, J21

Introduction

A characteristic feature of any economy is its tendency to change. This variability can be considered in different periods, i.e. long-, medium- and short-term. The fluctuations of economic categories have been the subject of numerous studies. Long-term and cyclical changes are among the most frequently discussed issues, whereas short-term fluctuations are normally omitted or eliminated from analyses. Long-term changes are attributed decisively to

both these changes when formulating economic policy and in the context of functioning of individual economic entities. Exclusion of short-term fluctuations from research seems unjustified, as they can be an important component of the analyzed categories. The labor market, due to periodic variability of market phenomena, is an interesting and frequent area of research (Rembeza et al. 2015, p. 360; Eberts, Randall 1998 , p. 416, Grady, Kapsalis 2002, p. 29, Olkiewicz 2015, p. 401, Jażdżewska 2017, p. 154). The issues of emerging mismatches in the supply and demand for labor, fluctuations in productivity or wage volatility are undertaken by researchers both in theory and in practice (Hall 1991, p. 27, Kusz, Misiak 2017, p. 147; Lopes de Melo 2018, p. 321). However, the state of research in this area seems to be still insufficient, especially in relation to short-term analyses.

The aim of the article is to analyze and assess the seasonal variation in the number of employees in the enterprise sector in Poland in 2008-2016. The basic question to which the answer was sought was whether the seasonality of average employment in the enterprise sector can be observed in Poland and its provinces (*voivodships*), and if so, how extended this seasonality, and the trend of changes and their distribution, are throughout the year. A review of national and foreign literature (BazEkon, EBSCO, JSTOR, ProQuest) allowed to formulate two main hypotheses. The first assumes that all Polish provinces are marked by a high seasonality of the average number of employees in the enterprise sector. Meanwhile, according to the second hypothesis, the seasonality of employment is similar in Poland and in all provinces throughout the year.

This study uses data on the quarterly average employment in the enterprise sector gathered by the Central Statistical Office (GUS) for the period from the first quarter of 2008 to the fourth quarter of 2016. The seasonal component was isolated based on the Census X-12 ARIMA procedure, while its estimation was performed using the econometric suite EViews 6.0.

The article was divided in the following way. The first part justifies the need to include short-term observations in labor market research. The second part contains a description of the seasonal measurement method and the characteristics of the data used in the empirical research. Discussion of the results of empirical research, together with the drawing of relevant conclusions, make up the third and final part of the paper.

An overview of the problem of seasonality of the labor market

The labor market is an important element of every economy, and its changes concern not only economic categories, but more importantly, they reflect social changes. There are

strong interdependencies between the economy as a whole and the labor market. Changes in the economy affect fluctuations in employment and unemployment, demographic conditions for changes in the labor force and economic growth, which in turn have an impact on redistribution of income. Thus, the labor market functions in a dynamically changing environment and is subject to constant fluctuations: long-, medium- and short-term alike. The simplest way to illustrate these changes is through population flows between economically active and inactive groups. Time aside, the reasons for these changes may include institutional conditions, inflow of labor from abroad or technological changes (Kwiatkowski, Włodarczyk 2017, p. 163, Kaźmierczyk 2011, p. 59, Kaźmierczyk 2008, pp. 141-142). A significant part of macroeconomic analyses intends to describe the mechanisms shaping the rate and changes in employment, unemployment and wages (Romer 2012, p. 202). They determine the balance on the labor market as a result of adjustments in enterprises and households. Another way to explain the causes of fluctuations in the labor market is, for example, through match models or efficiency wage models (Mortensen, Pissarides 2011, p. 14, Ehrenberg, Smith 2016, p. 375). A common feature of these considerations is their attempt to explain the occurrence of the observed phenomena in the labor market. At the same time, they provide the basis for conducting empirical analyses in this area.

A significant part of empirical research concerning labor market categories - i.e. unemployment, the average wage or the number of job vacancies - focuses on determining changes in these phenomena over time. The nature of changes and their conditions are complex and difficult to interpret unambiguously. Long-term changes (trends) cause shifting of a labor market category (e.g. employment) to a point that has not been achieved before. Mid-term fluctuations cause, at least in part, a return to the initial state. In contrast, seasonal fluctuations are a component of short-term changes, and their course is similar to cyclical fluctuations within the business cycle, although they are anticipated. The predictability of seasonal changes stems from the fact that they are repeated relatively regularly over time, most often on an annual basis. The reasons for the occurrence of seasonal changes in the labor market may be fluctuations of basic economic categories (including production) or they may be related to the weather and seasons, plus one can also refer to institutional conditions such as the organization of the school year (Allcock 1989, p. 387; Commons, Page 2001, p. 153, Goulding et al., 2005, p. 209). Seasonality, reflected primarily in the reduction of employment in certain periods of the year, should be regarded as a phenomenon negatively affecting the functioning of labor markets, as it always prompts waste of labor. In the so-called low season,

there is compulsory unemployment, while high season is associated with the lack of satisfying an excessive demand for work.

The results of seasonality analyses of labor market categories such as unemployment, employment, average wages and productivity, indicate significant discrepancies in terms of level and change trends. Seasonal fluctuations in the number of unemployed people are definitely higher than seasonal fluctuations in the number of employees. Additionally, the conclusions from the analysis of short-term employment changes suggest that in the majority of developed economies around the world seasonal fluctuations in the number of employees are lower than seasonal fluctuations in the number of hours worked. A significant difference in seasonality is also observed in specific economic sectors as well as regions and countries (Grady, Kapsalis 2002, p. 12, Rembeza et al. 2015, p. 377, Kaźmierczyk 2008, pp. 144-146). Two sectors of the economy in particular are exposed to large seasonal changes, namely construction, and agriculture, forestry and fishing (Johnson et al. 1998, p. 340, Wilson 2017, p. 31). However, low seasonality can be seen in employment in industry. For this reason, it will be the analyzed in detail further down in this study. It is also worth emphasizing that peripheral areas are more susceptible to seasonality than urban areas, which is true for both employment and unemployment (Ball1989, p. 45, Eberts, Randall 1998, p. 420, Ledent et al, 2017, p. 4).

Methods and data sources

The main objective of the study concerned the analysis and assessment of the seasonality of the average number of employees in the enterprise sector in Poland in 2008-2016. Seasonality in the case of economic phenomena (including labor market categories) is usually considered on the basis of a calendar year. Its characteristic feature is a return to the initial state after completion of a full cycle, in this case a year. Seasonality is shaped by a number of factors whose nature requires the use of dynamic models in which the role of the explanatory variable is time. Time is not the cause, but rather it represents a set of variables that make seasonality what it is. Among the methods of seasonal equalization of data, methods based on the TRAMO/SEATS and Census X-12 ARIMA procedures are most commonly used (Fischer 1995, p. 2). In the article, the algorithm Census X-12 ARIMA was used to estimate the seasonal component[1].

[1]The empirical course of average employment in the enterprise sector in Poland and Polish provinces in 2008-2016 made it necessary to apply the multiplicative model to the decomposition of time series.

The use of the Census X-12 ARIMA procedure is based on the fact that economic phenomena - due to the dynamics of periodic fluctuations – divide into components, one of which is the seasonal component. Decomposition of the time series consists in isolating from the input series (Yt) the following components: trend-cycle (Tt), random component (It), effect of different number of working days (Dt), effect of holidays (Et) and seasonal component (St) (Grutkowska, Paśnicka 2007, p. 8). Mathematically, this can be expressed using the following formula:

$$Yt = Tt \blacksquare St \blacksquare It \blacksquare Et \blacksquare Dt \quad (1)$$

where:

■ – depending on the considered multiplicative or additive model signifies the sign of multiplication or addition

In order to achieve the main objective of the study, data on the average employment in the enterprise sector was used, the way it is reported in the Polish Central Statistical Office (GUS). According to the definition provided by GUS (GUS, 2017, p. 8), an employed person is someone who is employed full-time or part-time. National statistical data refer to the average employment in business entities in the enterprise sector, in which the number of employees is more than 9 persons. Information on average employment in the enterprise sector was collected at national (Poland) and regional (provinces) level. A seasonality survey was conducted based on quarterly data from the first quarter of 2008 to the fourth quarter of 2016 (a total of 612 observations)[2]. The initial period of the analysis was due to the fact that that in 2008 the Polish economy, like other economies around the world, experienced a downturn caused by the global financial crisis. Meanwhile, 2016 was the last year with full reporting at the time of the survey.

The empirical study was carried out based on the following research timeline:

Stage 1.Analysis of the average annual seasonality of average employment in the enterprise sector in Poland and Polish provinces in 2008-2016.

Stage 2. Analysis of the quarterly seasonality of average employment in the enterprise sector in Poland and Polish provinces in 2008-2016 throughout the year.

Research results

As already mentioned, seasonality concerns relatively regular changes in economic variables, occurring most often throughout the year. Employment, as a labor market category,

[2]17 times series with 36 observations in each

is of seasonal nature, i.e.it reports increases and decreases in selected periods of the year. In addition, some industries in the economy are exposed to stronger short-term fluctuations, including tourism industry, agriculture, construction (Marshall 1999, p. 18, National Bank of Poland, 2013, p. 8). These conditions allow to assume that the seasonality of the aggregate number of average employment in the enterprise sector in Poland and Polish provinces will occur and that it will be statistically significant.

The initial step in the analysis of the average annual and quarterly seasonality of average employment in Poland and its provinces was the separation of the seasonal component from the time series of the average number of employees in the enterprise sector, followed by the verification of its statistical significance. The statistical significance of seasonal fluctuations was verified by means of statistical tests: the Stable Seasonality test (Friedman Test) and the Kruskall-Wallis test (Jarrett, Kyper 2005, p. 540). Time series, in addition to stable seasonality, may also be influenced by other types of seasonal movements, e.g. mobile seasonality (Jarrett, Kyper 2005, p. 541). The existence of statistically significant mobile seasonality was verified using the evolutive seasonal test (the Evolutive Seasonality test). The calculations were made using the econometric suite EViews 6.0. Results of statistical significance tests of the separated seasonal component from the time series of average employment in the enterprise sector in Poland and Polish provinces are presented in Table 1. The seasonal component was considered statistically significant when at least one of the tests indicated presence of a statistically significant seasonality in the time series of the average number of employed people.

The tests of the significance of the seasonal component of the number of employees in the enterprise sector in Poland confirmed its serial existence. In the case of regional labor markets in Poland, according to the results, only in 8 out of 16 provinces, the calculated seasonal component is statistically significant. This could be explained, among others, by the level of aggregation of the average number of employees, the specificity of regional business sectors, or it may result from a relatively small number of observations in specific time series. In the subsequent stages of the empirical study, the time series of the number of employees in the enterprise sector for Poland and in selected provinces were analyzed. Only those provinces in which there was a statistically significant seasonality of the average employment in the enterprise sector were analyzed. These were: Dolnośląskie, Małopolskie, Mazowieckie, Podlaskie, Pomorskie, Warmińsko-Mazurskie, Wielkopolskie, and Zachodniopomorskie.

Table 1. Test of significance of the seasonal component of the quarterly average employment in the enterprise sector in 2008-2016

Province	Tests of seasonality		
	Friedman (F-value)	Kruskal-Wallis (p-value)	Mobile seasonality (F-value)
łódzkie	7,5948 (0,759)	0,4228 (0,9355)	0,7171 (1,363)
śląskie	3,1552 (0,676)	2,1786 (0,5361)	0,2459 (1,281)
świętokrzyskie	8,8567 (0,700)	6,0576 (0,1088)	0,8035 (1,799)
dolnośląskie*	8,1673 (17,403)[a]	24,6998 (0,0000)[b]	0,6649 (1,218)
kujawsko-pomorskie	7,2198 (0,465)	3,5675 (0,3121)	0,9322 (2,315)
lubelskie	8,7691 (0,868)	4,2183 (0,2388)	0,6228 (1,085)
lubuskie	6,3938 (1,036)	3,1969 (0,3622)	0,5863 (1,444)
małopolskie*	13,5989 (14,413)[a]	22,1940 (0,0000)[b]	2,5863 (2,423)[c]
mazowieckie*	19,8873 (5,489)	21,6268 (0,0000)[b]	4,4269 (1,752)
opolskie	14,2601 (0,626)	2,2309 (0,5258)	1,8775 (1,215)
podkarpackie	6,4855 (0,074)	0,4018 (0,9398)	0,4726 (1,111)
podlaskie*	11,4174 (0,902)	5,2530 (0,1541)	2,4019 (3,827)[b]
pomorskie*	6,9892 (0,470)	2,2029 (0,5331)	0,8097 (2,448)[c]
warmińsko-mazurskie*	27,1196 (1,532)	4,8334 (0,1844)	5,3925 (2,527)[c]
wielkopolskie*	13,2796 (14,348)[a]	21,3299 (0,0000)[b]	1,9689 (4,530)[b]
zachodniopomorskie*	2,5818 (6,130)[a]	18,4121 (0,003)[b]	1,2095 (2,546)[c]
Polska	5,5259 (7,156)[a]	16,2906 (0,009)[b]	0,8714 (3,040)[c]

Note:[a]significance at 0.1%; [b] significance at 1%; [c] significance 5%.

Source: own calculations based on GUS data for average employment in the enterprise sector, available at: https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica (retrieved 27.05.2018).

The analyzed provinces are regions whose economies are characterized by a significant share of agriculture, construction and tourism, higher than in other regions of the country (GUS, 2017). In 2016, Wielkopolskie and Mazowieckie provinces had the highest value of purchase of agricultural products per one hectare of arable land; this advantage resulted mainly from the purchase of agricultural animal products. In the surveyed group of provinces, the share of employees in agriculture, forestry, hunting and fishing varied rom 0.8% (in Mazowieckie) to 3.8% (in Warmińsko-Mazurskie) of the total number of employees. In the Mazowieckie, Małopolskie, Wielkopolskie, Dolnośląskie and Pomorskie provinces, the

highest level of renovation and construction production in Poland was recorded. The construction sector employed from 5.7% (in Mazowieckie) to 8.2% (in Małopolskie) of the total number of employees. On the other hand, Zachodniopomorskie, Małopolskie, Pomorskie, Mazowieckie i Dolnośląskie are the provinces where tourists in Poland recorded the largest number of overnight stays in 2016. The lowest share of the number of employees in the sector related to accommodation and food services was noted in Wielkopolskie Province, i.e. 1.2% of the total number of employees, while the highest share was observed for Zachodniopomorskie Province (3.1%).

The seasonal component, isolated and verified in terms of statistical significance, was subjected to further analyses. In the first stage of the study, the average annual level of seasonality of average employment in the enterprise sector was analyzed. The average annual seasonality of the average number of employees in Poland was small and subject to slight positive changes over time – see Table 2 for detailed data.

Table 2.Average annual seasonality of average employment in the enterprise sector in Poland in 2008-2016 [%]

Year	Average annual seasonal component
2008	0,05
2009	0,07
2010	0,09
2011	0,11
2012	0,14
2013	0,17
2014	0,20
2015	0,23
2016	0,25

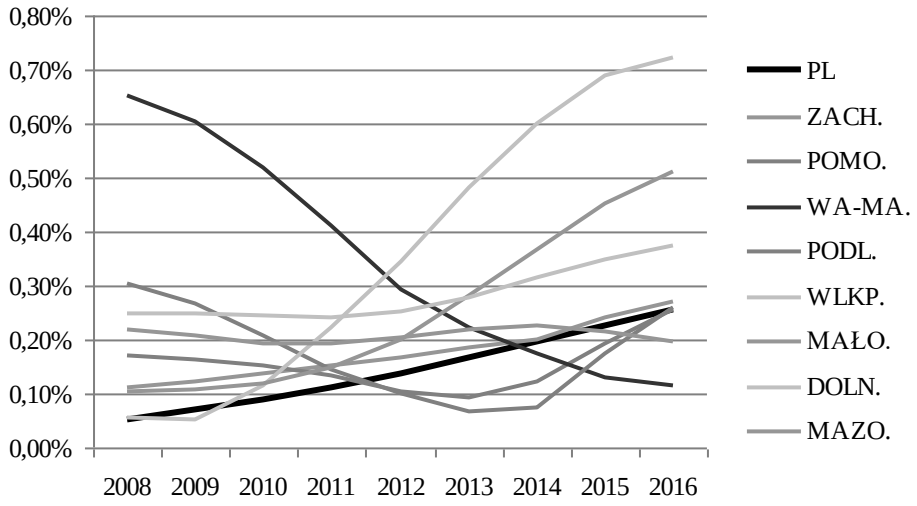
Source: own calculations based on GUS data for average employment in the enterprise sector, available at: https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica (retrieved 27.05.2018).

The first year of analysis was characterized by the lowest level of seasonality, at which time the average annual seasonality was at approx. 0.05%. This tendency can be analyzed in the context of production fluctuations and the possibility of companies using flexible forms of employment, including seasonal employment. In the face of production reduction in 2008, enterprises sought more flexible forms of employing people whose work could be adjusted seasonally. The adoption of legislative changes in Poland in 2009, i.e. in the period of slowdown in production growth, prompted an increase in seasonal fluctuations in employment in the enterprise sector, which is still noticeable today.

Similar calculations of the average annual seasonality of the average number of employees were made for selected provinces. Figure 1 shows the average annual rate of

seasonal fluctuations of the average number of employees in the enterprise sector in Poland and in selected Polish provinces in 2008-2016. The average annual seasonality rate of the average number of employees in all provinces was low, although in the first year of analysis seasonality ratios for all provinces were higher than the corresponding rate for Poland. In the last year, this relationship was not so unambiguous. This may suggest the direction of changes that occurred in the regional sectors of enterprises, such as increasing the importance of industries whose business activity is exposed to greater seasonal fluctuations. The course of the average seasonality was also diversified in terms of the direction of change, although most of the provinces recorded, as in the case of Poland, a positive direction of change. The exception was the labor market of Warmińsko-Mazurskie Province, in which the average annual level of seasonality of the average number of employees in the enterprise sector decreased.

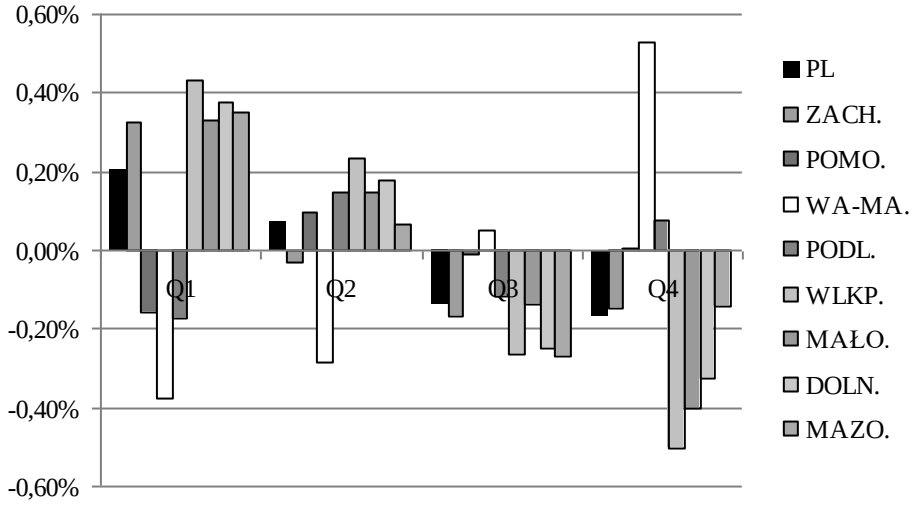
Figure 1. Average annual seasonal changes in the average number of employees in Poland and selected provinces in 2008-2016



Source: own calculations based on GUS data for average employment in the enterprise sector, available at: https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica (retrieved 27.05.2018).

The second stage of the study was the analysis and assessment of the distribution of quarterly seasonal fluctuations in the number of average employment in the enterprise sector throughout the year. Seasonal changes throughout the year for Poland were arranged in one annual cycle with an increase in seasonal employment in the first two quarters of the year and a decrease in seasonality of employment in the last two quarters of the year (see Figure 2).

Figure 2.Distribution of seasonal changes in the average number of employees in the enterprise sector throughout the year in Poland and in selected provinces



Source: own calculations based on GUS data for average employment in the enterprise sector, available at: https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica (retrieved 27.05.2018).

The distribution of the quarterly seasonality of average employment in the enterprise sector in selected provinces did not differ significantly from the quarterly level of seasonality throughout the year in Poland (see Figure 2). The exception was Warmińsko-Mazurskie Province, in which the quarterly seasonality of employment in the enterprise sector decreased in the first two quarters, while it increased in the third and fourth quarter. Minor discrepancies are also observed in the quarterly distribution of average employment in Pomorskie, Podlaskie and Zachodniopomorskie. Perhaps it is the structure of the enterprise sector that determines the different nature of relationships in these regions. These provinces are the most visited tourist regions in Poland, with a significant coastal tourism concentration and lakes frequently visited in the summer. An additional factor affecting seasonality in these provinces may spring from the relatively large share of agriculture, forestry, hunting and fishing.

The observation regarding the amplitude of seasonal changes in the average number of employees in the enterprise sector in Poland and selected provinces seems to be important[3]. The peak-to-peak value of seasonal employment fluctuations calculated for Poland was small and stood at 0.37%. Analyzing the amplitude of fluctuations in the regional system with a lower amplitude than the amplitude for Poland, only two provinces were characterized: Pomorskie (0.25%) and Podlaskie (0.32%). The remaining regions recorded higher

[3]The amplitude of seasonal fluctuations is understood as the peak-to-peak value of seasonality ratios, calculated as the difference between the maximum and the minimum rate of quarterly seasonal fluctuations throughout the year.

differences between the top and bottom rate of seasonal fluctuations. Wielkopolskie (0.93%) and Warmińsko-Mazurskie (0.91%) had the highest amplitude, although it should be recognized that it was still relatively small.

Conclusions

The analyzed empirical material allowed to verify the research hypotheses and draw the following conclusions. First, the labor market in Poland was characterized by a relatively low level of fluctuations in seasonal average employment in the enterprise sector. In addition, there are regions in Poland where no statistically significant seasonality of average employment in the enterprise sector was observed. This observation, only partially, allows to positively verify the first hypothesis. Another conclusion refers to the assumptions of the second hypothesis. The common characteristic of the quarterly seasonality of employment in Poland and in the analyzed provinces is its similar distribution throughout the year. In both cases, seasonal employment is higher in the first two quarters of the year, and lower in the last two (with the exception of the labor market in Warmińsko-Mazurskie). Furthermore, the common characteristic of seasonality distribution of average employment in the enterprise sector throughout the year in Poland and selected provinces is the small peak-to-peak value of fluctuations.

The analysis is an attempt to highlight the legitimacy of including short-term analyses into the canon of research on the activity of labor markets. The conclusions drawn from the empirical study indicate the necessity of conducting short-term analyses, as they can serve as a starting point to assess the region's economic specifics, conditions for the development of entrepreneurship or the regulations of the labor market adopted by the state. In addition, the analyses discussed in this study concerned only one category of the labor market at national level. Research should be extended to include unemployment, average wages, productivity as well as other countries, which is the future direction of the authoress' research in this area.

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Zróżnicowanie sezonowości zatrudnienia w Polsce

Abstrakt

Sezonowość w gospodarce definiuje się jako względnie regularne zmiany wielkości ekonomicznych o charakterze krótkookresowym. W badaniach empirycznych aspekt sezonowości jest często pomijany lub eliminowany z szeregów czasowych, chociaż większość zjawisk ekonomicznych charakteryzuje się zmiennością krótkookresową i dopiero uwzględnienie jej w analizie w pełny sposób charakteryzuje badane zjawiska. Celem artykułu jest analiza i ocena zróżnicowania sezonowości przeciętnej liczby zatrudnionych w sektorze przedsiębiorstw w Polsce. Określono wielkość i tendencję zmian sezonowości przeciętnego zatrudnienia w sektorze przedsiębiorstw oraz jej rozkład w trakcie roku. Przedmiotem analiz jest także porównanie oszacowanych dla Polski wahań sezonowych przeciętnego zatrudnienia z sezonowymi wahaniami przeciętnego zatrudnienia na rynkach wojewódzkich. W opracowaniu wykorzystano kwartalne dane Głównego Urzędu Statystycznego o przeciętnej liczbie zatrudnionych w sektorze przedsiębiorstw dla Polski i dla rynków wojewódzkich za okres od I kwartału 2008 roku do IV kwartału 2016 roku. Do wyodrębnienia składnika sezonowego użyto procedury Census X-12 ARIMA. Uzyskane wyniki wskazują, że sezonowość przeciętnego zatrudnienia w sektorze przedsiębiorstw w Polsce jest niewielka i wykazuje tendencję rosnącą. Rozkład wahań sezonowego zatrudnienia w sektorze przedsiębiorstw w trakcie roku w Polsce ogółem i analizowanych województwach jest podobny i cechuje się niewielką amplitudą wahań. W niektórych województwach sezonowość w szeregu czasowym przeciętnej liczby zatrudnionych w sektorze przedsiębiorstw nie występuje.

Słowa kluczowe: zatrudnienie, sezonowość, rynek pracy