KAMILA RADLIŃSKA

kamila.radlinska@tu.koszalin.pl
Koszalin University of Technology. Faculty of Economic Sciences
2 Sniadeckich St., 75-453 Koszalin, Poland
ORCID ID: http://orcid.org/0000-0003-1953-3598

Seasonal and Cyclical Employment Fluctuations. An Example of Employment Adjustments in the Industrial Sector of Central and Eastern European Countries

Abstract

Theoretical background: Labour market theories and theories of cyclical fluctuations are broadly concerned with the problem of employment fluctuations, but they usually clearly separate the problem of cyclical employment fluctuations from its seasonality. This is an unjustified approach, since comparing cyclical employment fluctuations with its seasonality provides insight into the full dynamics of employment fluctuations. Considering that the number of scientific studies that simultaneously address the issue of employment adjustments in economic cycles and seasonality of employment is relatively small and their results are inconclusive, it was considered that the issues raised in the article may provide new generalizations.
Purpose of the article: The main objective of the article is to examine the mechanisms of employment adjustment in response to cyclical and seasonal fluctuations in production. In order to achieve the main objective of the article, an empirical study was conducted, which was focused on the identification, assessment and comparison of cyclical and seasonal fluctuations in employment in the industrial sector in the Central and Eastern Europe (CEE) countries in 1q.1995–4q.2021.

Research methods: The analyzes of identification and assessment of employment adjustments during economic fluctuations and seasonality of employment in the industrial sector in the CEE countries are based on time series models. The empirical study consists in comparing the conclusions from the analyzes of employment adjustments during fluctuations in economic activity with the conclusions of analyzes of seasonal fluctuations in employment. The research methods were mainly focused on two areas: employment adjustments during cyclical changes in economic activity and seasonal fluctuations in employment.
Main findings: The analysis of employment fluctuations in the industrial sector of the CEE countries allowed to formulate three main conclusions. (1) An analysis of labour hoarding showed that in the industrial sector of the CEE countries, labour hoarding was a common employment practice during periods of economic fluctuation, and its level did not differ significantly between countries. Labour hoarding during cyclical fluctuations resulted from the lack of adjustment of the number of employees with a noticeable adjustment of the number of working hours. (2) A research on the seasonality of employment fluctuations showed significant and important seasonality of employment in the industrial sector of the CEE countries, with seasonal fluctuations in the number of workers being smaller than seasonal fluctuations in the number of hours worked. (3) The mechanism of cyclical and seasonal adjustment of employment seems to be related. Changes in the cyclical fluctuations of employment can be explained by its seasonality, so the speed with which employment adjusts to economic fluctuations may depend on its tendency to fluctuate during the year.

Introduction

A review of the literature, analysis of empirical research results and observation of the labour market indicate that economies alternate between periods of expansion when employment increases and periods of recession when it decreases (Barsky & Miron, 1989; Van den Bosch & Vanormelingen, 2023). In addition, it is noted that changes in employment are not smooth, change relatively regularly during the year (Geremew & Gourio, 2018; Zipperer & Skott, 2011). Employment fluctuations resulting from cyclical and seasonal changes in economic activity are therefore a natural and common phenomenon, observed in every economy, its individual regions and sectors (Beaulieu & Miron, 1991; Clark, 1998). Although usually the cyclical nature and seasonality of employment are considered separately.

Thus, cyclical fluctuations in production affect employment, and economic crises lead to cyclical unemployment and underemployment. For enterprises, this means the need to take it (the cyclical nature of production) into account when determining the demand for labour. Labour demand is a derivative of production and when determining it, enterprises determine not only the number of employees or the number of working hours, but also the demand for qualifications. This is particularly important in the case of specialist activities and in enterprises using new technologies. Therefore, in some industries, hoarding employees during a recession is the result of rational decisions by enterprises, which are further supported by anti-crisis packages (Giupponi & Landais, 2023; Kluzek, 2021). On the other hand, employment seasonality analysis allows for a better understanding of seasonality and employment patterns. Seasonal fluctuations in production are strongly differentiated by industry, therefore, employment in sectors is subject to strong adjustments during the year. Selected industries and sectors are naturally subject to high seasonality. Agriculture, due to natural factors, is an industry

characterized by large seasonal fluctuations in production and employment. Similarly, construction activity is limited in winter, with most work being done in spring, summer and fall. Therefore, an increase in labour demand in these sectors should be expected in this period. The tourism sector is affected by climatic, weather and institutional factors. Many people go on vacation in the summer because of the warm weather and spend it with their children and family who are on summer vacation. Therefore, in the tourism sector, the demand for seasonal workers appears especially in the summer. In other sectors, i.e. in trade, employment also changes dynamically during the year due to growing sales, e.g. during the Christmas holidays.

The main objective of the article is to examine the mechanisms of employment adjustment in response to cyclical and seasonal fluctuations in production. In order to achieve the main objective of the article, an empirical study was conducted, which was focused on the identification, assessment and comparison of cyclical and seasonal fluctuations in employment in the industrial sector in the CEE countries. The objective of the empirical study is therefore to compare and assess employment adjustments during production cyclical fluctuations and the seasonality of employment in the industrial sector in the CEE countries in 1q.1995–4q.2021. The questions that were tried to be answered were formulated in the form. Does the industrial sector observe labour hoarding during economic crises, and if so, is the practice of labour hoarding mitigated by hourly employment adjustments? What is the level of average annual employment fluctuations and employment fluctuations during the year, and in which countries seasonal adjustment of employment to changes in the production volume in the industrial sector takes place through a stronger adjustment of the number of employees and in which countries through adjustment of working hours? Is there a relationship between labour hoarding and seasonal employment fluctuations in the industrial sector of the CEE countries?

The content of the article has been divided into three main parts. The first part reviews the theoretical premises of employment adjustment during fluctuations in economic activity and seasonal fluctuations in employment. The second part of the article is a description of the methodology of empirical research, which includes the scope of research, main objectives and research assumptions. The third part of the article presents the results of empirical research along with their description. The article ends with a conclusion, which contains the main conclusions resulting from literature studies and conducted empirical research, as well as generalizations regarding the labour hoarding during economic fluctuations and the level of seasonal employment fluctuations.

Literature review

Employment fluctuations studies focus mainly on understanding its actual course, with particular attention being paid to assessing the degree of synchronization of employment cycles with economic cycles (Adamowicz et al., 2008; Harding &

Pagan, 2006; Sella et al., 2016). The links between cyclical fluctuations in employment and economic activity are analyzed in a multi-aspect manner in spatial and sectoral terms (Buddelmeyer et al., 2008; Davis & Haltiwanger, 1999). The results of analyzes of the location of break points, the amplitude of cycles and the duration of individual phases and full cycles of employment and production indicate their spatial and cross-sectoral differentiation. There is evidence in the scientific literature that employment is pro-cyclical, although the dynamics of changes in economic activity do not exactly match the dynamics of changes in employment. Slower and delayed changes in employment are also observed (Burnside et al., 1993; Pater, 2010; Radlińska et at., 2020). Labour market theories describe the mechanisms of adjusting employment to changes in production volume, explaining delays in employees' decisions in enterprises, e.g. market conditions, labour market regulations (Nunziata, 2003; Cichocki et al., 2015; Kwiatkowski & Włodarczyk, 2012). From a microeconomic perspective, one explanation for the delayed employment response to changes in economic activity is that enterprises treat the costs of layoffs, re-hiring and training as a component of the profit function (Hamermesh, 1996; Dossche et al., 2021). These delays contribute to the creation of labour hoarding in enterprises and, by extension, in economies (Strzelecki et al., 2009). Labour hoarding is a consequence of the assumption of fixed employment costs, at least in relation to selected groups of employees, which are strongly influenced by the characteristics of employees and labour market institutions (Fedotenkov et al., 2024; Kwiatkowski & Włodarczyk, 2012; Stepanok, 2024; Cichocki et al., 2015). The speed and strength of adjustment employment to changes in production are also determined by sectoral conditions (Tortia, 2022; Behun et al., 2018; McConnell & Tracy, 2006). More consistent changes in employment with cyclical fluctuations in production are observed in economies with a high share of the private sector in total employment and in economies with low legal protection of employment and poorly functioning trade unions.

Employment seasonality analyzes mainly concern the measurement of the amplitude of fluctuations, the average annual measure of seasonality and employment fluctuations during the year and their comparison between countries, regions and sectors of the economy. Their conclusions are to serve the policy of counteracting seasonality (Yabancı, 2023; Vella, 2018). The results of these analyzes indicate that the general level of seasonality of employment in most economies is declining, although it remains very diversified by sector (Marshall, 1999; Rydzewski et al., 1993; Ferrante et al., 2018). A higher level of employment seasonality is observed in the economies of those countries where the share of sectors defined as seasonally sensitive is higher (Jolliffe & Farnsworth, 2003). Agriculture, construction and tourism sectors are still characterized by greater seasonality of employment than sectors related to, for example, transport and storage or public administration services (Gill & Gerard, 1991; Rydzewski et al., 1993). Similar conclusions can be drawn from the analyzes of the distribution of seasonal fluctuations in employment during the

year – seasonal fluctuations during the year and their level are strongly differentiated by sector (Koenig-Lewis & Bischoff, 2005). Analyzes of the seasonality of employment rarely focus on assessing the relationship between seasonal fluctuations in employment and fluctuations in economic cycles.

As the conclusions from the literature review indicate, usually cyclical and seasonal fluctuations are treated separately, the justification for such an approach is the belief that seasonal fluctuations disrupt the course of the studied phenomenon and make its analysis more difficult (Sims, 1974; Geremew & Gourio, 2018). It is the resultant of factors that affect only the course of the phenomenon in the annual cycle and does not provide significant information for understanding other periodic changes in the economy. As a consequence, the analyzed series of employment observations are decomposed, and the cyclical and seasonal components are analyzed separately. The process appear to be substantively unjustified. Employment is characterised by significant cyclical and seasonal fluctuations, therefore, only taking into account both types of fluctuations simultaneously allows for a full its characterisation. In addition, methodological considerations suggest that taking both types of fluctuations into account can provide new information when drawing general conclusions about employment practices in enterprises, sectors and economies. Cyclical and seasonal fluctuations are similar, because in both cases there are deviations from the average, i.e. from the long-term average determined by the trend in the case of cyclical fluctuations or from the annual average in the case of seasonal fluctuations. Cyclical fluctuations are characterized by low stability both in terms of the length of the cycle and the magnitude of fluctuations, while seasonal fluctuations are highly repeatable and can be forecast with high accuracy. Therefore, it can be assumed that from the pattern of seasonal fluctuations, much can be learned about the pattern of cyclical fluctuations. Economies and sectors exposed to large seasonal fluctuations in employment should also be more willing to flexibly adjust employment during economic cycles.

In the literature, only a few studies indicate that seasonal fluctuations are large and in many respects similar to cyclical fluctuations. In these studies, it is assumed that more predictable seasonal fluctuations can tell a lot about the origin and course of cyclical fluctuations, which are much more difficult to predict, and their consequences for the economy are much severe. Research by Beaulieu et al. (1992) showed that in the economies of OECD countries there is a large and positive correlation between seasonal and cyclical fluctuations of economic activity measured, among others, by employment. The results of the analyzes of Geremew and Gourio (2018) suggest, however, based on the data for the American economy, that only a few sectors are characterized by a positive relationship between cyclical fluctuations in employment and its seasonality. Therefore, the question remains whether economies and sectors characterized by large employment adjustments during cyclical fluctuations in production are also characterized by high seasonality of employment.

Research methods

The main objective of the empirical study is to identify and evaluate employment adjustments during economic fluctuations and seasonality of employment in the industrial sector in the CEE countries in 1q.1995–4q.2021. The complexity of the main objective requires verification of the following research hypotheses.

Hypothesis 1. In the industrial sector of the CEE countries, labour hoarding is a common practice of adjusting employment to changes in the economic situation, and its level differs between the industrial production section and the construction section.

Hypothesis 2. In the industrial sector of the CEE countries, labour hoarding is mitigated by adjusting hours worked, and this applies to a varying degree to the industrial production and construction sections.

Hypothesis 3. In the industrial sector, in the sections production and construction in the CEE countries, there is a significant seasonality of aggregate employment, which varies between sections, with seasonal fluctuations in the number of employees being smaller than seasonal fluctuations in the number of hours worked.

Therefore, the objective scope of the empirical study is the identification and assessment of employment adjustments used during economic fluctuations and seasonality of employment. The subjective and spatial scope of the empirical study covers the industrial sectors of the economies of Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia, i.e. selected countries of Central and Eastern Europe. The industrial sector has been distinguished according to the traditional division of economic activity into three main sectors (Agriculture, Industry and Services). The specificity of industrial production and the EUROSTAT methodology allow for the analysis of employment in the industrial sector in two separate sections (EUROSTAT, 2008). Therefore, the study covered the industrial sectors of the CEE countries, which include section industrial production (BCDE) and section construction (F). The choice of the scope of the spatial empirical study, i.e. the area of CEE countries, is justified by the fact that the area defined in this way is not only a geographically concentrated region, but, more importantly, an area encompassing countries with a common culture, history, politics and economy, whose political and economic order was relatively recently (NBP, 2007; Rapacki & Próchniak, 2014). In addition, these countries are members of the European Union, which makes the labour markets in these countries similar in terms of institutional environment, economic structure, directions of trade and capital exchange (Smętkowski, 2015). The time range of the empirical study covers the period from 1q.1995 to 4q.2021 and was limited by the availability of comparable data. Only in the case of Estonia and the Czech Republic this period was shortened due to the lack of data on the number of hours worked in the full analyzed period. The specific scope of the study determines the choice of research methods.

The analyzes of identification and assessment of employment adjustments during economic fluctuations and seasonality of employment in the industrial sector in the

CEE countries are based on time series models. The empirical study consists in comparing the conclusions from the analyzes of employment adjustments during fluctuations in economic activity with the conclusions of analyzes of seasonal fluctuations in employment. Thus, the research methods were mainly focused on two areas: employment adjustments during cyclical changes in economic activity and seasonal fluctuations in employment.

Employment adjustments during fluctuations in economic activity were assessed on the basis of the results of the analysis of the traditional and recursive Pearson's linear correlation coefficient (Maulud & Abdulazeez, 2020). Based on the assumption of the pro-cyclicality of labour productivity (LPP), the level of employment adjustment during cyclical changes in economic activity, i.e. the level of labour hoarding (LH_P), was estimated.

$$LH_P = \frac{cov(CFdGVA, CFdLPP)}{D(CFdGVA)D(CFdLPP)}$$

where:

cov(CFdGVA, CFdLPP) – covariance of the dynamics of cyclical fluctuations in the number of employees and the dynamics of cyclical fluctuations of gross value added,

D(CFdGVA)D(CFdLPP) – the standard deviation of the respective marginal distributions.

Identification of employment practices during cyclical changes in economic activity and the stability of these adjustments took place during the analysis of the recursive Pearson linear correlation coefficients of the dynamics of labour productivity and hours worked and the dynamics of gross value added with a sliding time window of 12 quarters (corr. 12qCFdGVA vs. CFdLPP, corr. 12q CFdGVA vs. CFdLPH). Cyclical changes in gross value added and employment in the industrial sector of CEE countries were identified using the Christiano–Fizgerald filter (CF) (Christiano & Fitzgerald, 2003).

In the analysis of the seasonality of employment in the industrial sector of CEE countries, it was decided to separate the seasonal component using the TRAMO/SEATS ARIMA X-12 procedure. In this way, an indicator responsible for seasonal employment fluctuations was obtained, which is an indicator of employment deviations from the trend (Fischer, 1995). The following seasonal employment components were analyzed (Sharpe & Smith, 2005): Mean Seasonal Variation (MSV), i.e. average annual seasonal fluctuations in the number of employees (MSV_P) and the number of hours worked (MSV_H),

$$MSV = \sum_{n=1}^{j} \left(\frac{\left| \frac{E_{u,n} - E_{a,n}}{E_{a,n}} \right|}{4} \right) \times 100$$

where:

$E_{u,i}$, $E_{a,i}$ – seasonally and non-seasonally adjusted number of employees (number of hours worked) in a given quarter of the ith year.

The results obtained on its basis make it possible to characterize the general level of seasonality of employment and the mechanism of employment adjustments during the year.

In the next stage of the analysis of the seasonality of employment in the industrial sector in the CEE countries, the general level of seasonality of employment in SF_P was determined as the average level of average annual fluctuations in the number of employees in the industrial sector of the CEE countries MSV_P for the entire analysis period, in accordance with the formula.

$$SF_P = \frac{\sum_{i=1}^{n} MSV_P}{n}$$

Conclusions from analyzes of employment adjustments during cyclical changes in economic activity and seasonal fluctuations in employment are the basis for an attempt to answer the research question: is there a relationship between labour hoarding and seasonal employment fluctuations in the industrial sector in the CEE countries. The negative relationship between labour hoarding and seasonality of employment will mean that industrial sectors in with low seasonality of employment will also be characterized by a high level of labour hoarding, i.e. a small degree of employment adjustments during economic fluctuations.

In accordance with the adopted research methodology, in the analysis of employment adjustments used during economic fluctuations and seasonality of employment, seasonally unadjusted quarterly data on the average number of employees expressed in thousands persons were used and the average number of working hours, expressed in thousands work hours. Due to the subject scope of the study, the data was supplemented with additional quantitative information on the production, which was defined as gross value added expressed in EUR million, in constant prices 2015 = 100 for the industrial sector of each economy. In addition, bearing in mind that the analysis of labour hoarding in the industrial sector of the CEE countries is based on the assumption of the pro-cyclicality of labour productivity, in the data preparation step, measures of labour productivity were calculated accordingly. Labour productivity (LPP) was defined as the ratio of gross value added to the number of employees, while hourly productivity (LPH) was calculated as gross value added per hourly work unit (Baroniene & Zirgutis, 2017; Lankauskiene, 2014). The source of aggregated data was the EUROSTAT database.

Results and discussions

This part of the article presents the results of the analysis and assessment of employment adjustments in the business cycle and seasonal fluctuations of employment in the industrial sector in the CEE countries in 1q.1995–4q.2021.
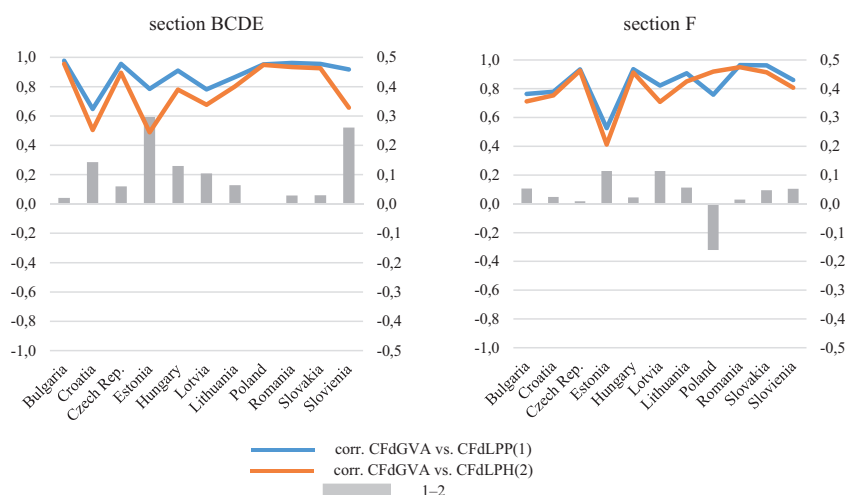

Figure 1. The relationship between the dynamics of gross value added and the dynamics of labour productivity per person and the dynamics of labour productivity per hour worked in the industrial sector in the economies of the CEE countries in 1q.1995–4q.2021

Note: 0.9 < corr. CFdGVA vs. CFdLPP ≤ 1.0 – pure labour hoarding; 0.7 < corr. CFdGVA vs. CFdLPP ≤ 0.9 – high labour hoarding; 0.5 < corr. corr. CFdGVA vs. CFdLPP ≤ 0.7 – moderate labour hoarding; 0 < corr.corr. CFdGVA vs. CFdLPP ≤ 0.5 – low labour hoarding; -1.0 ≤ corr. corr. CFdGVA vs. CFdLPP ≤ 0 – no labour hoarding and 0.9 < corr. CFdGVA vs. CFdLPH < 1.0 – no adjustments to working hours during economic change; 0.7 < corr. CFdGVA vs. CFdLPH < 0.9 – high adjustments to working hours during economic change; 0.5 < corr. CFdGVA vs. CFdLPH < 0.7 – moderate adjustments to working hours during economic change; 0 < corr. CFdGVA vs. CFdLPH < 0.5 – low adjustments to working hours during economic change; -1.0 < corr. CFdGVA vs. CFdLPH < 0 – no adjustments to working hours during economic change

Source: Author's own study based on EUROSTAT data (as of March 30, 2023).

The traditional correlation coefficient between the dynamics of gross value added and the dynamics of labour productivity per person in the industrial sector in the economies of CEE countries in 1q.1995–4q.2021 indicates the general level of delayed adjustments of employment to economic fluctuations, which in the literature are referred to as labour hoarding (LH_p). The difference between the correlation index of the pro-cyclicality of employment and the pro-cyclicality of hours worked indicates the use of hourly adjustments during cyclical production fluctuations. The results of the analysis, grouped into the industrial production section (section BCDE) and the construction section (section F), are presented in Figure 1.

In the section BCDE, a significant level of labour hoarding is observed, Pearson's linear correlation coefficients between changes in production and employment

productivity (cor. CFdGAV vs. CFdLPP) in most CEE countries are high and range from 0.78 (Latvia) to 0.98 (Bulgaria). The results of the analysis indicate that the reduction of production in the section BCDE does not result in proportional redundancies in the number of employees in most economies of the CEE countries. An exception is employment in the section BCDE of the Croatian economy, where the Pearson linear correlation coefficient was 0.65, which indicates that the practice of adjusting the number of employees to changes of production is used more often than observations in other CEE countries. Comparing the correlation dependencies of changes in production and labour productivity with the correlation coefficients of changes in production and hourly labour productivity in the sections BCDE of the CEE countries, it is noticed that changes in production do not reduce the number of employees, but they cause relatively strong adjustments of hours worked. Thus, the hours worked adjustment mechanism was a common mechanism for adjusting employment to cyclical changes in production in the section BCDE. The largest adjustments of hours worked to changes in the production are observed in Estonia and Slovenia, while this mechanism was used least frequently in Polish, Bulgarian, Romanian and Slovak enterprises of the section BCDE.

The section F also has significant levels of labour hoarding, but lower than in the section BCDE. In most CEE countries, Pearson's linear correlation coefficients between changes in construction production and labour productivity per person in section F were high and ranged from 0.76 (Bulgaria) to 0.96 (Slovakia, Romania). An exception was the Estonian section F, where the Pearson linear correlation coefficient was 0.53, which indicates a low level of labour hoarding and the practice of a significant adjustment of employment to changes in the production in the Estonian section F. The results also indicate that the reduction in production in section F results in a similar adjustment on the hours worked side.

To analyze the stability of the estimated level of labour hoarding, recursive linear Pearson correlation coefficients with a sliding window of 12 quarters (adjusted 12q CFdGAV vs. CFdLPP and adjusted 12q CFdGAV vs. CFdLPH) were calculated, which indicate convergence paths. The results of the estimated correlation coefficients for the industrial sector of section BCDE and section F are presented in Figures 2 and 3, respectively.
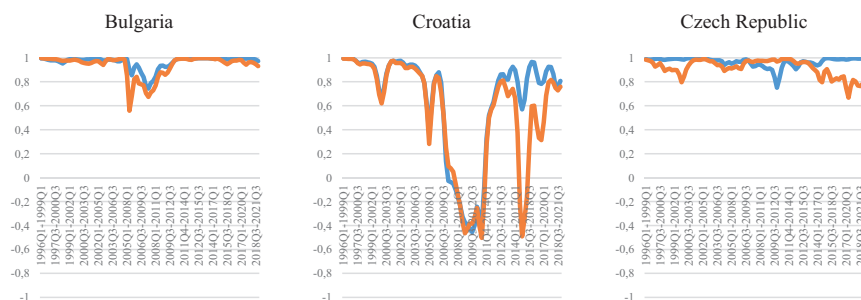
Figure 2. Pro-cyclicality of labour productivity – recursive correlations with a sliding window of 12 quarters in the CEE countries in the industrial sector – section BCDE (q1.1995–q4.2021)

Note: 0.9 < 12q corr. CFdGAV vs. CFdLPP ≤ 1.0 – pure labour hoarding; 0.7 < 12q corr. CFdGAV vs. CFdLPP ≤ 0.9 – high labour hoarding; 0.5 < 12q corr. CFdGAV vs. CFdLPP ≤ 0.7 – moderate labour hoarding; 0 < 12q corr. CFdGAV vs. CFdLPP ≤ 0.5 – low labour hoarding; -1.0 ≤ 12q corr. CFdGAV vs. CFdLPP ≤ 0 – no labour hoarding and 0.9 < 12q corr. CFdGAV vs. CFdLPH < 1.0 – no adjustments to working hours during economic change; 0.7 < 12q corr. CFdGAV vs. CFdLPH < 0.9 – high adjustments to working hours during economic change; 0.5 < 12q corr. CFdGAV vs. CFdLPH < 0.7 – moderate adjustments to working hours during economic change; 0 < 12q corr. CFdGAV vs. CFdLPH < 0.5 – low adjustments to working hours during economic change; -1.0 < 12q corr. CFdGAV vs. CFdLPH < 0 – no adjustments to working hours during economic change

* 1q2000–4q2021

Source: Author's own study based on EUROSTAT data (as of March 30, 2023).

Figure 3. Pro-cyclicality of labour productivity – recursive correlations with a sliding window of 12
quarters in the CEE countries in the industrial sector – section F (q1.1995–q4.2021)

Note: as in Figure 2.

* 1q.2000–4q.2021 (Estonia); 1q.1996–4q.2021 (Czech Republic)

Source: Author's own study based on EUROSTAT data (access @ March 30, 2023).

Comparing the results of the analysis of the pro-cyclicality of labour productivity between sections BCDE and F, which are presented in Figures 2 and 3, it can be seen that, in general, the section BCDE is characterized by a higher level of labour hoarding than section F. Moreover, the stability of labour hoarding in the section BCDE is greater than in the section F. Section F, similarly to section BCDE, uses hours worked adjustments during economic fluctuations, but only to a low extent.

Despite the high level of labour hoarding in the section BCDE in the CEE countries, economic crises have affected periodic fluctuations in the adjustment of employment in this sector, both in terms of the number of employees and the number of hours worked, which is clearly indicated in Figure 2. In the section BCDE adjustments of employment to changes in production took place through various adjustments to the number of employees and hours worked. Although specialist qualifications are required from people employed in the section BCDE, this did not protect the employees of this section from periodic redundancies. In the conditions of economic crises, only the Czech Republic and Slovenian enterprises of the section BCDE were more willing to reduce hours worked than to lay off employees. Perhaps because retraining them would require significant financial outlays. In addition, those laid off with higher qualifications may find employment in other enterprises despite the crisis and may be less available for work after the crisis. Similar results were obtained for section F. The overall level of labour hoarding in construction indicates a relatively high level, with the exception of the Estonian economy. However, this phenomenon is unstable over time. The employment productivity in the section F reacts more strongly to negative external shocks than in the section BCDE, which proves that labour is not hoard. The highest instability is observed in the section F of the countries of Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania, Poland and Romania. Smaller fluctuations in production and labour productivity in the period of negative external shocks are observed in the construction sectors of the Czech Republic, Slovakia and Slovenia. Sector F in all economies of the CEE countries uses the mechanism of adjusting hours worked during economic fluctuations only to a small extent.

The next planned stage of the analysis was to determine and evaluate the general level of employment seasonality and to characterize the mechanisms of employment seasonality in section BCDE and section F of CEE countries. The general level of seasonality of employment in SF_P was determined on the basis of average annual seasonal fluctuations in employment in 1q.1995–4q.2021 MSV_P separately for both analyzed sections, in accordance with the described research method. However, the specificity of employment seasonality mechanisms in the sections BCDE and F was identified on the basis of observations of seasonal fluctuations in the number of employees and seasonal fluctuations in the number of hours worked MSV_P, MSV_H and MQV_P, MQV_H.

The general level of seasonality of employment in industry sector was strongly differentiated between sections. The level of seasonality of employment in the section BCDE in the analyzed countries was lower than the level of seasonality of employ-

ment in the section F. This observation is explained by the fact that employment in the section F is closely related to climatic factors, so employment in this section decreases sharply in the winter. The seasonality of employment in the industrial sector in both sections was also spatially differentiated. The highest general level of employment seasonality in the section BCDE is characteristic of the economies of the following countries: Bulgaria, Croatia, Estonia, Hungary, where the general level of employment seasonality exceeds 1.0%. The remaining group of countries are countries with a relatively low general level of employment seasonality, with the level of seasonality below 1.0%. Employment in Slovenia was characterized by the smallest level of seasonality (0.1%). In turn, the general level of seasonality of employment in the section F was characterized by a higher level and also differentiated between countries. The highest overall level of employment seasonality, i.e. seasonality above 3.0% on average in the analyzed period, was characteristic of section F in Bulgaria, the Czech Republic, Estonia, Lithuania, Poland and Romania. The lowest level of seasonality of employment in section F was recorded in Slovenia (1.1%). The average level of average annual seasonal fluctuations in the number of employees in the industrial sector in the section BCDE and section F in the CEE countries, together with the characteristics of diversity, are presented in Table 1.

Table 1. General level of seasonality in the industrial sector, section BCDE and section F in the CEE countries 1q.1995–4q.2021 (%)

Country (standard deviation) (min., max)	General level of seasonality*	General level of seasonality in section BCDE	General level of seasonality in section F
Bulgaria	4.0 (-) (-,-)	1.4 (0.6) (0.7; 2.3)	3.5 (0.9) (1.8; 4.8)
Croatia	1.9 (-) (-,-)	1.3 (0.4) (0.6; 2.1)	2.3 (0.9) (1.4; 4.7)
Czech Republic	0.4 (-) (-,-)	0,3 (0.1) (0.1; 0.6)	4.7 (0.4) (4.1; 5.2)
Estonia	0.7 (-) (-,-)	1.1 (0.4) (0.5; 1.9)	4,5 (1.7) (0.6; 6.9)
Hungary	1.3 (-) (-,-)	1.2 (0.2) (0.9; 1.5)	1.2 (0.8) (0.3; 2.5)
Latvia	0.6 (-) (-,-)	0.5 (0.2) (0.2; 0.8)	2.2 (1.0) (0.5; 4.3)
Lithuania	0.7 (-) (-,-)	0.8 (0.3) (0.3; 1.4)	3.2 (0.7) (1.8; 4.4)
Poland	0.7 (-) (-,-)	0.6 (0.2) (0.1; 0.9)	3.2 (1.3) (1.6; 6.1)

Country (standard deviation) (min., max)	General level of seasonality*	General level of seasonality in section BCDE	General level of seasonality in section F
Romania	2.4 (-) (-,-)	0.5 (0.3) (0.1; 1.0)	3.1 (0.3) (2.6; 3.6)
Slovakia	0.3 (-) (-,-)	0.4 (0.2) (0.2; 0.7)	1.7 (0.6) (0.9; 2.8)
Slovenia	0.5 (-) (-,-)	0.1 (0.0) (0.1; 0.2)	1.1 (0.5) (0.6; 2.1)

Note: * concerns the general level of seasonality of employment in the country of CEE countries in 1q.1995–4q.2021

Source: Author's own study based on EUROSTAT data (as of March 30, 2023).

The results of the analysis of the average annual seasonal fluctuations in the number of employees and the number of hours worked showed that the average annual seasonal fluctuations in the number of employees in the section BCDE are noticeably lower than the average annual seasonal fluctuations in the number of employees in the section F.

Employment adjustments during cyclical changes and the specificity of seasonality of employment in the industrial sector motivated an attempt to compare the conclusions from the analysis of labor hoarding and employment seasonality in industrial sectors of the CEE countries, the results of this analysis are presented in Figure 4.
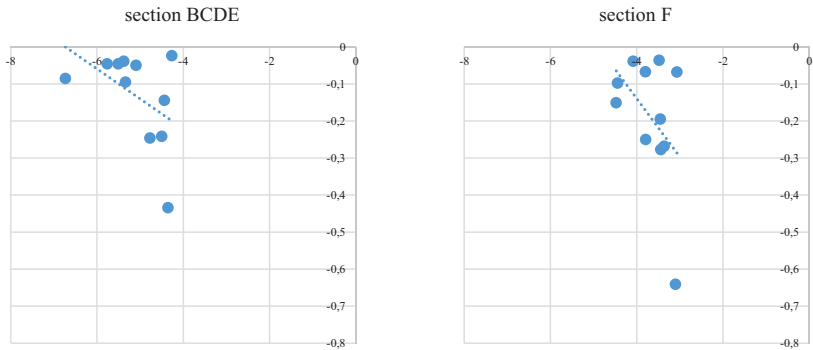

Figure 4. Labor hoarding and seasonal employment fluctuations in the industrial sector of the CEE countries in 1q.1995–4q.2021 – graphical analysis

Note: vertical axis – ln LH_p, horizontal axis – ln SF_p

Source: Author's own study based on EUROSTAT data (as of March 30, 2023).

Industrial sectors in the CEE countries, sections BCDE and F, indicate a negative relationship between employment adjustments in the period of economic fluctuations and the general level of seasonality of employment. The graphical analysis shows that

section F, i.e. the section with a higher level of seasonal fluctuations, is characterized by a relatively stronger adjustment of employment during economic fluctuations. In industrial sectors, section F, the location of points on the figure indicates a higher response of employment adjustments during cyclical fluctuations to changes in the general level of seasonality, in the BDCE cross-section this response is rather low. However, the small number of observations makes it difficult to statistically describe the relationship.

Conclusions

The scientific literature, especially labour market theories and theories of cyclical fluctuations, extensively address the problem of employment fluctuations, but usually clearly separate the problem of cyclical fluctuations in employment from its seasonality. Cyclical fluctuations in employment have been the subject of many publications. While, there are fewer analyses of seasonality of employment and they usually limit the scope of their studies selectively to industries, regions. This is an unjustified approach, since comparing cyclical fluctuations in employment with its seasonality provides insight into the full dynamics of employment fluctuations. Therefore, the article focuses on comparing cyclical fluctuations in employment with its seasonality. The pattern of seasonality of employment is more predictable, so it was assumed that much could be learned from it about cyclical fluctuations in employment. As a result, this can make it easier for enterprises and labour market institutions to formulate more flexible employment practices that can be used in crisis situations.

The empirical study presented in the article focused on the analysis of cyclical and seasonal fluctuations in employment in the industrial sector in the CEE countries from 1q.1995 to 4q.2021. The results of the empirical analyzes helped verify the adopted research hypotheses and formulate generalized conclusions.

The analysis of labour hoarding showed that in the industrial sector of Central and Eastern Europe, labour hoarding was a common practice of employment during economic fluctuations, and its level did not differ significantly between countries. These conclusions allow for a positive verification of the hypothesis about the common use of the practice of adjusting employment in the period of changes in the economic situation, with a higher level of labour hoarding in the section BCDE compared to section F. In addition, labour hoarding analysis showed that in the section BCDE, labour hoarding meant no adjustment in the number of employees with a noticeable adjustment in the number of working hours. In section F, enterprises used the working time adjustment mechanism less frequently. Conclusions from the analysis of employment adjustments in the period of production cyclical fluctuations also allowed for the adoption of the hypothesis that mitigating employment adjustments through adjustments to the number of hours worked, with these adjustments being more often used in the section BCDE than in the section F.

The study of differentiation of employment seasonality and seasonal adjustment of employment in industrial sectors of the CEE countries showed that the general level of seasonality of employment, i.e. the seasonality of the number of employees and the number of hours worked, was higher in the section F than in the section BCDE. Moreover, in both sections of the industrial sector, the level of seasonal fluctuations in the number of employees was lower than the level of seasonal fluctuations in the number of hours worked. Seasonal working hours adjustment is therefore a mechanism widely used in the industrial sector in the CEE countries. The conclusions from the study of the seasonality of employment confirmed the assumption formulated in the form of hypothesis 3. In the industrial sector in the section BCDE and section F in the CEE countries, there is a significant seasonality in aggregate employment and it is differentiated between sections, with seasonal fluctuations in the number of employees being smaller than seasonal fluctuations in the number of hours worked.

A graphical comparison of labour hoarding practices and employment seasonality fluctuations on the example of employment in the industry sector of the CEE countries revealed little correlation between employment adjustments during economic fluctuations and the overall level of employment seasonality. The negative relationship and the specificity of labour hoarding suggest that changes in the seasonality of employment and its cyclicality have the same direction, which confirms that in the industrial sector of the CEE countries, labour hoarding during economic fluctuations are also characterized by less seasonality of employment. The finding indicates that the mechanism of cyclical and seasonal employment adjustment may be related to each other. The speed at which employment adjusts to economic fluctuations may depend on its tendency to fluctuate during the year. However, this conclusion requires statistical confirmation.

The results of the empirical analyses resulted in some general conclusions. Labour hoarding is currently a common employment practice in industrial enterprises, both during cyclical fluctuations and seasonal fluctuations in production. Industrial enterprises in the first periods of economic downturn launch mechanisms to adjust employees' working hours without laying off workers (there is no clear cyclical fluctuation in employment). The explanation for this action is the assumptions of labour demand theory. Enterprises optimize their hiring decisions by considering the level of short-term employee underutilization that is acceptable to the enterprise. This level depends, among other things, on the individual situation of the enterprise, the individual characteristics of the employees and the market situation. The reasons for the small cyclical adjustments in employment in the industrial sector can be found in the financial situation of enterprises (the better the economic situation of the enterprise, the smaller the cyclical fluctuations in employment), level of technologies used (more advanced production technology makes it necessary to keep highly specialized workers even during a crisis). A possible explanation is also the enterprise's ability to forecast future market situations (enterprises that perform market analysis are characterized by more flexible employment practices). Current labour shortages in the labour market are

further fuelling labour hoarding practices at enterprises, and the increase in demand
for highly skilled workers is working similarly. All of these reasons contribute to the
observed low adjustment of employment during business cycles and lower employ-
ment seasonality. Findings from the analysis of seasonality of employment indicate,
similarly, that enterprises with more seasonal employment also adjust employment
more flexibly during business cycles. Thus, the seasonality of employment may be one
potential reason for its cyclicality. By observing patterns of seasonality in employment,
enterprises and labour market institutions can create conditions that will promote their
adaptation to adjust employment during business cycles.

The finding of the relationship between cyclical and seasonal employment fluc-
tuations has set some interesting directions for future research. The first direction
for future research is to introduce a larger set of research facilities, going beyond the
industrial sector and the group of 11 CEE countries. It can be assumed that extending
the subjective and spatial scope of the study would ensure greater statistical precision
of the results and a stronger basis for drawing conclusions. The second direction of
research is the inclusion in the analysis of microdata on employment adjustments
during cyclical and seasonal fluctuations. A survey among enterprises would allow
for broadening the possibilities of interpretation, identifying the factors responsible
for the application of the employment adjustment mechanism during economic
fluctuations and throughout the year, e.g. in connection with the financial situation
of the enterprises, technical progress or selected groups of employees.

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