JOURNAL OF SECURITY AND SUSTAINABILITY ISSUES
ISSN 2029-7017 print/ISSN 2029-7025 online
2022 Volume 12
http://doi.org/10.47459/jssi.2022.12.8

THE IMPACT OF THE COVID-19 PANDEMIC ON ENTERPRISES IN POLAND IN VIEW OF ECONOMIC SAFETY

Bartosz Kozicki [1], **Szymon Mitkow**[2], **Tadeusz Bąk**[3], **Stanisław Topolewski**[4]

[1, 2]*Military University of Technology, Poland*
[3]*State Higher School of Technology and Economics in Jaroslaw, Poland*
[4]*University of Natural Sciences and Humanities in Siedlce, Poland*

E-mails: [1]bartosz.kozicki@wat.edu.pl; [2]szymon.mitkow@wat.edu.pl;
[3]tedbak@wp.pl; [4]stanislaw.topolewski@uph.edu.pl

Received 15 March 2022; accepted 11 May 2022; published 30 May 2022

Abstract. The article presents a multidimensional comparative analysis of the number of employees in the enterprise sector in Poland on a quarterly basis between 2010-2021 and new and withdrawn jobs dynamically in terms of economic security. The volume of employment and salary for work in Poland in the enterprise sector by type of activity was analyzed. The last stage of the research was the analysis and evaluation of the time series of salaries in Poland and its forecasting for the future.

Keywords: economic security, multidimensional comparative analysis, enterprise, COVID-19, forecasting.

Reference to this paper should be made as follows: Kozicki, B., Mitkow, S., Bąk, T., Topolewski, S. 2022. The impact of the Covid-19 pandemic on enterprises in Poland in view of economic safety. *Journal of Security and Sustainability Issues*, 12, 97-108. http://doi.org/10.47459/jssi.2022.12.8

JEL Classifications: O10, O11

1. Introduction

The COVID-19 pandemic has led to major changes in global markets (Besenyő, Kármán, 2020; Okunola, Fakunle, 2021; Periokaite, Dobrovolskiene, 2021; Kostiuk et al., 2021; Kinowska, 2021; Mikołajczak et al., 2022). Even in such an economic power like the United States, a strong and dynamic increase in the unemployment rate was observed - to the level of 14,6% in April 2020. From February to April 2020, the increase was 11,2 percentage points (Kozicki, Mitkow, 2021). The impact of the virus on the situation in the world has become a premise for the research problem of the study: Will the use of a multidimensional comparative analysis allow to observe the impact of the COVID-19 pandemic on the enterprise sector in Poland? The aim of the study is a multidimensional comparative analysis of the enterprise sector in Poland in terms of the dynamic analysis of the number of jobs and salaries in terms of the maintenance of economic security. A research hypothesis was outlined for the research problem and the aim of the work. The use of a multidimensional comparative analysis and time series analysis of salaries in the enterprise sector in Poland will allow to observe the impact of the COVID-19 pandemic on this sector and to forecast salaries for 2022-2023. The research method of a multivariate comparative analysis was used in the article in the form of clustering and the forecasting with the Holt's exponential smoothing method (Jurgilewicz et al. 2022).

2. Analysis of the literature on the research subject

In the literature, an enterprise is considered to be an organizational unit conducting economic activity, legally, organisationally, territorially and economically separated, with human, financial, material and intangible resources (Encyclopedia of management, 2022). Enterprises focus on three types of activity: trade, service or production. The goal is to make a profit, i.e. a positive difference between the income earned and the costs incurred. Each enterprise has legal capacity and its form is described in a given legal system.

A multidimensional comparative analysis was used in the study. It is a group of statistical methods that simultaneously analyze at least two variables describing each examined object (Łuniewska, 2006, p. 9). An analysis and evaluation of the time series of salaries in the enterprise sector in Poland was also conducted. The methodology of the analysis and evaluation of time series in the literature is widely described (Mitkow et al., 2021; Rabej, 2018; Makridakis et al., 1998; Zagdański, Suchwałko, 2016; Czyżyński, Klóska, 2019,). The research made it possible to select the Holt's exponential smoothing method for the forecasting of data on salaries in enterprises in Poland (Dittmann, 2016).

The research conducted in the study is important in terms of the maintenance of economic security in Poland. Economic security is the certainty of survival consisting in access to markets and financial resources which guarantees the stable development of its entities (Nurzyńska, 2016, p. 22). According to W. Kitler, it is a kind of national security, a process involving various activities, the main goal of which is to ensure the economic conditions necessary for the survival, prosperity and sustainable development of society, as well as the efficient operation of the state and its institutions (Kitler, 2011, p. 49). The changes in the level of economic security in Poland have certainly been and are being influenced by the COVID-19 pandemic. The first case of this infectious disease was reported in Wuhan, China in December 2019 (Zhu, Zhang, et al., 2020). Due to its rapid spread and the threat it posed to human health (Matuka, 2020), on March 11, 2020, the World Health Organization declared COVID-19 a pandemic (Satomi, et al., 2020). This, in turn, led, especially at the beginning of the pandemic, to a stagnation in the passenger air transport sector (Sebastian Mikosz for BI ..., 2020; Derewienko, 2021), and then to its large limitation (Kozicki, Stajniak, 2021).

In Poland, efforts were made to limit the impact of the pandemic, many orders were introduced, including the necessity to wear face masks (Gajos-Kaniewska, 2020) and the widespread use of disinfectants. Since the outbreak of the pandemic in companies around the world, remote work with the use of IT software has started to develop dynamically on an unprecedented scale. In Poland, in 2020, about 8,9 percent of employees used remote work (Anagnostopulu, 2021). In the ranking of countries in Europe in terms of the number of employees working remotely, Poland took fifteenth place. Such a low level of remote work in Poland resulted from the specific nature of the activities of Polish enterprises. The largest number of workers in Poland is employed in the industrial processing, trade, repair of motor vehicles, transport and storage and in construction. These types of activities must in most cases be conducted stationary. During the COVID-19 pandemic, a decrease in the number of people employed was observed in Poland (Leśniak, 2021; Jurgilewicz et. al., 2021). There was also a visible reduction in the salaries paid to employees (Labor market in Poland in 2020 ..., 2021).

3. Multidimensional analysis of enterprises in Poland

The research began with a line chart of data on the number of employees in the enterprise sector in Poland on a quarterly basis between 2010-2021 in thousands (Fig. 1).

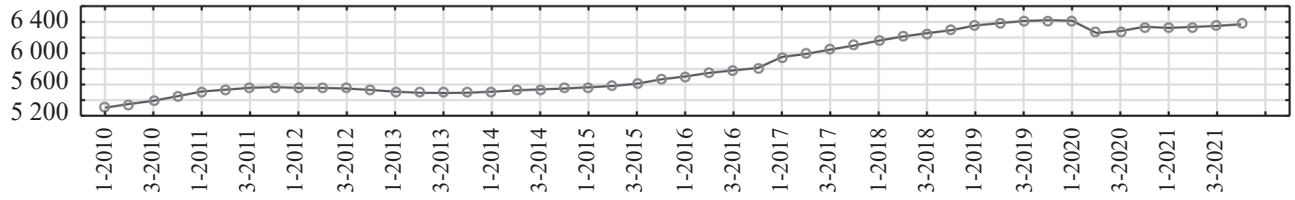

Figure 1. A line chart of data on the number of employees in the enterprise sector in Poland on a quarterly basis between 2010-2021 in thousands

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The data in Figure 1 shows that from 2010 to 2012, a growing trend in the number of employees in the enterprise sector in Poland was visible. At that time, the arithmetic means of the number of employees in the analyzed years showed the following values: 2010 - 5 373 750; 2011 - 5 554 250; 2012 – 5 547 500. In 2013, a decrease to the arithmetic mean level of 5 497 000 was observed. Then, from 2013 to 2019, a growing trend was visible. The arithmetic means of the number of employees in the analyzed period per years were as follows: 2014 - 5 529 250; 2015 – 5 604 750; 2016 – 5 760 500; 2017 – 6 020 750; 2018 – 6 230 000; 2019 – 6 392 250.

In 2020, a decrease in the number of employees in the enterprise sector was observed to the arithmetic mean level of 6 323 500. In 2021, however, an increase to 6 344 000 employees.

In the period under consideration, the highest standard deviations from the arithmetic mean were observed in the following years: 2020 – 69 553,3; 2017 – 64 095,6; 2010 - 62,275,6; 2018 - 57 515,2; 2016 - 46 722,6; 2015 – 44 244,6; 2019 – 30 598,2; 2011 – 24 998,3; 2021 - 19 544,8; 2014 – 17 231,3; 2012 – 12 261; 2013 - 8 124.

At that time, the events in 2020 had a huge impact on the enterprise sector in Poland. The COVID-19 pandemic was announced worldwide. This led to a decline in the number of employees. This trend continued until the end of 2021 with a slight increasing trend dynamically.

The next stage of the research was a multidimensional analysis of newly created jobs in the enterprise sector in Poland. Newly created jobs are jobs created as a result of organizational changes, expansion or change in the profile of activity and all jobs in newly created units (Central Statistical Office, as of 9.04.2022).

The analysis began with a box plot of data on new jobs in enterprises in the group of 16 voivodships in Poland between 2011-2020 in thousands.

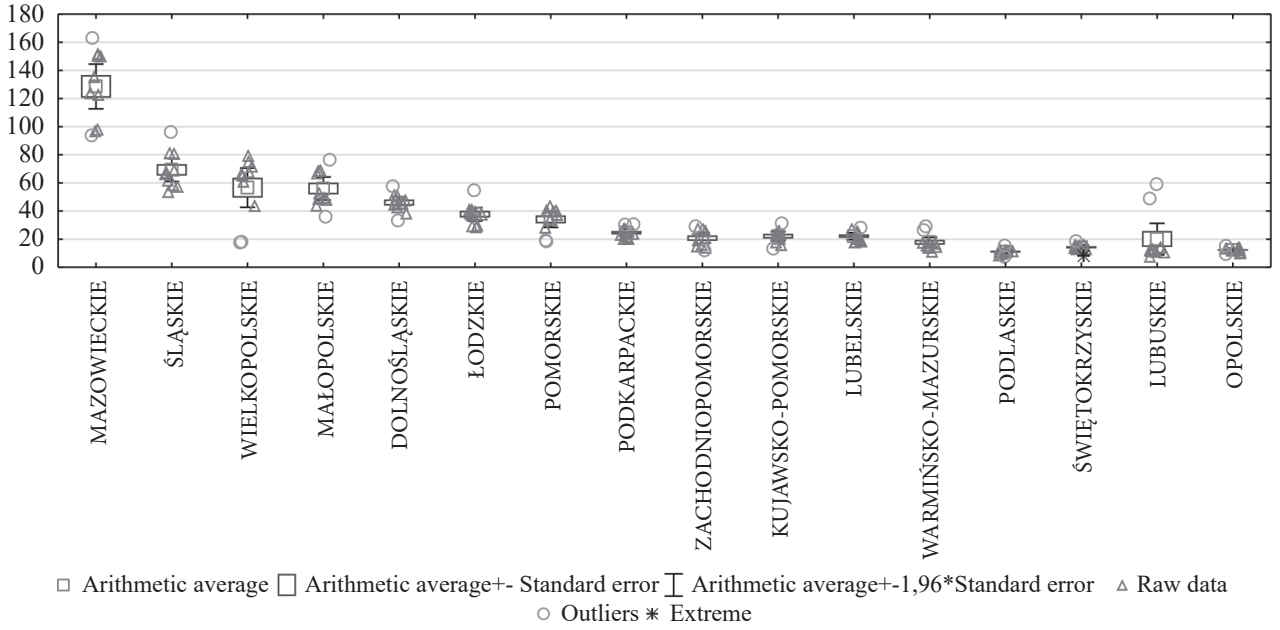

Figure. 2. Box plot of data on new jobs in enterprises in the group of 16 voivodships in Poland between 2011-2020 in thousands

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The data compiled in Figure 2 shows that the highest arithmetic mean of the numbers of new jobs in enterprises in Poland between 2011-2020 can be seen in the following voivodships: mazowieckie: 128 590; śląskie: 69 260; wielkopolskie: 56 600; małopolskie: 55 990; dolnośląskie: 46 010; łódzkie: 37 730; pomorskie: 34 080; podkarpackie: 24 600; lubelskie: 22 150; kujawsko-pomorskie: 22 110; zachodniopomorskie: 20 720; lubuskie: 20 110; warmińsko-mazurskie: 17 800; świętokrzyskie: 14 220; opolskie: 12 340; podlaskie: 11 120.

Considering the outliers and extreme values, it was observed that the highest outlier of new jobs in Poland was in the mazowieckie voivodship in 2014 and amounted to 163 000. The lowest one was in podlaskie voivodship in 2014: 7 500.

Summing up, the lowest outliers in respective voivodeships are 2011-2013 and 2020. The highest outliers, on the other hand, can be seen in 2018.

Then, the data on new jobs in enterprises in years in Poland between 2011-2020 in thousands were analyzed (Fig. 3).

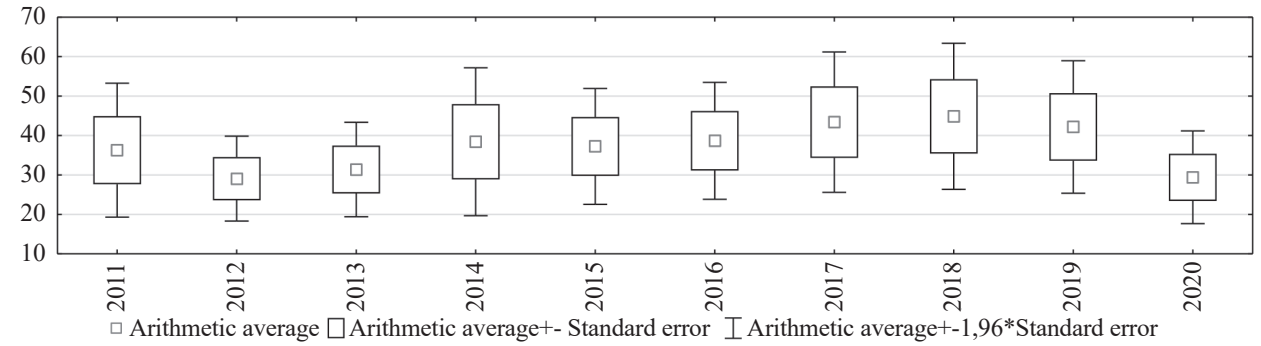

Figure. 3. Box plot of data on new jobs in enterprises in years in Poland between 2011-2020 in thousands

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

Figure 3 shows that the number of new jobs in enterprises in Poland between 2011-2020 fluctuated around the arithmetic mean of 37 089. The largest drops in the number of new jobs in enterprises were observed in the following years:

1. 2020, when there was a decrease by 12 763 jobs compared to 2019;
2. 2012, when there was a decrease by 7 213 jobs compared to 2011.

The decline in the number of new jobs in 2020 was due to the impact of the COVID-19 pandemic.

Then, the study covered data on the withdrawn jobs in enterprises in the group of 16 voivodeships in Poland between 2011-2020 in thousands (Fig. 4).

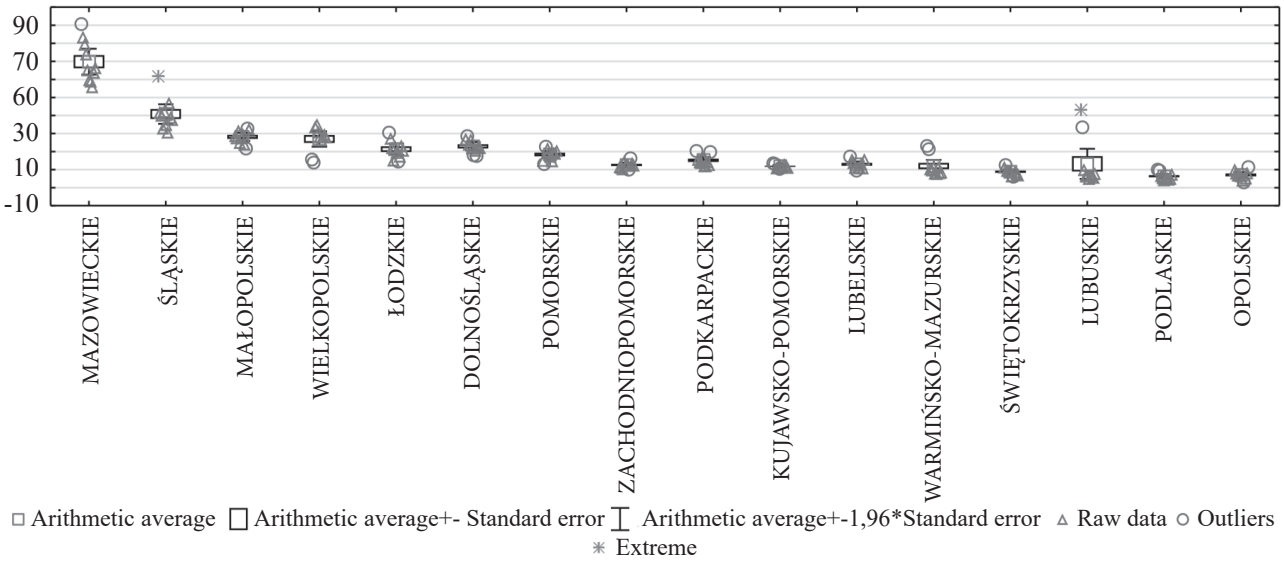

Figure. 4. Box plot of the data on withdrawn jobs in enterprises
in the group of 16 voivodeships in Poland between 2011-2020 in thousands

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

Figure 4 shows that the arithmetic mean of the largest number of withdrawn jobs in the enterprise sector in Poland between 2011-2020 was as follows in respective voivodships (from the highest to the lowest values): in mazowieckie: 69,830; śląskie: 40 820; małopolskie: 28 013; wielkopolskie: 26 970; dolnośląskie: 22 910; łódzkie: 21 330; pomorskie: 18 350; podkarpackie: 15 180; lubuskie: 13 200; lubelskim: 12 930; zachodniopomorskie: 12 590; Warm warmińsko-mazurskie: 12,010; kujawsko-pomorskie: 11 870; świętokrzyskie: 8 830; opolskie: 7 040; podlaskie: 6 360.

Values extremely deviating from the arithmetic mean were observed in two voivodeships:

- śląskie, where the arithmetic mean of the withdrawn jobs in the enterprise sector was 61 700 in 2011;
- lubuskie, where the arithmetic mean of withdrawn jobs in the enterprise sector was 17 200 in 2011.

Then, the research covered data on withdrawn jobs in enterprises in years in Poland between 2011-2020 in thousands.

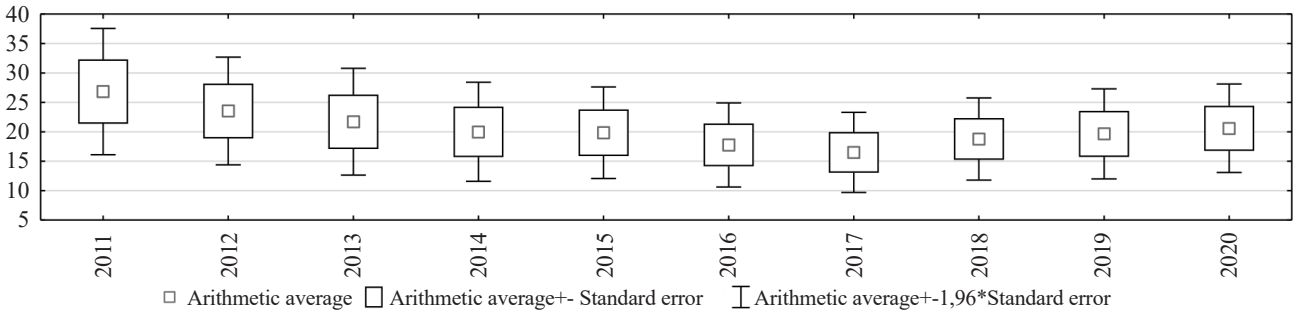

Figure. 5. Box plot of data on withdrawn jobs in enterprises in years in Poland between 2011-2020 in thousands

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The data presented in Figure 5 shows that from 2011 to 2017, a downward trend in the number of jobs withdrawn in the enterprise sector in Poland is visible. On the other hand, from 2017 to 2020, a growing trend is visible. The arithmetic mean of the number of withdrawn jobs in the enterprise sector in Poland is 20 522 jobs. However, the standard deviation from the arithmetic mean was at the level of 16 511 jobs.

Another study is the analysis of data on employment in the enterprise sector by type of activity in thousands in February 2022 (Fig. 6).

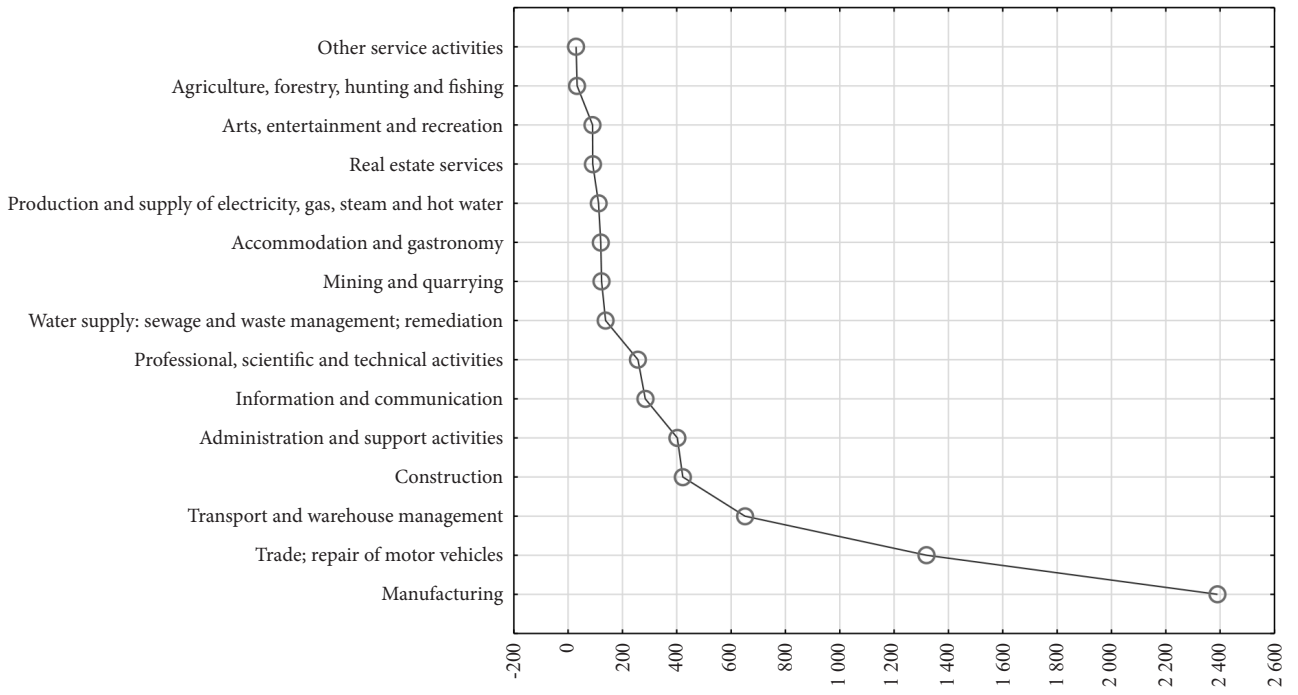

Figure. 6. Line chart of employment data in the enterprise sector by type of activity in thousands in February 2022

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

Figure 6 shows that most people were employed in the following types of activity in the enterprise sector in Poland in February 2022:

1. Manufacturing: 2 390 600;
2. Trade; repair of motor vehicles: 1 319 400;
3. Transport and warehouse management: 651 400;
4. Construction: 421 900;

5. Administration and support activities: 401 900;
6. Information and communication: 283 800;
7. Professional, scientific and technical activities: 257 100;
8. Water supply: sewage and waste management; remediation: 138 100;
9. Mining and quarrying: 123 300;
10. Accommodation and gastronomy: 120 300;
11. Production and supply of electricity, gas, steam and hot water: 112 000;
12. Real estate services: 90 600;
13. Arts, entertainment and recreation: 90 300;
14. Agriculture, forestry, hunting and fishing: 33 300;
15. Other service activities: 29 600.

Then, the research covered the average salary rates in the types of activity in the enterprise sector in Poland in February 2022.

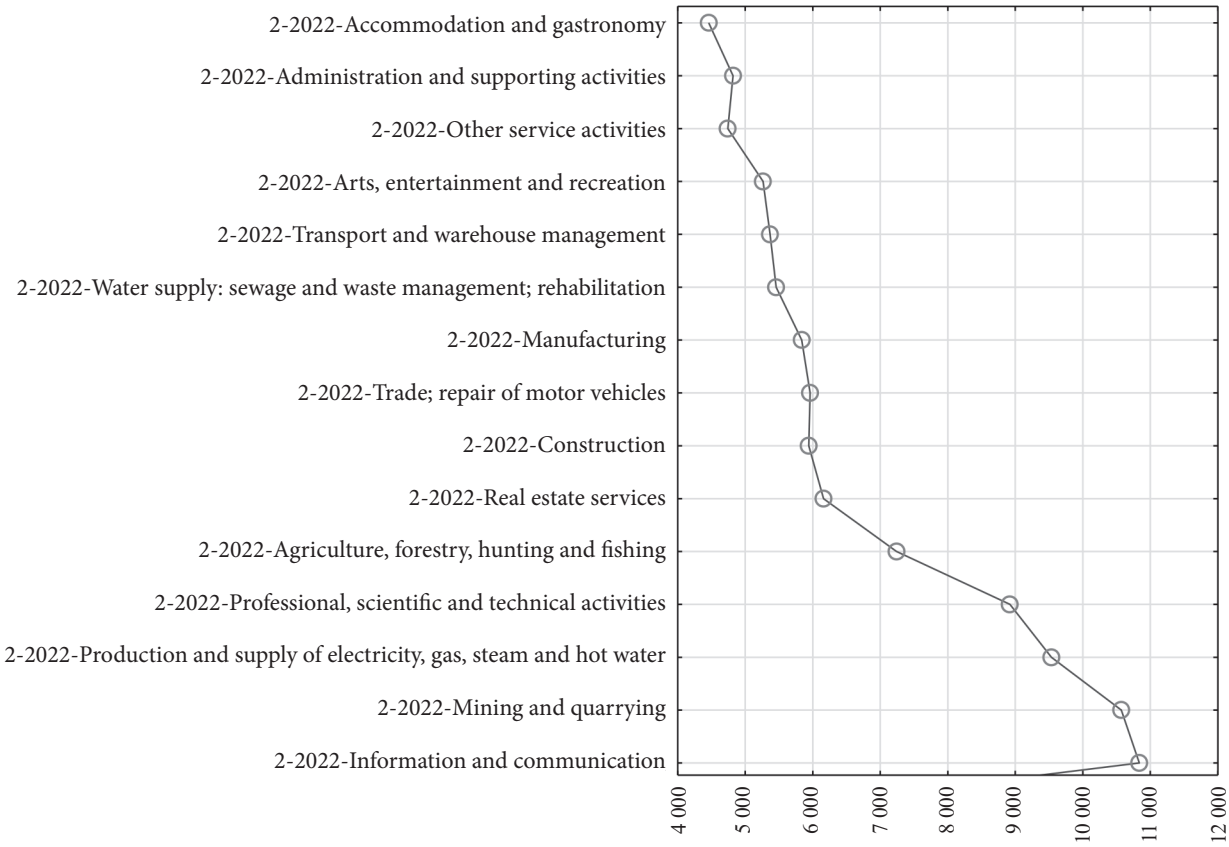

Figure. 7. Line chart of data on salaries in the enterprise sector by type of activity in thousands in February 2022

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The ranking of salary rates by types of activity in the enterprise sector was as follows (from the highest to the lowest values):

1. Information and communication: 10 837,01;
2. Mining and quarrying: 10 571,51;
3. Production and supply of electricity, gas, steam and hot water: 9 536,43;
4. Professional, scientific and technical activities: 8 920,93;
5. Agriculture, forestry, hunting and fishing: 7 241,19;

6. Real estate services: 6 161,74;
7. Construction: 5 942;
8. Trade; repair of motor vehicles: 5 960,64;
9. Manufacturing: 5 835,83;
10. Water supply: sewage and waste management; rehabilitation: 5 459,4;
11. Transport and warehouse management: 5 368,1;
12. Arts, entertainment and recreation: 5 265,38;
13. Other service activities: 4 743,19;
14. Administration and supporting activities: 4 820,02;
15. Accommodation and gastronomy: 4 459,11.

The last stage of the research is the analysis of average salaries in the enterprise sector in Poland from January 2010 to February 2022. First, a line graph of the corporate salary data in thousands from January 2010 to February 2022 was outlined and evaluated.

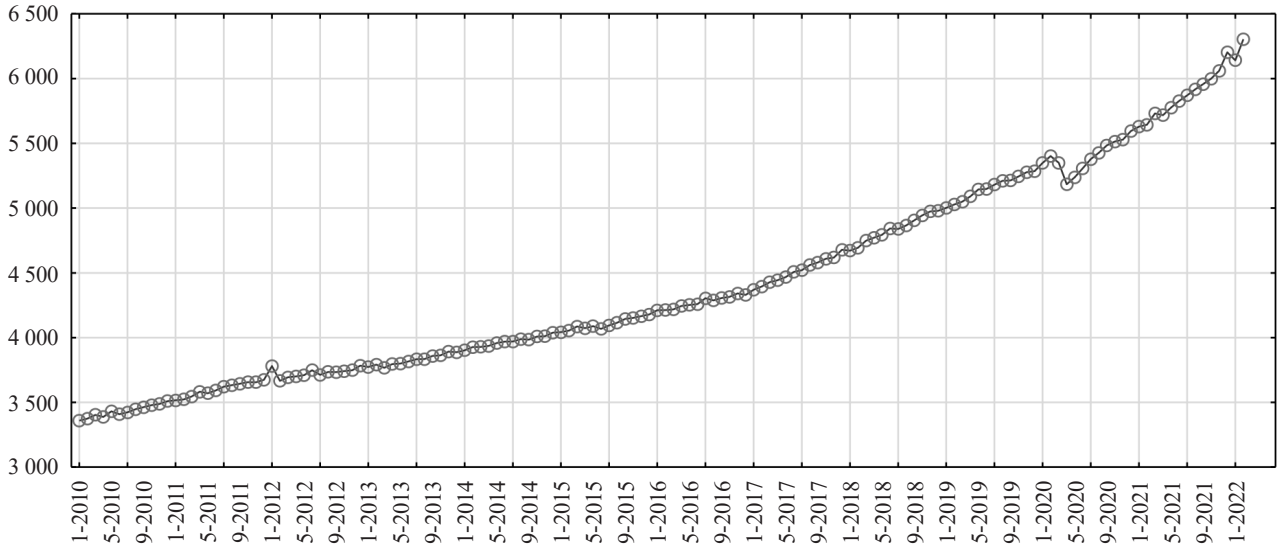

Figure. 8. A line chart of data on salaries in the enterprise sector in thousands from January 2010 to February 2022

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The information presented in Figure 8 allows us to observe a growing trend in salaries in the enterprise sector in Poland with a visible decrease in April 2020 compared to March 2020 by PLN 12,18. The arithmetic mean of salaries in the analyzed period was PLN 4 416,56. Standard deviation from the arithmetic mean is PLN 771,05.

3. The forecasting of salaries in the enterprise sector in Poland

The last stage of the research was the forecasting of the considered data using the Holt's exponential smoothing method. The obtained forecasts together with the actual data and remainders are outlined in Figure 9.

The last stage of the research was the forecasting of the considered data using the Holt's exponential smoothing method. The obtained forecasts together with the actual data and remainders are outlined in Figure 9.

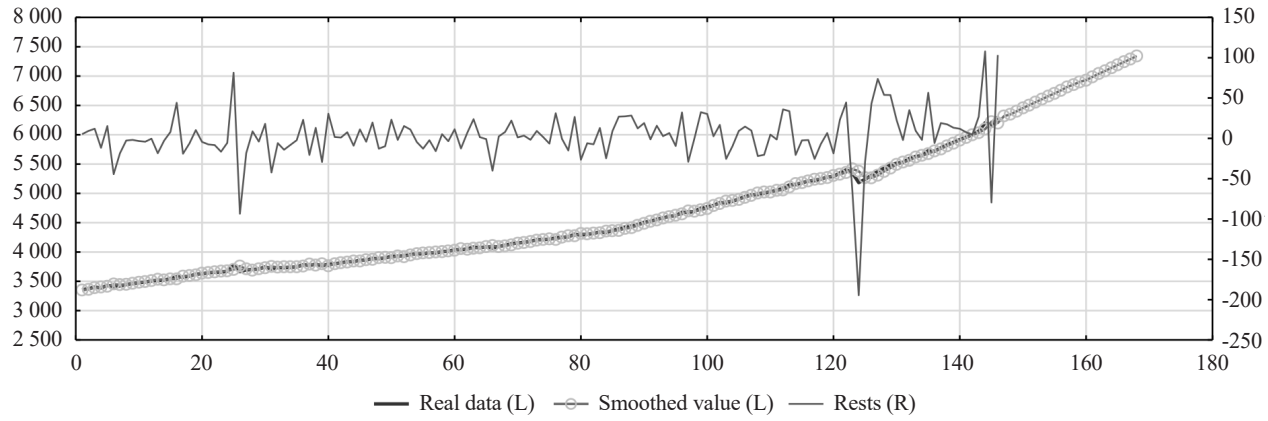

Figure. 9. Forecasting of data on salaries in the enterprise sector in thousands for 2022-2023

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The obtained forecasts show an upward trend. The arithmetic mean of salaries in the enterprise sector in Poland in 2022 will amount to PLN 6 478,74 and in 2023 it will increase to PLN 7 067,67. The standard deviation from the arithmetic mean of the forecasts is PLN 348,64. The median of the forecasts obtained is PLN 6 785,16. Table 1 presents the analysis of forecasting errors.

Table 1. Analysis of forecasting errors

Index	Value
Mean percentage error	0,05
Mean absolute percentage error	0,43

Source: own study based on data obtained from the website: https://bdl.stat.gov.pl/ (as of 9.04.2022)

The analysis of forecasting errors shows that the forecast obtained is very good. The mean absolute percent error was 0,43 percent and the mean percent error was 0,05 percent.

4. Summary and conclusions

The COVID-19 pandemic had a major impact on the corporate sector in Poland. In 2020, it led to a decrease in the number of employees to the arithmetic mean level of 6 323 500 from the level of 6 392 250 recorded in 2019.

The analyzes conducted in the study show that as a result of the impact of the pandemic, declines in the number of new jobs in the enterprise sector in Poland were visible. In summary, the lowest outliers in respective voivodships were observed between 2011-2013 and in 2020, when an infectious disease pandemic was announced. On the other hand, the highest outliers in the number of new jobs in the enterprise sector in Poland are 2018 - arithmetic mean 44 863.

The voivodeship in which the most novel jobs were created and withdrawn was mazowieckie. The arithmetic mean of new jobs between 2011-2020 was 128 590, while for the jobs withdrawn it was 69 830.

The largest number of people in the enterprise sector in Poland in February 2022 was employed in the following types of activity:

1. industrial processing: 2 390 600;
2. trade and repair of motor vehicles: 1 319 400;
3. transport and warehouse management: 651 400;
4. construction: 421 900.

The above-mentioned industries and their occupancy contributed to the low level of remote work in Poland. They mostly require stationary work.

The highest salaries were recorded in February 2022 in IT and communication - at the level of PLN 10 837,01.

An upward trend was observed in the time series of salaries in the enterprise sector in Poland between 2010-2021. This became the premise for the forecasting of the series for the future with the use of the Holt's exponential smoothing method. The arithmetic mean of salaries in the enterprise sector in Poland in 2022 will amount to PLN 6 478,74 and in 2023 it will increase to PLN 7 067,67.

The observed regularities described in the study are extremely important in terms of the maintenance of the economic security of Poland. Therefore, it is important to analyze data on enterprises constantly and systematically in Poland in order to respond quickly and precisely to dynamic deviations caused by random factors, such as, for example, the COVID-19 infectious disease pandemic.

References

Anagnostopulu, A. 2021. Business Insider. *Praca zdalna w pandemii. Te liczby rozwiewają powszechne złudzenie*, https://businessinsider.com.pl/twoje-pieniadze/praca/praca-zdalna-liczba-osob-pracujacych-z-domu-w-polsce-w-2020-r/8yvnxq9, accessed 10.04.2022

Besenyő, J., Kármán, M. 2020. Effects of COVID-19 pandemy on African health, political and economic strategy. *Insights into Regional Development,* 2(3), 630-644. https://doi.org/10.9770/IRD.2020.2.3(2)

Czyżyński, R., Klóska, R. 2019. *Wybrane zagadnienia z prognozowania (Selected issues of forecasting)*, Szczecin: Wydawnictwo Naukowe Uniwersytetu Szczecińskiego.

Derewienko, E. 2021. *Pandemia cofnęła lotnictwo o 15 lat, lotniska świeciły pustkami. W ubiegłym roku 70 proc. pasażerów mniej niż w 2019 (The pandemic had shifted aviation back 15 years, and the airports were empty. Last year, 70 percent. passengers less than in 2019)* https://300gospodarka.pl/news/pandemia-cofnela-lotnictwo-o-15-lat-2020-rok-liczba-pasazerow-70-proc-mniej, accessed 10.04.2022

Dittmann, P. 2016. *Prognozowanie w przedsiębiorstwie. Metody i ich zastosowanie (Forecasting in the enterprise. Methods and their application)*, Warszawa: Wolters Kluwer Polska Sp. z o.o., Wydawnictwo Nieoczywiste.

Encyklopedia zarządzania (Management encyclopedia), hasło: Przedsiębiorstwo, 10.04.2022, https://mfiles.pl/pl/index.php/Przedsi%C4%99biorstwo , accessed 10.04.2022

Gajos-Kaniewska, D. 2020. *Obowiązek noszenia maseczek od 16 kwietnia – jest nowe rozporządzenie (Obligation to wear masks from April 16 - there is a new regulation)* https://www.rp.pl/prawo-dla-ciebie/art773711-obowiazek-noszenia-maseczek-od-16-kwietnia-jest-nowe-rozporzadzenie , accessed 10.04.2022

Główny Urząd Statystyczny (Central Statistical Office), https://bdl.stat.gov.pl/bdl/dane/podgrup/tablica, accessed 9.04.2022

Jurgilewicz , M., Malec, N., Piwowarski, J., Kozicki, B. 2021. Forecasting the Reserve Money of the Central Bank of Poland in the Aspects of Economy Security. *Journal of Security and Sustainability Issues*, 11, ISSN 2029-7017, 525-536. https://doi.org/10.47459/jssi.2021.11.49

Jurgilewicz, M., Kozicki, B., Piwowarski, J., Grabowska, S. 2022. Contemporary challenges for the economic security of enterprises in Poland. *Journal of Security and Sustainability Issues*, 12, ISSN 2029-7017, 71-80. https://doi.org/10.47459/jssi.2022.12.6

Kinowska, H. 2021. Core features for the design of remuneration systems for sustainable human resource management during the covid-19 pandemic: Polish companies' experiences. *Entrepreneurship and Sustainability Issues*, 8(4), 389-402. http://doi.org/10.9770/jesi.2021.8.4(23)

Kitler, W. 2011. *Bezpieczeństwo narodowe RP. Podstawowe kategorie, uwarunkowania, system (National security of the Republic of Poland. Basic categories, conditions, system)*, Warszawa: Akademia Obrony Narodowej.

Kostiuk, Y., Kohútová, V., Straková, J., Koleda, N. 2021. Added value in the transport sector during COVID-19 pandemic: a comparison of the EU countries. *Entrepreneurship and Sustainability Issues*, 9(2), 303-315. http://doi.org/10.9770/jesi.2021.9.2(20)

Kozicki, B., Mitkow, Sz. 2021. A multidimensional comparative analysis of the labor market in the United States in terms of economic security, *Systemy Logistyczne Wojsk,* 1(54), https://doi.org/10.37055/slw/140381

Leśniak, G.J. 2021, Główny Urząd Statystyczny, *GUS: W 2020 r. pandemia i lockdown zaburzyły dotychczasowe trendy na rynku pracy (Central Statistical Office, GUS: In 2020, the pandemic and lockdown disrupted the current trends in the labor market)*, https://www.prawo.pl/kadry/jak-pandemia-wplynela-na-rynek-pracy-w-2020-r-analiza-gus,511639.html, accessed 10.04.2022

Łuniewska, M., Tarczyński, W. 2006. *Metody wielowymiarowej analizy porównawczej na rynku kapitałowym (Methods of multidimensional comparative analysis on the capital market)*, Warszawa: Wydawnictwo Naukowe PWN.

Makridakis, S.G., Wheelwright, S.C., Hyndman, R.J. 1998. *Forecasting methods and applications*, New York: John Wiley and Sons.

Matuka, A. 2020, COVID-19 Outbreak and US Economic Policy Uncertainty: An ARDL Approach. *SSRN Electronic Journal* https://www.researchgate.net/publication/344083397

Mikołajczak, P., Schmidt, J., Skikiewicz, R. 2022. The COVID-19 pandemic consequences to the activity of NGOs. *Entrepreneurship and Sustainability Issues*, 9(3), 330-349. http://doi.org/10.9770/jesi.2022.9.3(20)

Mitkow, Sz., Tomaszewski, J., Kozicki, B. 2021. *Bezpieczeństwo militarne a potencjał osobowy Sił Zbrojnych RP (Military security and the personnel potential of the Polish Armed Forces)*, Warszawa: Wydawnictwo Wojskowej Akademii Technicznej.

Nurzyńska, A. 2016. *Bezpieczeństwo usług w międzynarodowym transporcie lotniczym przewozów pasażerskich (Security of services in international passenger air transport)*, Katowice: Wydawnictwo Naukowe SOPHIA.

Okunola, J. L., Fakunle, S. O. 2021. Community participation: a pragmatic solution to negative impacts of Covid-19 on household's socioeconomic lives. *Insights into Regional Development,* 3(4), 21-33. http://doi.org/10.9770/IRD.2021.3.4(2)

Periokaite, P., Dobrovolskiene, N. 2021. The impact of COVID-19 on the financial performance: a case study of the Lithuanian transport sector. *Insights into Regional Development*, 3(4), 34-50. http://doi.org/10.9770/IRD.2021.3.4(3)

Rabiej, M. 2012. *Statystyka z programem Statistica*, Gliwice: Wydawnictwo Helion.

Rynek pracy w Polsce w 2020 roku – jak zarabialiśmy w czasie pandemii? (The labor market in Poland in 2020 - how did we earn during the pandemic?), 23.02.2021, BNP Paribas, https://www.bnpparibas.pl/blog/rynek-pracy-w-polsce-w-2020-roku-jak-zarabialismy-w-czasie-pandemii, accessed 10.04.2022

Satomi, E. et al., April 2020, Alocação justa de recuros de saúde escassos diante da pandemia de COVID-19 Considerações éticas, *Einstein*, São Paulo 18(2), 1-5. https://doi.org/10.31744/einstein_journal/2020AE5775

Sebastian Mikosz dla BI: Nic nie zapowiadało takiego załamania rynku lotniczego (Sebastian Mikosz for BI: Nothing foreshadowed such a collapse of the aviation market), 25.12.2020, Business Insider, https://businessinsider.com.pl/firmy/strategie/koronawirus-covid-19-a-linie-lotnicze-podsumowanie-2020-roku-sebastian-mikosz-iata/zcjyyc2 , accessed 10.04.2022

Stajniak, M., Kozick,i B. 2021. *Air passenger transport in Europe before and during the COVID-19 pandemic versus economic security*, IBIMA – International Business Information Management Conference (37th IBIMA), Cordoba, Spain.

Zagdański, A., Suchwałko, A. 2016. *Analiza i prognozowanie szeregów czasowych. Praktyczne wprowadzenie na podstawie środowiska R (Time series analysis and forecasting. Practical introduction based on the R environment)*, Warszawa: Wydawnictwo Naukowe PWN SA.

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., et al. 2020. A Novel Coronavirus from Patients with Pneumonia in China. *New England Journal of Medicine*, 82(8), 727-733.

Bartosz KOZICKI is an assistant professor at the Military University of Technology, PL. Research interests: national security, internal security.
ORCID ID: 0000-0001-6089-952x.

Szymon MITKOW is a Professor at the Military University of Technology, PL. Research interests: national security, internal security.
ORCID ID: 0000-0003-2845-2589.

Tadeusz BĄK is a Professor at the State Higher School of Technology and Economics in Jaroslaw, PL. Research interests: internal security, sociology.
ORCID ID: 0000-0001-8826-6978.

Stanisław TOPOLEWSKI is a Professor at the University of Natural Sciences and Humanities in Siedlce, PL. Research interests: national security, internal security.
ORCID ID: 0000-0001-8268-3754.