

THE IMPACT OF THE COVID-19 PANDEMIC ON THE FINANCIAL CONDITION OF LARGE ENTERPRISES IN POLAND

Monika MIŚKIEWICZ-NAWROCKA

University of Economics in Katowice; monika.miskiewicz@ue.katowice.pl, ORCID: 0000-0002-2766-1322

Purpose: The aim of the research is to assess the financial condition of large enterprises in Polish voivodeships, taking into account the division into the private sector and the public sector in the years 2007-2021, and to try to classify the analyzed voivodeships into separate classes according to the level of the studied phenomenon.

Design/methodology/approach: To achieve the goal, the TOPSIS method was used, which allows for the assessment of the examined objects and their comparison in terms of the analyzed phenomenon.

Findings: The conducted analysis made it possible to rank and group voivodeships in terms of the financial condition of large enterprises, both for the public and private sectors. When researching the impact of the Covid-19 pandemic on the financial condition of large non-financial enterprises, it can be noticed that enterprises started to reduce the costs of their economic activities, the total number of enterprises decreased, but the percentage of enterprises reporting a net profit on their economic activity increased. Despite the difficult condition caused by the pandemic, companies were able to pay off their obligations.

Research limitations/implications: The financial condition of enterprises, estimated with the TOPSIS synthetic measure, is a variable which is not directly measurable. Its value is generated by observations of diagnostic variables that are directly measurable. The choice of diagnostic variables is a subjective choice of the researcher and should be carried out reliably, preceded by studies of the relevant literature.

Practical implications: It shows changes and highlights the differences between the financial condition of enterprises in different voivodeships. Indicates objects that behave similarly.

Social implications: (if applicable) What will be the impact on society of this research? How will it influence public attitudes? How will it influence (corporate) social responsibility or environmental issues? How could it inform public or industry policy? How might it affect quality of life? Not all papers will have social implications.

Originality/value: Showing that the use of the TOPSIS method to analyze the financial condition of public and private sector enterprises in Poland is possible and allows for the classification of voivodeships in terms of the studied phenomenon. The article, the use of the method is useful for traders and investors.

Keywords: TOPSIS measure, linear ordering, financial condition of enterprises.

Category of the paper: research paper.

1. Introduction

The financial condition of the enterprise is an important determinant of the changes taking place in it. The conducted research shows that there is a strong positive correlation between the financial indicators and the investment decisions made (Kolegowicz, Krzemiński, 2019). Preparation of a reliable opinion on the state of the enterprise, reflecting the actual state of the enterprise, requires conducting appropriate studies, which may not be limited only to the financial statements (Hamrol, 2013). The assessment of the company's financial condition should be carried out in time and space, and therefore should take into account the internal and external conditions of the assessed enterprise. Internal factors include the selection of appropriate tools (e.g. financial analysis) enabling the analysis of changes taking place in the enterprise and drawing correct conclusions. External factors include the principles of the company's operation against the background of its environment, assessment of the strengths and weaknesses of the enterprise related to the resources held, as well as opportunities and threats in its environment (Gackowska-Cieściów). The subject of the analysis should also be relations at the level of the industry in which the company operates and the phenomena occurring in its closer and more distant environment (Hamrol, 2013). The structure of the company's capital is strongly influenced by both the environment and the factors generated by the sector in which it operates (Szymańska, Jegers, 2014).

The environment of the enterprise, both internal and external, is undoubtedly one of the main determinants of its operation and development. The environment of the enterprise includes not only other entities related to its functioning, but also phenomena and processes that are outside them and which are not influenced by (Kraska, 2022). One of such unpredictable phenomena called "black swan" (Szczepański, 2020) was the outbreak of the Covid-19 pandemic. Its consequences and impact on the economy had a huge impact on many areas of life, both social and economic. The introduced restrictions resulting from the lockdown limited the running, and even in many cases also closing, of economic activities.

The aim of the research is to assess and influence the Covid19 pandemic on the financial condition of large non-financial enterprises in Polish voivodeships, taking into account the division into the private and public sectors in 2007-2021. The TOPSIS measure was used to group voivodeships in terms of the financial condition of enterprises. The research used statistical data from the Local Data Bank of the Central Statistical Office in selected years.

2. TOPSIS measure

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is a linear ordering method in which two reference points of objects in a multidimensional space are determined - a pattern and an anti-pattern. The basis of linear ordering is a synthetic variable (also known as an aggregate variable, a synthetic measure, a synthetic measure of development, a taxonomic measure of development, an aggregate measure of development), the values of which are estimated on the basis of observations of diagnostic variables describing the examined objects. Estimated values of a synthetic variable allow for the ordering of objects in terms of the studied phenomenon.

The construction of the TOPSIS synthetic measure follows the following steps (Hwang, Yoon, 1981; Bał, 2016):

- normalization of variables according to the formula:

$$z_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^n x_{ij}^2}} \quad (1)$$

where x_{ij} – observation of the j -th variable for the object i ,

- estimating the coordinates of the positive ideal:

$$z_{0j}^+ = \begin{cases} \max_i \{z_{ij}\} & \text{for stimulants} \\ \min_i \{z_{ij}\} & \text{for destimulants} \end{cases} \quad (2)$$

- estimating the coordinates of the negative ideal:

$$z_{0j}^- = \begin{cases} \min_i \{z_{ij}\} & \text{for stimulants} \\ \max_i \{z_{ij}\} & \text{for destimulants} \end{cases} \quad (3)$$

- calculating the distance of objects from the positive ideal:

$$d_{i0}^+ = \sqrt{\sum_{j=1}^m (z_{ij} - z_{0j}^+)^2} \quad (4)$$

- calculating the distance of objects from the negative ideal:

$$d_{i0}^- = \sqrt{\sum_{j=1}^m (z_{ij} - z_{0j}^-)^2} \quad (5)$$

- value of an aggregate variable according to the formula:

$$q_i = \frac{d_{i0}^-}{d_{i0}^- + d_{i0}^+} \quad (6)$$

The estimated variable takes values from the interval $q_i \in [0,1]$, where the best object is the one with the highest value of q_i , and the worst one with the lowest value of q_i .

3. Financial condition of large enterprises in Poland in the years 2007-2021

Figure 1-2 shows the average financial results of Polish non-financial enterprises, including net profit and net loss in 2007-2021 for the private and public sectors.

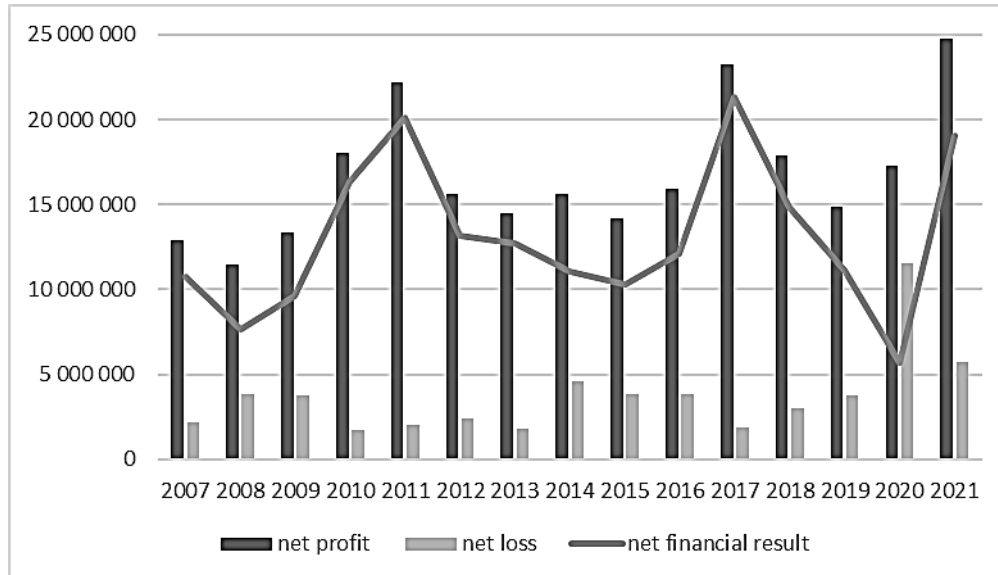


Figure 1. Net financial result, net profit and net loss of public sector non-financial enterprises in Poland in 2007-2021.

Based on the data in Figure 1, it can be noted that the highest values of the net financial result, and also the net profit for public sector enterprises, were recorded in 2011, 2017 and 2021. and the lowest net loss in 2011. The lowest financial result is observed in 2020, i.e. in the year the WHO announced the Covid-19 pandemic. The impact of the pandemic is also visible when analyzing the net loss value, which in 2020 is several times higher than in previous years, which results in a much lower financial result.

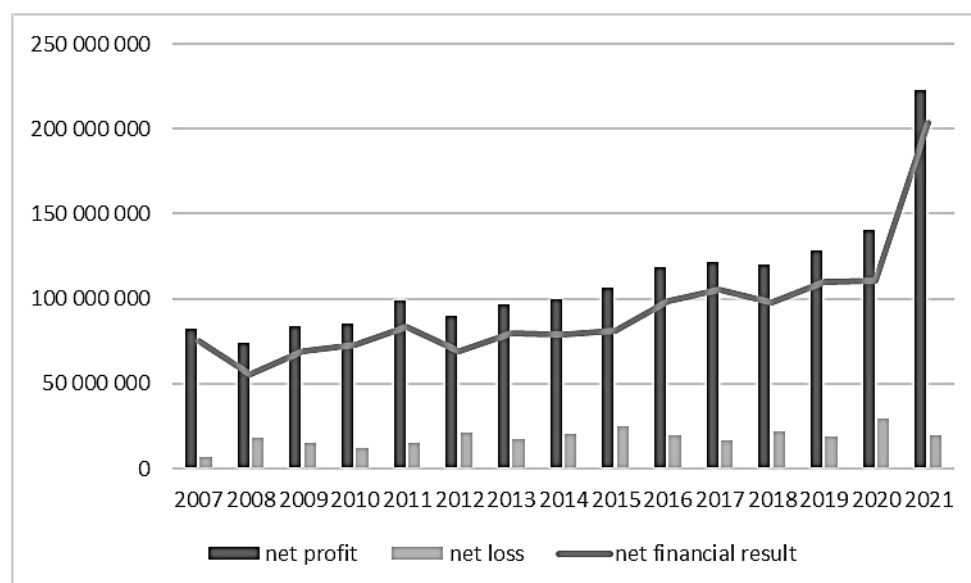


Figure 2. Net financial result, net profit and net loss of private sector non-financial enterprises in Poland in 2007-2021.

When analyzing private sector enterprises (Fig. 2), it can be observed that they are characterized by higher values of the analyzed indicators than public sector enterprises. In the case of private sector enterprises, the net profit as well as the financial result are systematically growing, and they reach the highest values in 2021. During the pandemic (2020-2021), the ratio of net loss to net profit in the analyzed years is much lower than in the public sector, similarly in 2007-2009, 2014-2017 and 2019.

4. Empirical analysis

The subject of the study were Polish voivodeships in the years 2007-2021. In order to organize the voivodeships according to the financial condition of large enterprises, the TOPSIS measure was used. Over 17,000 enterprises from both the public and private sectors, regardless of their subject of economic activity, were taken into account in the study. The data used in the analysis concerned the financial condition of large enterprises that employ more than 49 people and are required to submit financial reports. The considered indicators describe the financial condition of enterprises in voivodeships in a multilateral manner. The financial indicators used come from the Local Data Bank of the Central Statistical Office (GUS) and cover the years 2007-2021. In the selected years, the number of enterprises in the GUS data changed, but not more than 3%.

Tables 1-7 characterize the dynamics of the studied variables using single-base indexes for each voivodeship in 2019 compared to 2007 and in 2020 and 2021 compared to 2019. The largest and smallest values of the estimated indexes are marked in bold.

When analyzing the data in Table 1, it can be seen that in the public sector, the net profit of enterprises increased in 2019 compared to 2007 only in 5 voivodeships. The highest increase was recorded for the Świętokrzyskie Voivodeship, then Małopolskie Voivodeship. However, the largest decrease was in the Opolskie Voivodeship. During the Covid19 pandemic in 2020, there was a decrease in the net profit of enterprises in 8 voivodeships compared to 2019, while in 2021 only in two: in Lubuskie and Świętokrzyskie. The largest increase was recorded in 2021 in Podlaskie Voivodeship compared to 2019. In the private sector, the net profit of enterprises in 2019 compared to 2007 increased in almost all voivodeships, with the exception of Świętokrzyskie. The highest increase in the indicator was recorded for the Lubelskie Voivodeship. During the Covid19 pandemic in 2020, there was an increase in the net profit of private sector enterprises in all provinces compared to 2019. The highest increase was recorded in the Dolnośląskie Voivodeship, and the smallest in the Lubuskie Voivodeship. In 2021, compared to 2019, a significant drop in the net profit of enterprises in Mazowieckie voivodship has already been noted, as well as in Wielkopolskie, Śląskie and Podkarpackie voivodships. The highest increase of over 25 times was recorded for the Zachodniopomorskie Voivodeship.

Table 1.
Net profit index of public and private sector enterprises

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/1007	2020/2019	2021/2019
Dolnośląskie	0,43	0,75	1,68	1,52	1,84	1,84
Kujawsko-Pomorskie	0,65	1,71	2,57	2,28	1,55	1,55
Lubelskie	0,25	0,71	1,33	3,22	1,35	1,35
Lubuskie	1,64	0,62	0,67	2,45	1,21	1,21
Łódzkie	0,21	1,27	1,29	2,12	1,47	1,47
Małopolskie	2,23	0,92	1,49	2,40	1,53	1,53
Mazowieckie	1,63	1,57	1,62	1,66	1,70	0,08
Opolskie	0,03	1,07	1,23	1,58	1,63	3,14
Podkarpackie	0,55	1,45	1,95	2,56	1,28	0,55
Podlaskie	0,72	1,94	4,22	2,38	1,31	6,14
Pomorskie	1,69	0,51	2,18	2,00	1,65	2,99
Śląskie	0,84	0,39	2,61	1,40	1,97	0,24
Świętokrzyskie	5,46	0,71	0,88	0,94	1,26	1,28
Warmińsko-Mazurskie	0,82	2,31	2,34	2,21	1,54	14,25
Wielkopolskie	1,29	0,56	1,09	2,76	1,32	0,20
Zachodniopomorskie	0,73	1,19	1,08	2,32	1,49	25,78

Table 2 presents net loss indices of public and private sector enterprises. In the public sector, the highest increase in net loss for enterprises in 2019 compared to 2007 was recorded in the Warmińsko-Mazurskie voivodship. And the biggest decrease for the Pomorskie voivodship. In 2020, for most voivodships, there was a decrease in the value of net loss of enterprises or a slowdown in its growth. The exception is the enterprises of the Podkarpackie Voivodeship, for which the net loss in 2021 compared to 2019 increased more than 13 times. In the private sector, in 2019, compared to 2007, the net loss of enterprises increased for all voivodships. The highest increase in the indicator was recorded for the Pomorskie Voivodeship, and the smallest increase for the Warmińsko-Mazurskie Voivodeship. During the Covid-19 pandemic, there was a decrease in the net loss of private sector enterprises for 5 voivodships in 2020 compared to 2019, while in 2021 for 9 voivodships.

Table 2.
Index of net loss of public and private sector enterprises

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/1007	2020/2019	2021/2019
Dolnośląskie	4,11	1,62	1,40	3,80	2,00	1,14
Kujawsko-Pomorskie	1,30	0,72	1,00	4,11	0,45	0,42
Lubelskie	1,21	0,93	1,26	1,41	0,63	0,80
Lubuskie	1,91	0,42	0,45	1,25	1,33	1,13
Łódzkie	2,58	0,91	0,84	3,18	1,04	0,40
Małopolskie	0,77	2,93	1,58	5,28	1,29	0,52
Mazowieckie	1,17	3,98	2,43	1,76	2,02	1,13
Opolskie	1,13	0,97	2,16	4,57	1,44	1,21
Podkarpackie	0,40	1,40	13,46	3,96	0,87	0,80
Podlaskie	0,96	1,80	0,86	1,60	0,70	0,41
Pomorskie	0,26	11,69	0,41	5,35	1,06	1,06
Śląskie	7,30	2,53	1,21	3,77	2,06	0,94
Świętokrzyskie	2,62	1,33	0,74	4,05	1,09	0,52
Warmińsko-Mazurskie	15,36	2,56	1,00	1,03	1,36	0,86
Wielkopolskie	5,83	6,96	1,61	2,42	1,66	2,84
Zachodniopomorskie	0,53	0,83	0,83	1,42	0,71	1,55

In Poland, in the analyzed period, the percentage of enterprises reporting a net profit in the public sector systematically decreased from 74.5% in 2007 to 66.2% in 2019. In the private sector, the percentage of enterprises reporting a net profit in the analyzed period was very diversified and ranged from (77.3%; 83.5%), in 2007 it was 83.5% and in 2019 83.1%. During the pandemic in 2020, only 65% of public sector enterprises reported net profit and 81.7% of private sector enterprises. In 2021, the percentage of enterprises reporting a net profit increased to 68.6% in the public sector and 85.7% in the private sector. When analyzing the financial condition of enterprises in individual voivodeships (Table 3), it can be seen that in the public sector the percentage of enterprises reporting a net profit decreased in 2019 compared to 2007 for almost all voivodeships. For the remaining 3 voivodeships (Podkarpackie, Małopolskie, Lubuskie), this percentage slightly increased. On the other hand, in the private sector, the indices showing changes in the share of the number of enterprises reporting net profit in the total number of enterprises in 2019 compared to 2007 oscillate around 1. During the Covid-19 pandemic, the percentage of public sector enterprises reporting profit increased in 8 voivodeships. In 2020 and 2021, the highest increase was recorded in the Lubelskie Voivodeship. On the other hand, the largest decrease in the indicator was recorded in Małopolskie in 2020, and in 2021 in Opolskie. In the private sector, the outbreak of the pandemic in 2020 resulted in a decrease in the number of enterprises reporting a net profit in most provinces, and in 2021 an increase in this number for almost all provinces. The exception is Podkarpackie and Świętokrzyskie.

Table 3.

Index share of enterprises with net profit in the total number of enterprises

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/2007	2020/2019	2021/2019
Dolnośląskie	0,80	1,01	1,15	1,01	0,98	1,02
Kujawsko-Pomorskie	0,91	0,99	1,12	0,98	1,01	1,06
Lubelskie	0,79	1,19	1,32	1,00	1,01	1,03
Lubuskie	1,00	1,03	1,03	1,08	0,98	1,01
Łódzkie	0,80	1,13	1,03	0,97	1,00	1,06
Małopolskie	1,06	0,82	0,93	1,00	0,97	1,04
Mazowieckie	0,97	0,88	0,95	0,98	0,96	1,03
Opolskie	0,78	0,85	0,87	0,97	0,97	1,03
Podkarpackie	1,01	1,07	0,96	1,02	0,99	0,99
Podlaskie	0,98	1,17	1,04	1,01	0,99	1,04
Pomorskie	0,91	1,06	1,08	1,01	0,99	1,01
Śląskie	0,89	0,99	1,00	0,98	0,98	1,04
Świętokrzyskie	0,88	0,90	1,11	1,01	0,95	0,99
Warmińsko-Mazurskie	0,69	1,02	1,09	1,04	0,99	1,01
Wielkopolskie	0,86	0,97	1,07	1,00	1,01	1,05
Zachodniopomorskie	0,80	1,03	1,10	1,03	0,97	1,01

The cost level indicator for public sector enterprises in the analyzed years assumes values in the range [78.5; 116.2], while in 2019, compared to 2007, slight increases in the indicator can be noticed (Table 4) for most voivodeships. For private sector enterprises the values of the index are less diversified and belong to the range [87.9; 99.7]. Based on the data in Table 4,

it can be seen that in 2019, for almost all voivodeships, slightly higher values of the enterprise cost level indicator were recorded than in 2007. During the pandemic, this indicator for both public and private sector enterprises slightly decreases compared to 2019.

In Poland, in the analyzed years, the gross sales profitability indexes remained above 4.1 in the private sector and above 2.0 in the public sector, which means that enterprises showed efficiency in their basic business activities. In the public sector, the profitability ratio decreased from 3.0 in 2019 to 2.7 in 2020, and then increased to 4.1 in 2021. In the private sector, during the pandemic, the profitability ratio increased from 4.4 in 2019 to 5.0 in 2020 and 6.0 in 2021. When analyzing the data contained in Table 5 concerning the profitability ratio, it can be noticed that in the analyzed years, public sector enterprises in many voivodeships are unprofitable (indicators below 0). For the voivodships with negative profitability ratios in 2019 and the following years, the sign "-" was entered. The enterprises of Podlaskie voivodeship are characterized by the highest growth, for which the profitability index increased 13.5 times in 2021 compared to 2019. In the private sector in the analyzed years for all voivodships profitability indicators are positive. Comparing the profitability of enterprises in 2007 and 2019, it can be seen that these indicators have decreased for most voivodeships. The exception is Wielkopolskie, Zachodniopomorskie, Kujawsko-Pomorskie and Lubelskie, for which the profitability index of enterprises increased by 61% in 2019 compared to 2007. During the pandemic, the profitability ratio increased for almost all provinces. The exceptions are the Łódzkie, Podkarpackie and Śląskie voivodships in 2010, and in 2021 - Łódzkie. The highest increase in the profitability ratio was recorded for the Świętokrzyskie Voivodeship in 2020 and for the Śląskie Voivodeship in 2021.

Table 4.
Index of enterprise cost indexes

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/1007	2020/2019	2021/2019
Dolnośląskie	1,05	1,03	0,97	1,04	1,01	0,98
Kujawsko-Pomorskie	1,02	0,98	0,96	1,00	0,99	0,97
Lubelskie	1,01	1,02	1,02	0,99	0,99	0,98
Lubuskie	1,00	1,01	1,01	1,02	0,98	0,98
Łódzkie	1,06	0,99	0,99	1,02	1,00	0,97
Małopolskie	0,96	1,00	0,96	1,00	0,99	0,97
Mazowieckie	1,01	0,98	0,99	1,02	1,00	0,97
Opolskie	1,14	1,00	1,01	1,03	1,00	0,98
Podkarpackie	1,00	0,98	1,05	1,01	1,00	0,99
Podlaskie	1,00	0,98	0,94	1,01	0,99	0,98
Pomorskie	0,99	1,05	0,95	1,02	0,99	0,97
Śląskie	1,04	1,11	0,97	1,03	1,01	0,98
Świętokrzyskie	0,94	1,03	1,03	1,05	0,98	0,97
Warmińsko-Mazurskie	1,07	1,04	0,98	1,00	0,99	0,97
Wielkopolskie	0,96	1,07	1,01	1,01	1,00	0,99
Zachodniopomorskie	0,97	0,99	0,99	1,00	1,00	0,99

Table 5.
Index of enterprises' gross sales profitability index

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/2007	2020/2019	2021/2019
Dolnośląskie	-	-	-	0,51	1,07	1,28
Kujawsko-Pomorskie	0,36	3,08	3,62	1,06	1,16	1,47
Lubelskie	1,10	0,48	0,60	1,61	1,07	1,11
Lubuskie	0,24	-	-	0,64	1,27	1,36
Łódzkie	-	-	-	0,92	0,91	0,77
Małopolskie	1,56	0,85	1,19	0,96	1,16	1,43
Mazowieckie	0,81	2,09	1,06	0,80	1,07	1,22
Opolskie	-	-	-	0,67	1,04	1,29
Podkarpackie	3,30	0,97	0,76	0,73	0,81	1,33
Podlaskie	0,24	-	13,50	0,93	1,18	1,20
Pomorskie	1,52	-	2,08	0,89	1,13	1,38
Śląskie	-	-	-	0,58	0,87	1,61
Świętokrzyskie	3,05	0,95	1,07	0,57	1,30	1,43
Warmińsko-Mazurskie	-	-	-	0,81	1,21	1,55
Wielkopolskie	0,85	0,36	0,82	1,00	1,09	1,15
Zachodniopomorskie	1,77	1,35	0,35	1,09	1,00	1,12

1 and 2 degree financial liquidity ratios were used to assess the financial liquidity of enterprises. The 1st degree financial liquidity ratio is the ratio of short-term investments to short-term liabilities (excluding special funds) (GUS, stst.gov.pl). In the literature, values close to 0.2 are assumed as the optimal value of the 1st degree liquidity ratio. However, in the analyzed period, this condition is not met for public sector enterprises, and the values of the indicator for all voivodeships exceed the set level, which proves the existence of the phenomenon of overliquidity. For private sector enterprises, the liquidity ratios for all voivodeships are much lower than the corresponding values for the public sector. On average, the values hover around 0.3. In the private sector, corporate liquidity ratios tend to increase for almost all voivodships, which is clearly visible during the pandemic, also in the public sector (Table 6).

Table 6.
Index of the financial liquidity ratio of st. 1

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/1007	2020/2019	2021/2019
Dolnośląskie	1,46	1,04	1,29	0,81	1,07	0,93
Kujawsko-Pomorskie	2,26	1,00	0,77	1,35	1,28	1,06
Lubelskie	1,12	0,63	0,51	1,09	1,05	1,01
Lubuskie	2,57	0,56	0,56	1,05	1,48	1,07
Łódzkie	0,84	1,33	1,38	1,27	1,00	0,79
Małopolskie	0,73	0,83	1,06	1,50	1,12	1,04
Mazowieckie	1,56	1,51	1,31	1,13	1,06	1,07
Opolskie	0,57	1,05	1,09	1,04	1,30	1,27
Podkarpackie	2,03	1,08	1,01	1,12	1,24	1,00
Podlaskie	1,28	1,01	1,26	1,61	1,38	1,14
Pomorskie	1,18	1,42	1,23	1,02	1,28	1,37
Śląskie	1,61	0,96	0,85	0,88	1,24	1,09
Świętokrzyskie	4,79	1,12	1,47	0,94	1,23	0,85
Warmińsko-Mazurskie	0,69	1,18	1,27	1,32	1,44	1,25
Wielkopolskie	2,32	0,49	0,48	0,98	1,21	1,15
Zachodniopomorskie	3,95	0,76	0,84	1,91	1,45	0,94

Second degree financial liquidity ratio (accelerated liquidity ratio) is the ratio of short-term investments and short-term receivables to short-term liabilities (excluding special funds) (GUS, stst.gov.pl). The optimal value of the indicator is in the range [1 - 1.2]. In the analyzed years, for public sector enterprises, the values of the indicator were in the range (1.08; 1.43), while during the pandemic it was 136.3 in 2020 and 163.1 in 2021. This means that enterprises did not have problems with the repayment of short-term debts. However, the results higher than 1.2 (in 2015-2018, 2020-2021) suggest the phenomenon of excess liquidity, i.e. the use of current assets in an ineffective manner. In the private sector, the 2nd degree financial liquidity ratio, even during a pandemic, fluctuates around 1, which proves that enterprises did not have problems with financial liquidity or timely repayment of current liabilities. Taking into account the administrative division, it can be noticed that for most voivodships the financial liquidity ratios for public sector enterprises tend to increase and lead to overliquidity. The decreasing tendency is shown by enterprises from the Małopolskie, Podkarpackie and Śląskie voivodships. The lowest values of the liquidity ratio in the analyzed period were obtained for the Pomorskie and Śląskie voivodships, which in the case of the Śląskie voivodship (0.7 in 2021) indicates the possibility of a risk of loss of financial liquidity. In the case of private sector enterprises, the liquidity ratios oscillate around 1 for almost all voivodships, with the exception of Warmińsko-Mazurskie in 2011-2014 (table 7)

Table 7.

Index of the financial liquidity ratio of st. 2

	Public sector			Private sector		
	2019/2007	2020/2019	2021/2019	2019/1007	2020/2019	2021/2019
Dolnośląskie	1,32	0,94	1,11	0,84	1,00	0,96
Kujawsko-Pomorskie	1,79	0,97	0,81	1,00	1,14	1,08
Lubelskie	0,76	0,79	0,60	1,13	1,05	0,97
Lubuskie	1,41	0,70	0,67	0,83	1,20	1,02
Łódzkie	0,90	1,18	1,31	0,99	0,96	0,95
Małopolskie	0,68	0,94	1,06	1,13	1,05	1,05
Mazowieckie	1,08	1,40	1,56	1,09	1,00	1,01
Opolskie	0,74	1,00	0,99	0,94	1,13	1,09
Podkarpackie	0,96	1,08	1,10	1,11	1,03	0,93
Podlaskie	0,96	1,05	1,22	1,18	1,11	1,09
Pomorskie	1,25	0,95	0,94	0,89	1,12	1,15
Śląskie	1,01	0,90	0,89	0,88	1,07	1,01
Świętokrzyskie	3,22	1,10	1,56	0,93	1,08	0,92
Warmińsko-Mazurskie	0,57	1,27	1,27	0,92	1,14	1,09
Wielkopolskie	1,40	0,68	0,66	0,88	1,04	1,05
Zachodniopomorskie	2,76	0,69	0,81	1,13	1,21	0,96

In the next stage of the research, a set of diagnostic variables was defined, eliminating the variables that were too strongly correlated with each other. Table 8 presents the set of diagnostic features taken into account in the study, taking into account the division into stimulants (S) and destimulants (D). The selection of the following measures resulted from the analysis of the factors determining the changes taking place. From among the initially considered measures, due to the high degree of correlation with other variables, the following were abandoned: gross turnover profitability index, net turnover profitability index, short-term receivables, short-term investments, short-term liabilities, current assets, inventories.

Table 8.
Diagnostic variables

Symbol	Name	Stymulant/destimulant
X1	Net profit [thou. PLN/company]	S
X2	Net loss [thou. PLN/company]	D
X3	Share of the number of enterprises reporting a net profit in the total number of enterprises [%]	S
X4	Cost level indicator [%]	D
X5	Gross sales profitability indicator [%]	S
X6	1st degree financial liquidity [%]	S
X7	2st degree financial liquidity [%]	S

In order to organize Polish voivodeships according to the level of the studied phenomenon, the TOPSIS measure was used. Tables 9-10 show the values of the above-mentioned measure and the position of voivodeships in the ranking in 2007-2021, broken down into the public sector and the private sector of enterprises. The voivodeships occupying the highest and lowest positions in the ranking in the analyzed period are marked in bold.

Table 9.
Ranking of voivodeships according to the TOPSIS measure values for public sector enterprises in 2007-2021

Public sector	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Dolnośląskie	3	3	3	6	12	12	16	13	15	16	16	10	12	13	9
Kujawsko-Pomorskie	10	14	4	4	3	2	2	3	4	2	2	7	10	4	6
Lubelskie	2	7	6	7	4	4	3	6	3	3	4	8	3	7	7
Lubuskie	8	5	7	11	8	11	5	4	9	12	11	13	9	11	14
Łódzkie	7	4	2	1	1	1	9	9	12	13	14	14	14	12	12
Małopolskie	6	8	8	5	6	8	8	11	6	10	10	4	2	2	3
Mazowieckie	4	10	12	13	16	16	4	1	1	1	1	1	1	1	1
Opolskie	1	1	1	12	9	10	7	5	8	8	7	12	13	10	13
Podkarpackie	12	13	14	15	15	15	14	14	14	14	13	9	8	6	11
Podlaskie	11	12	11	14	14	14	12	8	10	9	8	11	11	9	5
Pomorskie	16	16	9	8	10	5	6	15	5	5	5	2	6	14	2
Śląskie	14	9	15	2	2	6	15	16	16	15	15	15	16	16	16
Świętokrzyskie	13	2	13	10	7	7	13	7	7	7	9	5	5	3	4
Warmińsko-Mazurskie	9	11	10	9	13	13	11	12	13	11	12	16	15	15	15
Wielkopolskie	5	6	5	3	5	3	1	2	2	4	3	3	4	8	8
Zachodniopomorskie	15	15	16	16	11	9	10	10	11	6	6	6	7	5	10

Table 10.
Ranking of voivodeships according to the TOPSIS measure values for private sector enterprises in 2007-2021

Private sector	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Dolnośląskie	2	8	2	1	1	1	4	4	4	3	9	15	15	15	15
Kujawsko-Pomorskie	13	16	14	16	6	12	7	8	9	8	15	6	13	5	3
Lubelskie	12	9	9	5	4	2	5	7	3	6	4	7	3	3	4
Lubuskie	9	11	11	13	14	9	10	9	10	10	11	10	6	7	9
Łódzkie	10	7	15	9	12	4	2	3	16	2	6	3	14	11	5
Małopolskie	6	6	3	2	7	3	8	5	2	5	5	2	9	2	1
Mazowieckie	16	12	4	8	16	6	16	16	5	16	16	11	2	14	2
Opolskie	7	5	5	10	10	13	13	15	13	14	13	9	10	12	10
Podkarpackie	8	10	7	7	8	7	6	11	11	4	3	14	8	9	11
Podlaskie	11	14	13	14	15	14	12	14	14	15	14	13	4	10	7
Pomorskie	5	2	8	3	5	5	3	6	6	7	2	4	12	4	6
Śląskie	1	3	16	15	2	15	14	1	15	12	8	16	16	16	14
Świętokrzyskie	3	1	6	6	3	8	15	12	7	11	7	5	7	6	8
Warmińsko-Mazurskie	15	15	12	11	13	11	9	13	12	13	12	12	11	13	12
Wielkopolskie	4	4	1	4	9	16	1	2	1	1	1	1	1	1	16
Zachodniopomorskie	14	13	10	12	11	10	11	10	8	9	10	8	5	8	13

The above results, obtained as a result of the linear ordering of objects, formed the basis for the classification of voivodeships into homogeneous groups, based on the level of the studied phenomenon. The total range of variability of measures was divided into four class ranges to which individual voivodeships were assigned, according to the following rules (Kuc, 2012; Zeliaś, 2000):

- group I (high level of development of the phenomenon): $m_i > \bar{m} + S_m$,
- group II (the average degree of development of the phenomenon): $\bar{m} + S_m < m_i < \bar{m}$,
- group III (low level of development of the phenomenon): $\bar{m} < m_i < \bar{m} - S_m$,
- group IV (very low level of development of the phenomenon): $m_i < \bar{m} - S_m$,

where:

$$\bar{m} = \frac{1}{n} \sum_{i=1}^n m_i ,$$

$$S_m = \sqrt{\frac{1}{n} \sum_{i=1}^n (m_i - \bar{m})^2} .$$

The results of the spatial distribution of the obtained groups in 2007, 2009, 2014, 2019, 2020 and 2021 are presented on the following maps (Fig. 1-2). The darkest colors are the voivodeships belonging to group I, and the lightest ones belonging to group IV.

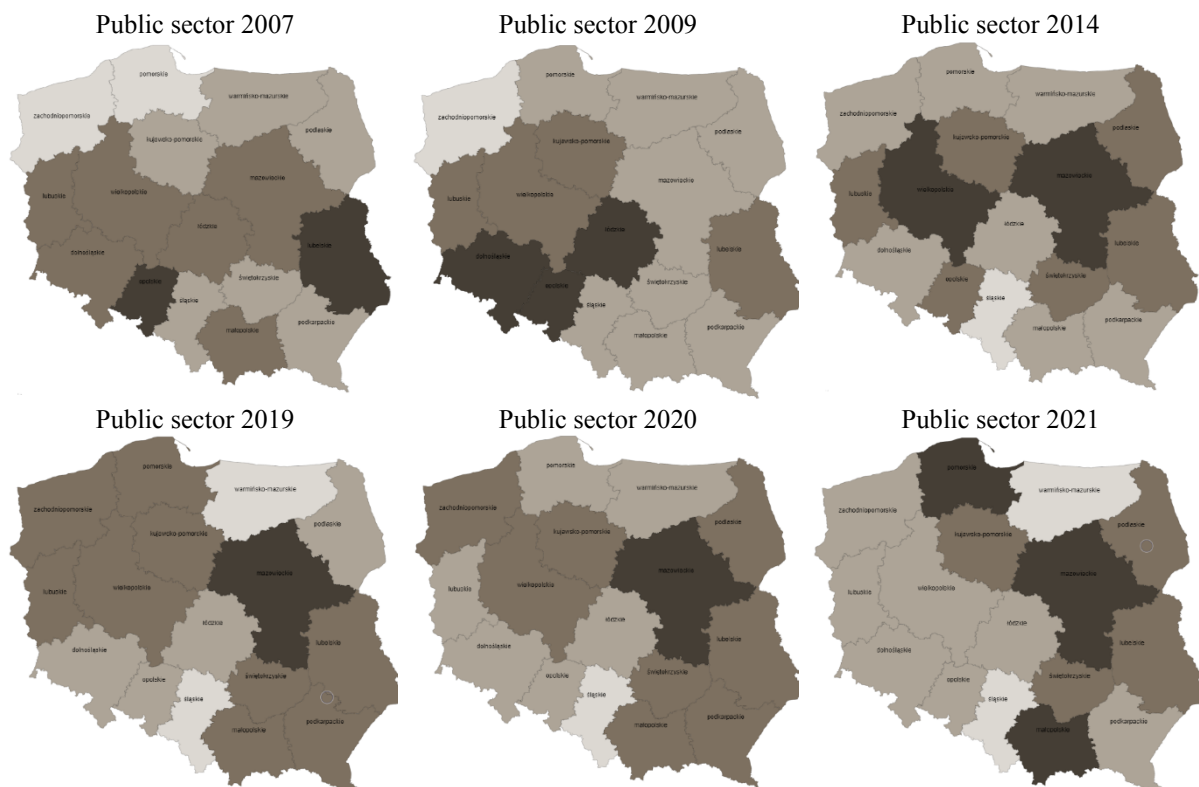


Figure 3. Spatial distribution of voivodeships in terms of the financial condition of public sector enterprises in 2007, 2009, 2014, 2019, 2020, 2021.

Based on the data presented in Table 9, it can be concluded that in the analyzed period the condition of public sector enterprises in individual voivodships has changed dynamically. The Mazowieckie Voivodeship is characterized by the greatest differentiation, which in 2011-2012 fell to the last position in the ranking, and since 2014 it has been ranked 1st. The smallest differentiation was recorded for the Warmińsko-Mazurskie voivodeship. During the pandemic, the greatest changes were recorded for the Pomorskie Voivodeship, while the positions of the Mazowieckie, Śląskie and Warmińsko-Mazurskie voivodships remained unchanged. On the basis of Figure 3, it can be seen that before the outbreak of the Covid19 pandemic, the financial condition of enterprises in the north-western voivodships of Poland improved compared to the others. During the pandemic, the voivodships of the eastern and central part of the country were in a better position - they took higher positions in the ranking. The voivodships in the western part of the country were in the 3rd and 4th groups, so the condition of enterprises in these voivodships was worse than in other voivodships

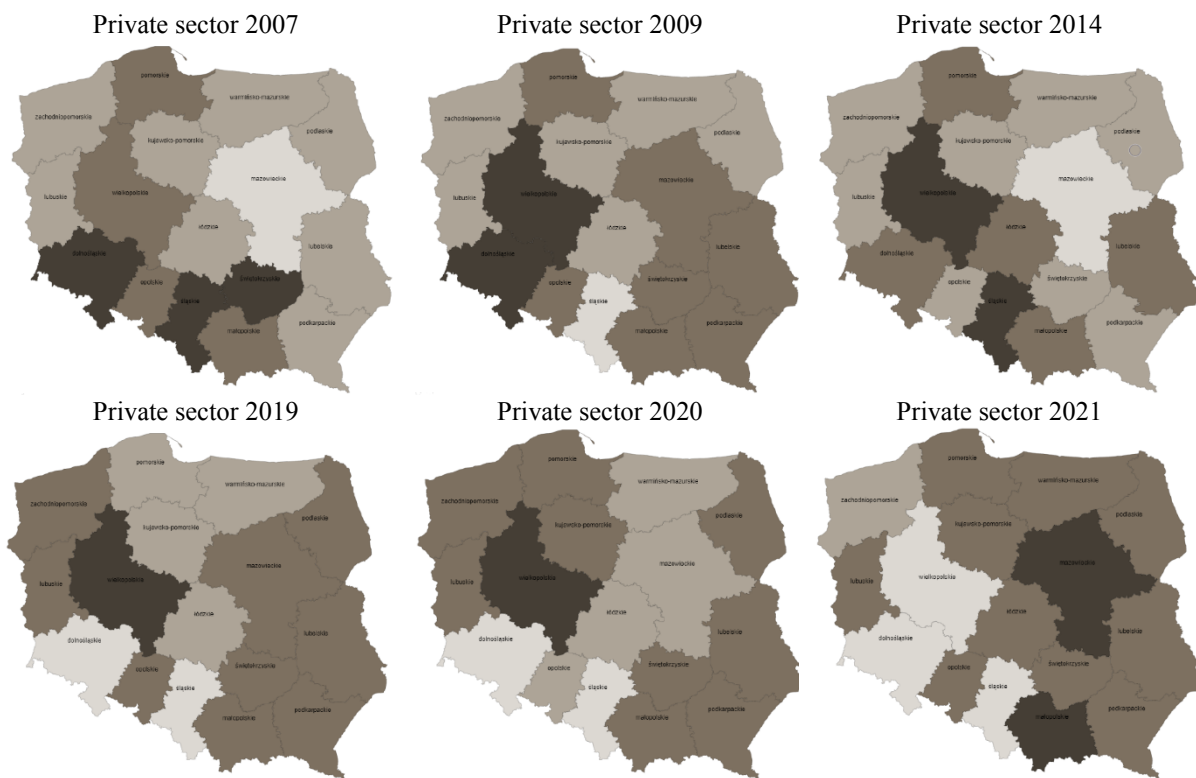


Figure 4. Spatial distribution of voivodships in terms of the financial condition of private sector enterprises in 2007, 2009, 2014, 2019, 2020, 2021.

Based on the data presented in Table 9, it can be concluded that in the analyzed period the condition of public sector enterprises in individual voivodships has changed dynamically. The Mazowieckie Voivodeship is characterized by the greatest differentiation, which in 2011-2012 fell to the last position in the ranking, and since 2014 it has been ranked 1st. The smallest differentiation was recorded for the Warmińsko-Mazurskie voivodeship. During the pandemic, the greatest changes were recorded for the Pomorskie Voivodeship, while the positions of the Mazowieckie, Śląskie and Warmińsko-Mazurskie voivodships remained unchanged.

On the basis of Figure 3, it can be seen that before the outbreak of the Covid19 pandemic, the financial condition of enterprises in the north-western voivodships of Poland improved compared to the others. During the pandemic, the voivodships of the eastern and central part of the country were in a better position - they took higher positions in the ranking. The voivodships in the western part of the country were in the 3rd and 4th groups, so the condition of enterprises in these voivodships was worse than in other voivodships

Based on the data presented in Table 10, it can be concluded that in the analyzed period the condition of large private sector enterprises has changed dynamically. The greatest diversification is characteristic for the Wielkopolskie Province, which in 2012 fell to the last position in the ranking, and since 2013 it has been ranked 1st, except for 2014 (2nd position). On the other hand, the smallest differentiation was noted for the Warmińsko-Mazurskie voivodship. During the pandemic, the greatest changes were recorded for Wielkopolskie, which fell from 1st position in the ranking to 16th, and then Mazowieckie and Małopolskie. The lowest differentiation is characteristic for Dolnośląskie (no change in position), followed by Śląskie, Warmińsko-Mazurskie and Opolskie. Based on the maps (Fig. 4), it can be noticed that during the economic crisis in 2007-2009, the voivodships of the south-eastern part of the country strengthened their positions in the ranking. A similar condition can be observed during the Covid19 pandemic, when voivodships from the central and eastern part of the country were included in groups 1 and 2. During the pandemic in 2021, the Wielkopolskie Voivodship was in the worst condition, falling to the last position in the ranking.

Conclusion

The study presents a taxonomic analysis of the financial condition of large enterprises in Polish voivodships using the TOPSIS aggregate measure. On the basis of the conducted research, it is possible to notice changes in the financial condition of enterprises in individual provinces, as well as differences in the financial condition between enterprises in the public and private sector.

When studying the impact of the Covid-19 pandemic on the financial condition of large non-financial enterprises, it can be noticed that enterprises started to reduce the costs of their economic activities, the total number of enterprises decreased, but the percentage of enterprises reporting a net profit on their economic activity increased. Despite the difficult condition caused by the pandemic, companies were able to pay off their obligations.

The Covid19 pandemic caused a decrease in the net profit of public sector enterprises in 8 voivodships compared to 2019, while in 2021 only in two. In the private sector, all voivodships recorded an increase in the net profit ratio. During the pandemic, both in the private and public sectors, the liquidity ratios of enterprises tended to increase for almost all

voivodships. Taking into account the administrative division, it can be noticed that for most voivodeships the financial liquidity ratios for public sector enterprises tended to increase and led to overliquidity. In the case of private sector enterprises, the 2nd degree liquidity ratios fluctuate at a constant level around 1 for almost all voivodships. During the pandemic, the gross sales profitability of enterprises increased, suggesting the phenomenon of excess liquidity, i.e. using current assets in an ineffective manner. Whereas the cost index for both public and private sector enterprises decreased compared to 2019.

The Covid-19 pandemic had an “equal effect” on the financial condition of large enterprises in individual provinces, as evidenced by slight changes in the ranking of provinces in 2019-2021. The exceptions are the Podlaskie, Kujawsko-Pomorskie and Wielkopolskie provinces. The biggest change, ie deterioration of the financial condition of enterprises, was recorded in the private sector for the Wielkopolskie voivodship.

References

1. Bank Danych Lokalnych, <https://bdl.stat.gov.pl/bdl/start>, 15.05.2022.
2. Bąk, A. (2016). Porządkowanie liniowe obiektów metodą Hellwiga i TOPSIS – analiza porównawcza. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, Taksonomia 26, Klasyfikacja i analiza danych – teoria i zastosowania*, pp. 22-31.
3. Hamrol, M. (2013). Niedoceniane aspekty badania sprawozdania finansowego przedsiębiorstwa. *Finanse, rynki finansowe, ubezpieczenia, nr 59*, pp. 123-132.
4. Kolegowicz, K., Krzemiński, P. (2019). The influence of financial condition on investment decisions in enterprises in Poland. *Scientific Paper of Silesian University of Technology, Organization and Management Series, No. 136*, pp. 243-255.
5. Kraska, E.M. (2022). Wpływ pandemii COVID-19 na kondycję finansową przedsiębiorstw w Polsce. *Przegląd Prawno-Ekonomiczny, 2*, pp. 79-96. <https://doi.org/10.31743/ppe.13241>.
6. Kuc, M. (2012). The implementation of synthetic variable for constructing the standard of living measure in European Union countries. *Oeconomia Copernicana, nr 3*. Polskie Towarzystwo Ekonomiczne, Oddział w Toruniu, pp. 5-19.
7. Szczepański, M. (2020). Epidemia koronawirusa jako wydarzenie typu „czarny łabędź”. *Przegląd Ekonomiczny, 20*, pp. 8-12.
8. Szymańska, A., Jegers, M. (2014). The Structure of Capital and Revenue in Social Enterprises. *Ekonomia Społeczna, No. 1*, pp. 51-68.
9. Zeliaś, A. (ed.) (2000). *Taksonomiczna analiza przestrzennego zróżnicowania poziomu życia w Polsce w ujęciu dynamicznym*. Kraków: Wydawnictwo Akademii Ekonomicznej.