



ECONOMIC RESILIENCE OF POLISH REGIONS AND ITS DETERMINANTS IN THE PERIOD OF COVID-19 PANDEMIC

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Abstract

The aim of the research was to identify, based on available literature, factors determining the level of economic resilience of Polish regions and then verify whether they actually contributed to a more effective amortization of the demand and supply shock caused by the COVID-19 pandemic. The thesis was put forward that regions with a diversified and competitive production and employment structure experienced the negative effects of the economic slowdown to a lesser extent in the initial period of the pandemic and built their production potential faster in the following years.

Based on the results obtained, the relationship between the level of diversification of the production structure and the economic resilience of the studied regions was not confirmed. On the other hand, it was noticed that voivodeships with a competitive production structure were more likely to experience a decline in the growth rate of GDP per capita in the year of the outbreak of the pandemic. At the same time, in subsequent periods they returned to a relatively dynamic path of economic growth more quickly.

PRĘŻNOŚĆ EKONOMICZNA POLSKICH REGIONÓW ORAZ JEJ DETERMINANTY W OKRESIE PANDEMII COVID-19

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Słowa kluczowe: prężność ekonomiczna, wzrost gospodarczy, aktywność gospodarcza.

Abstrakt

Celem badań było wskazanie, na podstawie dostępnej literatury, czynników określających poziom prężności ekonomicznej polskich regionów, a następnie zweryfikowanie, czy w istocie przyczyniły się one do bardziej efektywnej amortyzacji szoku popytowo-podażowego wywołanego pandemią COVID-19. W pracy postawiono tezę, że regiony o zróżnicowanej i konkurencyjnej strukturze produkcji i zatrudnienia w mniejszym stopniu doświadczyły negatywnych skutków spowolnienia gospodarczego w początkowym okresie pandemii oraz szybciej obudowały swój potencjał produkcyjny w kolejnych latach.

Na podstawie uzyskanych wyników nie potwierdzono związku między poziomem zróżnicowania struktury produkcji a odpornością ekonomiczną badanych regionów. Zauważono jednak, że województwa o konkurencyjnej strukturze produkcji były bardziej narażone na spadek dynamiki PKB na mieszkańca w roku wybuchu pandemii. Jednocześnie w kolejnych okresach szybciej wracały one na stosunkowo dynamiczną ścieżkę wzrostu gospodarczego.

Introduction

Modern regional economies are open systems. While functioning, they enter into various interactions with their environment, which most often take the form of exchange of goods and production factors. Each of such interaction can be a catalyst for changes in the dynamics and structure of economic and, more broadly, social processes that take place in their area. The net effect of these changes, whether their consequence will be the broadly understood socio-economic development of a given region or, on the contrary, its regression, depends on the nature of the impulse itself, but also on the potential of a given region to react and adapt to events and processes occurring in the environment. In the literature, this ability is called economic resilience.

The issue of regions' resilience to external shocks and their ability to overcome them has become particularly important in recent years. This results, on the one hand, from the ongoing economic globalization and the growing interdependence of economies that accompanies this process. As a result, all impulses appearing in the global socio-economic space are quickly and effectively transferred between subsequent economies and production sectors. Secondly, the turbulent nature of the global economy increases under the influence of frequent and unpredictable

events that fundamentally change the conditions for the development of entire socio-economic systems. Examples include the coronavirus pandemic of 2020, Russia's aggression against Ukraine and the resulting crisis in the energy resources market, and finally the rapid development of artificial intelligence technologies, which is fundamentally changing the conditions of competitiveness in an increasing number of production sectors.

Therefore, the aim of the presented article was to determine the potential of Polish regions to respond to negative external shocks using the example of the COVID-19 pandemic. Referring to the literature on economic resilience, it was determined what factors may influence greater economic resilience of voivodeships¹ and then, based on data on the functioning of the labor market and changes in GDP per capita, it was verified whether they contributed to the fact that selected Polish regions have experienced the negative effects of the economic slowdown initiated by the coronavirus pandemic to a lesser extent.

In the cognitive aspect, achieving the research goal will allow for a better understanding of the factors shaping the level of economic resilience of regional economies. This, in turn, in practical terms, will constitute a premise for determining the directions and tools of economic policy aimed at ensuring lasting and balanced economic development of regions.

Purpose and Scope of Analyses, Hypothesis and Research Methods

The aim of the research was to identify, based on available literature, factors which influence the level of economic resilience of Polish regions. It also allowed to verify whether they actually contributed to a more effective amortization of the demand and supply shock caused by the COVID-19 pandemic. The thesis was put forward that regions with a diversified and competitive production and employment structure experienced the negative effects of the economic slowdown to a lesser extent in the initial period of the pandemic and built their production potential faster in the following years.

Achieving the goal required dividing the analysis process into several stages. First, based on literature studies, the concept of economic resilience was defined and selected factors stimulating it were indicated. In relation to the presented analyses, it was the structure and level of diversification of the regional economy.

The next step was to examine which regions were most affected by the economic slowdown caused by the pandemic. Based on the analysis of changes

¹ Voivodships are the largest local government units in Poland. Taking into account their characteristics, in research practice they are often identified with economic regions. For this reason, in the presented work the terms voivodship and region will be used interchangeably.

in the dynamics of GDP per capita growth, those voivodeships were identified in which the sensitivity to the above-mentioned impulse was relatively the highest and the lowest.

Then, based on data on gross value added generated in a given voivodeship, the level of diversification of the regional economy was determined. The Herfindal-Hirschman index (HHI) was used for this purpose. Originally, it was used by the US antitrust authorities to assess the degree of market concentration (Kwiatkowska, 2014, p. 191). Over time, it also began to be used to assess the level of production diversification on a local and regional scale (Xiao & Drucker, 2013, p. 152). It is calculated according to the formula (Kwiatkowska, 2014, p. 192):

$$\text{HHI} = \sum_{i=1}^n u_i^2,$$

gdzie:

HHI – Herfindal-Hirschman Index;

u_i – the share of a given PKD section in the total added value generated in the i -th voivodeship.

For easier interpretation, the obtained indicator values were multiplied by 10,000. As a result, the indicator obtained values in the range $[10,000/n, 10,000]$. Values close to minimum mean low levels of concentration. It is usually assumed that a value less than 1,000 means a high level of diversification, from 1,000 to 1,800 means a moderate level and above 1,800 means a high level of production concentration (Kwiatkowska, 2014, p. 192).

Finally, the level of competitiveness of regional economies was determined, assuming, based on literature research, that a higher level of competitiveness is characterized by economies with a relatively low share of agriculture and non-market services in the structure of production and employment with a high share of market services. For this purpose, data on the number of employees in a given voivodeship, divided into PKD sections, was used. After calculating the share of each section in the total number of employees, the individual values were aggregated into production sectors according to the following scheme:

- agriculture – section A,
- industry – sections B, C, D, E, F;
- market services – G, H, I, J, K, L, M, N, R, S, T, U;
- non-market services – O, P, Q.

The analysis period covered the years 2013-2022, with the end of the time series determined by the availability of statistical data. On the one hand, it allowed for showing economic growth processes in a slightly longer time perspective, and on the other, it allowed for capturing the first symptoms of economic recovery in the post-pandemic period.

The data came from publicly available databases, including primarily the website of the Central Statistical Office – Local Data Bank (Bank Danych Lokalnych, 2023).

The Concept of Economic Resilience and Its Determinants

The concept of economic resilience is a relatively new idea in economic sciences. It was inspired by physical and natural sciences in the context of analyzes of the ability of complex mechanical and biological systems to respond to external shocks. It allows to understand and describe how economies react and gradually return to the equilibrium level after exposure to selected shocks and disruptions that lead to an economic slowdown or even recession. It also describes selected spatial relationships connecting these economies into larger socio-economic systems (Cresenzi *et al.*, 2016; Lagravinese, 2015; Tóth, 2015).

In its broadest sense, the term resilience refers to the ability of an entity or system to self-correct, restoring its initial state after external shocks or other disturbances. In a narrower sense, it is used to describe the relationships occurring in the observed entity during and after selected disruptions, such as a crisis or the process of economic transformation (Drobniak, 2014, p. 16). Importantly, for a long time it was the domain of considerations conducted within the technical sciences (engineering approach) (see Peng *et al.* 2017; Cai *et al.*, 2012) or natural sciences (ecological approach) (Wieteska-Rosiak, 2018, p. 34).

The concept of resilience was included in the scope of economic sciences only after the global economic crisis caused by the crash of the US real estate market in 2008. The concept of economic resilience is, in fact, an attempt to combine the technical (engineering) and ecological approaches within one, relatively coherent theory (Modica & Reggiani, 2014, p. 215).

As Drobniak notes (Drobniak, 2014, p. 16), in the literature on the subject one can find at least four different ways of defining this concept:

- as a way of responding to specific and unforeseen events and shocks;
- as the stability of the system in the face of emerging disturbances. In this respect it can be treated as a permanent feature, a property of the system;
- as the ability to avoid and cope with natural and anthropogenic threats;
- as a concept for better understanding the process of managing complex social and ecological systems.

To summarize, a socio-economic system can be considered resilient if, in the event of a negative shock, its balance (or development trajectory) is not disturbed or changes only slightly, or if it relatively quickly returns to the state before the shock occurred.

The most important indicators reflecting the level of economic resilience include, first of all, changes in the volume of production and changes in the level of employment (unemployment) (Sensier & Artis, 2014, p. 590). The analysis of employment changes may be particularly important because it better reflects the social consequences of economic shocks (Fratesi & Rodriguez-Pose, 2016, p. 39). This is due to the fact that the level of employment returns to the values observed before the shock and recession with a much longer delay than production (Reinhart & Rogoff, 2009, p. 470).

The literature on the subject contains many analyzes aimed at measuring the level of economic resilience and identifying its most important determinants. The results of these analyzes (their interesting review can be found in: Drobniak, 2015; Tóth, 2015; Martin & Sunley, 2020, Drobniak *et al.*, 2021) indicate that the key factors increasing the level of regional economic resilience are, among others, a diversified production structure, in which a relatively large part are activities related to the modern service sector.

For example, the research results of Daly *et al.* (2009) and Modica and Reggiani (2014) indicate that regions that specialized in service activities emerged from the periods of production collapse relatively faster (some of them did not even record a decline in production) than centers with relative dominance of manufacturing activities.

A diversified production structure stimulates economic resilience in three dimensions (Peng *et al.*, 2017, p. 91):

- it may be a factor preventing the economy from locking itself onto one development path as a consequence of excessive production specialization. Diversification can weaken the negative impact of the collapse in the dominant industry/production sector and facilitate rapid economic recovery;
- a diversified production structure allows for a better transfer and dispersion of external shocks in various directions (sectors and departments) of the economy, contributing to faster recovery and faster adaptation to changed conditions;
- adapting the production structure to changing conditions, strengthening scientific and technological innovations, rational development of natural resources and active nature protection proceed faster in the conditions of a diversified production structure.

Selected Dimensions of the Economic Resilience of Polish Voivodeships in the Period 2013-2022 – Analysis Results

The processes of development and economic growth of regions are of a long-term nature and should be analyzed in this perspective. This allows for capturing general trends and characteristic development features. For this reason, the years

2013-2022 were adopted as the research period. At the same time, the analysis was limited only to the analysis of the dynamics of changes in basic economic values in voivodeships, thanks to which it was possible to more clearly capture the impact of a negative external shock in the form of the COVID-19 pandemic on the socio-economic processes taking place in Polish regions.

Table 1 presents the growth rate of GDP per capita, as the most synthetic measure of the level of economic growth in Polish voivodeships in 2014-2022.

Table 1

Annual growth rate (in %) of GDP per capita of voivodeships in 2014-2022 (current prices)

Voivodeship	2014	2015	2016	2017	2018	2019	2020	2021	2022
Dolnośląskie	4.77	5.41	2.51	6.65	6.08	7.74	2.98	14.37	18.54
Kujawsko-Pomorskie	3.74	5.85	3.08	6.19	7.62	5.49	5.93	12.99	17.21
Lubelskie	3.35	3.72	3.72	7.37	5.07	8.04	3.87	12.37	15.90
Lubuskie	6.10	4.15	3.66	5.29	6.32	6.54	3.81	12.93	16.95
Łódzkie	4.93	5.47	2.86	6.80	6.92	8.83	6.09	11.53	14.81
Małopolskie	4.88	7.19	3.69	7.82	8.13	6.89	1.40	14.09	14.46
Mazowieckie	3.68	5.80	2.86	7.60	7.99	8.72	0.59	10.94	18.64
Opolskie	5.59	5.01	1.69	6.57	6.99	7.35	3.61	16.09	13.57
Podkarpackie	4.19	5.66	2.70	5.78	8.32	7.77	1.07	14.22	13.56
Podlaskie	3.97	3.51	2.81	8.31	6.63	8.30	5.28	11.65	18.15
Pomorskie	3.29	6.76	4.01	6.51	8.06	7.76	-0.53	16.02	21.26
Śląskie	4.39	5.90	2.96	6.87	7.53	6.38	0.83	16.15	18.91
Świętokrzyskie	4.70	4.67	2.16	6.62	8.11	6.16	5.10	12.98	11.67
Warmińsko-Mazurskie	4.98	4.31	3.61	5.48	5.00	6.63	6.99	12.45	14.81
Wielkopolskie	4.59	6.93	3.78	7.02	6.05	8.25	2.62	11.62	15.69
Zachodniopomorskie	5.34	6.30	2.19	6.60	7.14	6.73	4.46	12.61	13.92

Source: own study based on the Local Data Bank of the Central Statistical Office.

Taking into account the entire analyzed period, it should be emphasized that the average annual growth rate of GDP per capita was similar and ranged from 8.13% in the Pomorskie Voivodeship to 6.91% in the Świętokrzyskie. Importantly, relatively small disproportions in the dynamics of economic growth between voivodeships were observed in most of the analyzed years, not only for the average values for the entire research period. The difference between the voivodeship with the highest and lowest GDP per capita growth dynamics in 2014-2019 was from 2.31 percentage points in 2016 to 3.68 in 2015. Similarly, the coefficient of variation in 2014-2019 was relatively low and ranged from 11.72% in 2017 to 21.8% in 2017.

The trend of relatively stable and sustainable economic growth in voivodeships was disrupted by the onset of the coronavirus pandemic. Actions taken by Polish and European authorities to limit the transmission of the virus and prevent its negative socio-economic effects had a significant impact on the dynamics of development processes. As a result, the economic growth dynamics of voivodeships in 2020 and subsequent years has become significantly diversified. In the first year of the pandemic, the gap between GDP per capita growth rates increased to 7.52 percentage points and the coefficient of variation up to 63.9%. In the following years, these disproportions were not so large, but noticeably higher than in the period 2014-2019.

The demand-supply shock in the first period (2020) most affected the Pomorskie voivodeships, where a decrease in GDP per capita by 0.53% y/y was recorded, and the Mazowieckie voivodeship (an increase of 0.59%), Śląskie voivodeship (0.83%), Podkarpackie (1.07%) and Małopolskie (1.4%). At the same time, there were regions (Łódzkie, Kujawsko-Pomorskie, Świętokrzyskie, Warmińsko-Mazurskie, Podlaskie) where the annual economic growth rate was relatively high and exceeded 5%. Therefore, the question arises about the factors that could have influenced such a diverse response to changes in the conditions of development processes.

According to the concept of economic resilience, an important stimulator of the regions' ability to absorb external shocks is the diversified production structure. Hence, Table 2 presents the development of the HHI value added index (as a measure of the level of production diversification) in 2019, i.e. the period immediately preceding the outbreak of the pandemic.

Analyzing the spatial distribution of the HHI index, it can be noted that the level of production diversification in Polish regions in 2019 was relatively high. In four voivodeships its value was below 1,000 units, which indicates a highly diversified structure. In the remaining cases, they ranged from 1,034 to 1,302, i.e. at a moderate level, but significantly below the limit allowing the production structure to be described as highly concentrated.

Comparing the above information with data on the change in GDP per capita in 2020, it can be noted that the relatively high resistance to the shock caused by the onset of the COVID-19 pandemic (voivodeships with the highest GDP growth dynamics per capita) did not correspond to a high degree of production diversification. Conversely, the regions in which the greatest change in economic growth dynamics was observed in 2020 did not belong to voivodeships with a relatively high level of production concentration. In the first group of voivodeships, the average value of the HHI index in 2019 was 1,097 units, while in the second group it was 1,067 units. In other regions it was at the level of 1,113 units. The observed differences are therefore relatively small and do not allow identifying significant relationships between the degree of diversification of voivodeships' production in 2019 and the sensitivity of their economies to the shock of the pandemic and the socio-economic processes triggered by its outbreak.

Table 2

Values of the HHI value added index at the level of PKD sections
in Polish voivodeships in 2019

Voivodeship	HHI
Dolnośląskie	1,010
Kujawsko-Pomorskie	1,097
Lubelskie	1,246
Lubuskie	934
Łódzkie	1,238
Małopolskie	1,072
Mazowieckie	979
Opolskie	889
Podkarpackie	1,207
Podlaskie	1,302
Pomorskie	1,034
Śląskie	1,062
Świętokrzyskie	1,102
Warmińsko-Mazurskie	1,055
Wielkopolskie	1,256
Zachodniopomorskie	946

Source: own study based on the Local Data Bank of the Central Statistical Office.

The correlation coefficient between the HHI index value and the average GDP per capita growth rate of the surveyed voivodeships is negative, which confirms the thesis – regions with a more diversified production and employment structure were characterized by higher economic growth dynamics. Importantly, this relationship was observed both during the period of relatively good economic conditions (2014-2019) and the economic slowdown during the pandemic. On the other hand, it should be emphasized that the value of the calculated correlation coefficient was relatively small (-0.08), although this was probably due to the relatively small research sample.

Another feature of economies that is mentioned in the literature on the subject as important in the context of stimulating economic resilience is a modern and competitive production structure. Unlike economies with a relative dominance of traditional sectors (agricultural, industrial), it allows a relatively quick return of socio-economic systems to the initial development trajectory, generates high added value and high income from work (Merło *et al.*, 2015, p. 23).

For this reason, Table 3 presents the sectoral employment structure (as a measure allowing to assess the level of competitiveness of economies) in the studied regions in 2019, i.e. the year preceding the economic collapse caused by the COVID-19 pandemic.

Table 3

Sectoral employment structure in voivodeships in 2019

Voivodeship	Employment structure in %			
	agriculture	industry	market services	non-market services
Dolnośląskie	1.2	35.1	41.6	22.1
Kujawsko-Pomorskie	2.0	37.6	34.1	26.2
Lubelskie	2.1	32.5	32.1	33.3
Lubuskie	3.3	39.0	33.4	24.4
Łódzkie	1.2	35.2	39.5	24.1
Małopolskie	0.6	33.4	42.3	23.7
Mazowieckie	0.7	21.7	59.9	17.7
Opolskie	1.9	40.3	29.6	28.2
Podkarpackie	1.1	38.2	32.0	28.7
Podlaskie	1.6	33.5	33.0	31.8
Pomorskie	1.6	35.5	39.8	23.1
Śląskie	0.5	43.7	34.0	21.8
Świętokrzyskie	1.5	36.8	31.0	30.8
Warmińsko-Mazurskie	3.8	38.9	27.9	29.3
Wielkopolskie	2.0	36.3	44.6	17.1
Zachodniopomorskie	2.9	34.2	35.8	27.1

Source: own study based on the Local Data Bank of the Central Statistical Office.

The analysis of the above data allows for the observation of several fundamental facts in the context of changes in the level of economic activity of the surveyed voivodeships in the context of the COVID-19 pandemic.

Firstly, in the case of regions with the most competitive employment structure, a relatively large change in GDP dynamics could be observed in 2020 compared to the period before the outbreak of the pandemic. In four regions where employment in market services exceeded 40% of the total number of employees (Mazowieckie, Wielkopolskie, Małopolskie, Dolnośląskie), GDP per capita in 2020 was on average 1.9% higher than the year before. At the same time, in the voivodeships where this share was the smallest (below 34%), i.e. the Warmińsko-Mazurskie, Opolskie, Świętokrzyskie, Podkarpackie, Lubelskie, Podlaskie, Lubuskie and Śląskie voivodeships, an average increase in GDP per capita of 4.05% was recorded. In other voivodeships the increase was 3.34.

At the same time, in the following year in the first, most competitive group, the average GDP growth was 14.8%, while in the second (least competitive) group the increase was 14.4%. It follows that the large share of market services in the employment structure resulted in relatively high sensitivity to the shock

caused by the outbreak of the pandemic, but at the same time favored a faster recovery of growth potential in subsequent periods.

In turn, opposite trends could be observed in the labor market. The four voivodeships with the largest share of market services in the employment structure recorded the relatively smallest decline in employment (an average of -0.42%) in 2020 compared to 2019². In turn, in the regions where this share was the smallest, employment dropped on average by 1.99%. This, in turn, may suggest a relatively large impact of the employment structure on the sensitivity of regional labor markets.

Summary and Conclusions

The concept of resilience, including economic resilience, is a relatively new concept in economic sciences. In general terms, it means the ability of complex systems to self-repair, restoring the initial state of balance after the absorption of negative exogenous shocks. In a narrower economic sense, this term refers to economies that, in the face of a demand or supply shock, do not experience a significant decline in the level of economic activity or return to their original growth path relatively quickly. The issue of economic resilience becomes particularly important given the growing turbulent nature of the modern economy.

The aim of the presented analyzes was to determine the economic resilience of Polish voivodeships in the face of a negative external shock such as the outbreak of the COVID-19 pandemic in 2020. For this purpose, the change in GDP growth dynamics was determined in the period before and during the economic collapse caused by the pandemic. Additionally, it was checked whether, according to the literature on the subject, the factors stimulating the level of economic resilience could be a diversified and competitive structure of production and employment.

The analyzes carried out allowed for several basic conclusions to be drawn. Firstly, Polish regions had different reactions to the shock caused by the onset of the pandemic. As for the dynamics of GDP per capita growth, in 2020 in some regions there was a decrease (Pomorskie Voivodeship) or a slight increase (at the level of 1% or below) of this indicator (Mazowieckie, Śląskie and Podkarpackie Voivodeships). This is important because in previous years the increase was at the level of 5.5% on average in the country. At the same time, in some voivodeships (Łódzkie, Kujawsko-Pomorskie, Świętokrzyskie, Warmińsko-Mazurskie, Podlaskie) in 2020 GDP per capita increased by at least 5%. Therefore, this indicates the diversified economic resilience of Polish regions and raises the question about its determinants.

² Due to space limitations, detailed data on employment changes during the onset of the pandemic and during it were not presented.

As for the level of production diversification, measured by the Herfindal-Hirschman index, no significant relationships can be identified. The level of this indicator in all voivodeships in 2019 was at a level indicating a highly or moderately diversified production structure. At the same time, the differences in its values between individual voivodeships and groups distinguished due to the change in the dynamics of GDP per capita growth in 2020, were so small that it cannot be said to have an impact or not on the economic resilience of the examined economies.

The analyzes conducted show that the factor that significantly influenced the level of economic resilience of Polish regions during the COVID-19 pandemic was the competitive and effective production structure. Voivodeships with a relative dominance of market services in the first period of the slowdown caused by the pandemic recorded the relatively largest decline in GDP growth dynamics per capita. However, in the following year the economic growth rate in these regions was relatively the highest. At the same time, the decline in employment in 2020 was the smallest in these regions. This indicates a relatively high sensitivity of production to external demand and supply shocks, but also a high potential for rebuilding the original growth trajectory. Opposite trends were observed in regions where the structure of production and employment was not so competitive. This may also indicate that the uncompetitive production structure with a large share of industries characterized by low demand elasticity (mainly agriculture) was a factor building a higher level of regional resilience.

It follows from the above that building economic resilience requires strengthening structural changes in the production structure in the regions. Nevertheless, the mechanism of processes occurring in the economy during an exogenous shock remains unrecognized. The long-term characteristics of the response of the studied economies to external impulses are also unknown. Therefore these research issues will determine the direction of the author's future analyzes in relation to analyzes of the economic resilience of Polish regions.

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