Spatial Differentiation of Poland's Gross Domestic Product

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Abstract:

Purpose: The main aim of this study was to evaluate changes in spatial differentiation of Poland's gross domestic product (GDP). We also evaluated changes in GDP in specific provinces in Poland. Last, we analyzed the shadow economy in Poland.

Design/Methodology/Approach: Data for the study were obtained from the Statistics Poland data. The analyzed data covered the period from 1990 to 2023, which reported a total of 34 years of observations. We used tabular, graph and descriptive methods to present the spatial differentiation of GDP development.

Findings: The study revealed that in 2023, Poland's GDP exceeded PLN 3 trillion. We used the nominal GDP that is explained in current prices. Moreover, the biggest GDP was observed in the Mazovia, Silesia and Wielkopolskie voivodeships. In 2021 the highest GDP was produced in the Mazovia voivodeship (593 814 PLN million), the Silesia voivodeship (314 500 PLN million) and the Wielkopolska voivodeship (259 958 PLN million). The smallest GDP was observed in 2021 in the Opole voivodeship (53 994 PLN million), the Podlasie (58 369 PLN million) and the Świętokrzyskie voivodeship (60 381 PLN million). East voivodeships in Poland produce lower gross domestic products.

Practical implications: The study contributes to the development of the economy in Poland showing changes in gross domestic products (GDP). Poland is still divided into west with a better developed Poland and east with a lesser developed Poland. This is a clue for policy makers to address additional funding for the development in east Poland.

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1. Introduction

Gross domestic product (GDP) is the most important measure of the economy in the world. Even though the Gross Domestic Product is criticized and does not include all factors shaping the economy, it has its wide applications in analyzing the state of country development level (Thalassinos *et al.,* 2012; Thalassinos *et al.,* 2022).

Nominal GDP is measured in current prices and is good for analysis changes in short period of time. Nominal GDP is shaped by different factors and money supply has impact on its value in short period of time (Bórawski *et al.,* 2024). Whereas real GDP - is calculated in constant prices from a selected period, e.g., in prices from a selected year, it is obtained by summing up the value of production expressed in the currency of a given country, adjusted considering the changes in prices that have occurred.

There are many factors having an impact on GDP, for example: production, investment, export, consumption. The research conducted by different authors found correlation between different factors and GDP development.

Some scientists found a correlation between GDP and obesity. The authors found that a strong relationship between the incidence of overweight and obesity in the population and economic growth measured by the GDP per capita was observed (Zienkiewicz *et al.,* 2014). Other authors such as Lisowski and Wozniak (2022) analyzed fiscal preferences on profitability of enterprises against the GDP. They found that GDP, value added, GDP per capita and public consumption have an impact on profitability in medium-sized enterprises but it is negative.

Wozniak *et al.* (2019) measured the relationship between GDP and the development of SME (small and medium-sized enterprise). They found that there is a positive relationship between the GDP and the number of SMEs. However, the correlation is more evident between the GDP and medium-sized enterprises and number of employees rather than micro and small-seized companies.

Lyeonov *et al.* (2019) measured the correlation between green investment, the GDP per capita, GHG emissions and the share of renewable energy in the total energy consumption. The authors using statistical tools proved that green investment has impact on the GDP per capita growth by 6.4%, increase res in total final energy consumption by 5.6% and reduction of GHG emissions by 3.08%. These findings are very promising for the development of research and investment in the green economy.

Próchniak and Witkowski (2016) measured the convergence analysis using statistical tools and GDP in the EU countries. The authors found that the process of stochastic convergence in the EU countries is not as widespread as the cross-sectional studies on β or σ convergence indicate.

Próchniak (2016) measured the economic growth of chosen EU countries using Total Factor Productivity (TFP) index. He found that Baltic States achieved fast economic growth exceding 10% after accession to the EU.

The GDP measures the market value of all final goods and services produced in a country over a given period. GDP, money supply, currency rate, interest rate, inflation anticipation, imported inlation and other are the factors that scholars have consistently used to explain inflation (Lim and Sek, 2015; Bórawski *et al.,* 2024).

The GDP on the demand side is calculated as the sum of expenditures made by households, businesses, and the government over a given period. The following components of these expenses can be distinguished:

GDP = C+I+G+NX

- – Private consumption (C), i.e., consumption expenditure by households; they can be divided into expenditure on the purchase of durable goods, semi-durable goods, non-durable goods,
- – Government consumption (G), i.e., government spending; it consists of expenditure on goods and services and capital investments,
- – Accumulation (I) i.e., investment expenditure of enterprises; they consist of gross fixed capital formation, increase in tangible current assets,
- – Net exports (NX) or the difference between exports and imports.

The GDP as a measure has its weak points, for example:

- the value of leisure time and leisure,
- purely financial transactions (e.g., sale and purchase of securities, government transfers, non-refundable payments of money to citizens),
- external costs and benefits (e.g., environmental pollution, volunteer work),
- the standard of living is influenced by much more factors than just the volume of production and the rate of its growth,
- not every production meets people's needs.
- does not consider adverse externalities, e.g., noise, landscape defacement, water pollution,
- pure GDP does not talk about the wealth of the society, it only shows the strength of the economy,
- the GDP per capita does not show the actual distribution of income generated (it is calculated for an average citizen of a given country),
- the GDP ignores many economic phenomena, undeclared production, grey market, farms to–unregistered production, shadow economy, subsistence households and farms,
- considers final goods that reduce the level of welfare, e.g., cigarettes and alcohol in excessive quantities,
- does not consider the value of free time, as well as differences in working time to achieve the same level of GNP,
- does not fully express the conditions in which society lives, as it informs only about the size of the supply of goods and services at a given time,
- does not consider differences and changes in the distribution of income, which is important in international comparisons of countries with similar GNP per capita.

One of the most important problems in estimating the GDP is the existence of a shadow economy. It is a problem of public finance and the consequences of undertaken laws. The existence of a shadow economy creates many problems for the economy. Its effect creates a shortage of public incomes. This particularly can be seen in local communes which are not given proper incomes.

In this case, the shadow economy includes the unregistered activity of households, the benefit of production without notification, entitlements, concessions, licenses, and their incompatible declarations.

The Central Statistical Office estimated that informal economy accounts for about 13% of the GDP in Poland, while researcher according to the expert (Prof. F. Schneider), it was 23.3% of the GDP, with its level in Poland being one of the highest in Europe (Kotlińska, 2018).

2. Aim of the Study and Research Methodology

The main aim of the study was to analyze spatial differentiation of Poland's Gross Domestic Product (GDP). The detailed research objectives were to:

1. Identify the value of gross domestic product.
2. Analyzing the changes of gross domestic products in Poland.
3. Evaluation the shadow economy and its scale in Polish economy.

We used the tabular and graph methods to present the analysis. We used data from 1990 to 2022. Such long period of time enabled us to evaluate the changes in GDP in long period of time. We presented the date in USD and in Polish zloty. This helped to compare the changes in GDP in different currencies.

4. Results and Discussion

Poland was one of the poorest countries in the world as it transitioned from a centrally planned economy to a market economy. In 1989, Poland's THE GDP was equivalent to only 33% of Germany's The GDP (Raport…, 2023). In 1990, Poland was the world's 81st largest economy in terms of the GDP growth rate, below the global average.

Poland's GDP increased from USD 65.98 billion in 1990 to USD 860 billion in 2023, i.e., by around 1300%. The Polish economy grew more than 13-fold in the analyzed period (Figure 1). However, this calculation depends on the exchange rate USD-PLN (Figure 1).

Figure 1. *The GDP (USD billion)*
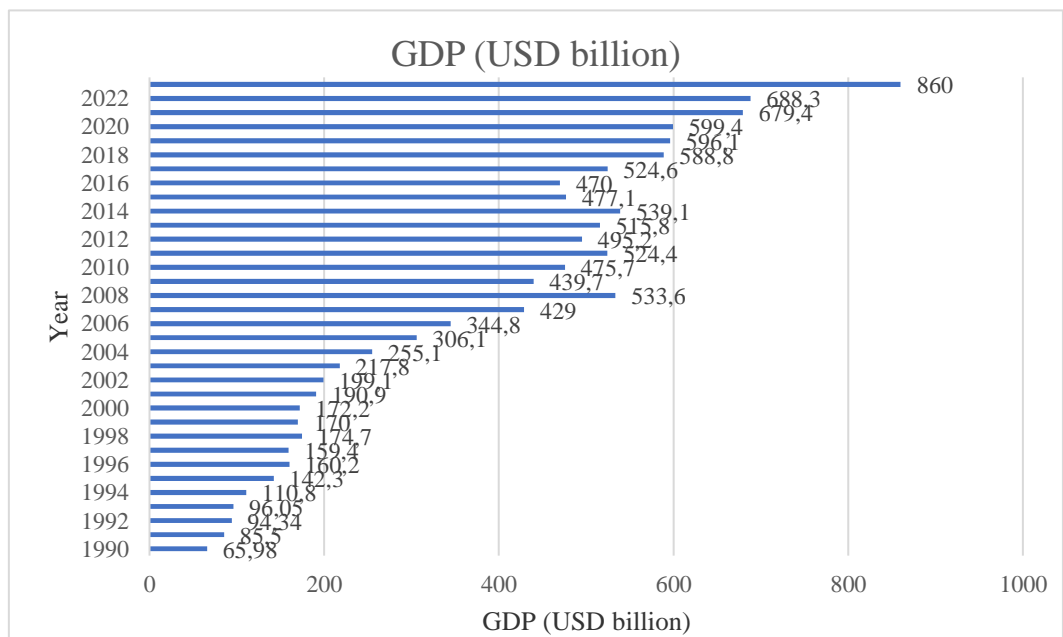
Source: Own elaboration based on Statistics Poland data.

In 1990, Poland's GDP per capita was 13-times lower relative to Japan, 12-times lower relative to the US, 11-times lower relative to the Federal Republic of Germany, and 10-times lower relative to France (Raport…, 2023). After 1989, Poland experienced the highest rate of economic growth in the group of eleven former Soviet bloc countries, and its GDP per capita increased more than 200% between 1989 and 2017. Poland's GDP per capita increased from USD 1731 in 1990 to USD 18,688 in 2022 (Figure 2).
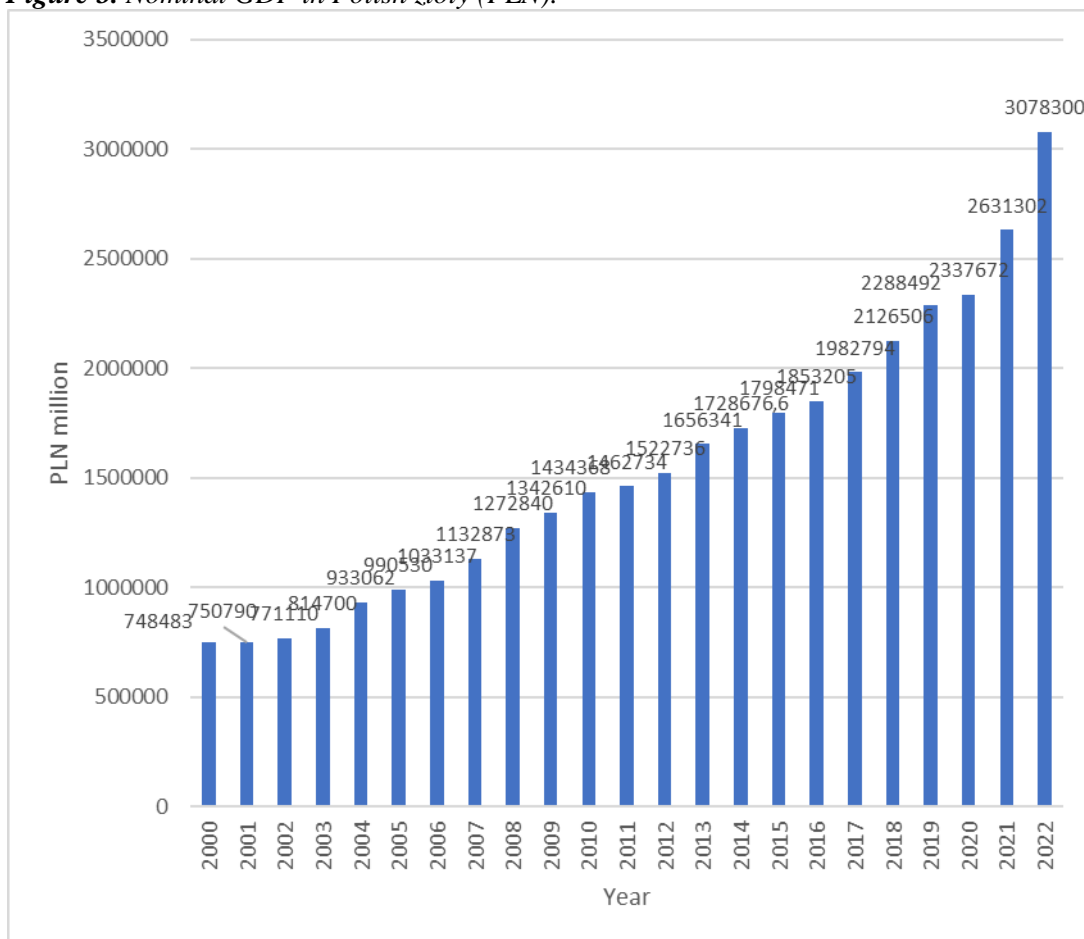
Figure 2. *The GDP per capita (USD)*
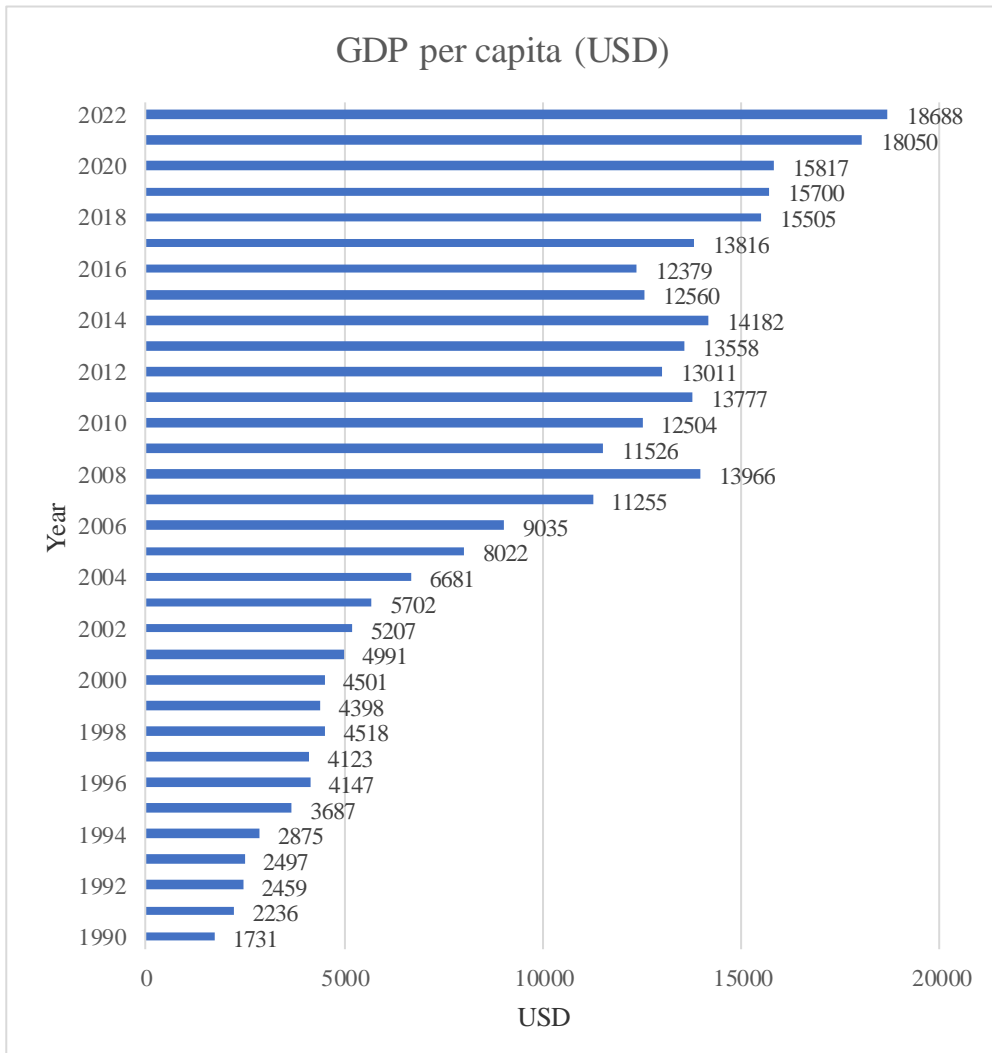
GDP increase of the Polish economy is presented in Figure 3. As we can see the Polish economy exceeded 3 trillion PLN in 2022. In fact, the GDP is higher than presented because we do not calculate the shadow economy (Figure 3).

Figure 3. *Nominal GDP in Polish zloty (PLN).*

Source: *Own elaboration based on Statistics Poland data.*

Poland's GDP varies across regions. The GDP is highest in the most developed Polish regions. In 2012, the GDP was highest in the voivodeships of Mazovia (PLN 593,814 million). The problem with Mozovia voivodeship GDP is that the highest is achieved by Warsaw and the nearest counties. Regions of Mazovia Voivodeship located far from Warsaw achieve lower GDP, which is similar to neighborhood voivodeships. People earn the most in Warsaw which is the capital of Poland and exerts more capital and international business (Table 1).

High GDP was also observed in Silesia (PLN 314,500 million), and Wielkopolska (PLN 259,958 million). In turn, the lowest GDP in 2012 was noted in the

voivodeships of Opole (PLN 53,994 million), Lubusz (PLN 56,102 million), Podlasie (PLN 58,369 million), Świętokrzyskie (PLN 60,381 million), and Warmia and Mazury (PLN 67,755 million).

Table 1. *The GDP of Polish voivodeships (PLN million)*

Voivodeship	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021
Poland	748 483	990 530	1 434 368	1 798 471	1 853 205	1 982 794	2 126 506	2 288 492	2 337 672	2 631 302
Lower Silesia	58 630	77 443	122 595	151 509	155 230	165 470	175 457	188 974	195 646	222 670
Kuyavia-Pomerania	36 272	46 338	64 837	79 685	82 012	87 022	93 521	98 401	102 446	114 909
Lublin	30 925	39 678	56 269	69 153	71 476	76 515	80 103	86 161	87 493	97 523
Lubusz	17 641	23 670	32 361	39 885	41 262	43 412	46 099	48 996	50 026	56 102
Łódź	45 657	61 850	88 895	109 670	112 361	119 598	127 386	138 047	144 450	159 665
Małopolska	56 433	75 053	108 886	141 845	147 322	159 309	172 749	185 151	189 463	215 847
Mazovia	152 817	206 633	308 920	396 696	409 268	441 670	478 679	522 310	536 016	593 814
Opole	17 476	22 642	31 082	37 828	38 298	40 677	43 380	46 396	46 872	53 994
Podkarpacie	29 882	39 220	55 224	70 540	72 429	76 649	83 067	89 467	89 287	101 498
Podlasie	17 431	23 054	32 932	39 865	40 893	44 203	47 035	50 801	52 595	58 369
Pomerania	41 914	56 376	81 313	103 604	108 072	115 519	125 287	135 565	136 028	157 785
Silesia	99 189	131 128	184 566	222 368	228 268	243 334	260 932	276 583	272 936	314 500
Świętokrzyskie	19 891	25 607	37 092	42 955	43 693	46 406	49 957	52 733	53 970	60 381
Warmia and Mazury	21 620	27 902	39 494	48 100	49 685	52 296	54 777	58 194	60 675	67 755
Wielkopolska	69 838	94 073	134 763	176 552	183 432	196 719	208 963	226 509	233 474	259 958
Western Pomerania	32 867	39 864	55 141	68 216	69 506	73 995	79 113	84 205	86 294	96 531

Source: *Own elaboration based on Statistics Poland data.*

In 2021 the highest GDP was observed in Mazovia voivodeshi (593 814 PLN million), Silesia voivodeship (314 500 PLN million) and Wielkopolska voivodeship (259 958 PLN million). The smallest GDP was achieved in 2021 in Opole voivodeship (53 994 PLN million), Podlasie (58 369 PLN million) and Świętokrzyskie voivodeship (60 381 PLN million).

These results indicate that eastern regions are characterized by slower economic growth than the western parts of the country. Based on these differences, Poland has been traditionally divided into the richer Poland A (western regions) and the poorer Poland B (eastern regions) (Table 1).

4.1 GDP per Capita

Poland is catching up with richer countries. Let us add that in the recently published Eurostat ranking on purchasing power in relation to the GDP (GDP per capita in EU countries), Poland took 19th place. We are consistently catching up with the richer countries, although we are still far from the richest.

The Eurostat report shows that the purchasing power index for Poland (GDP per capita) last year reached 79 percent of the EU average. For comparison, the last on the list, Bulgaria, had an average rate of 59 percent, and the inhabitants of wealthy Luxembourg 261 percent of the average for the entire EU.

In 2021 the GDP per capita on average in Poland was 69,3 thousand PLN. Warsaw and the nearest communes achieved 202,9%, whereas the whole Mazovia voivodeship 87,9% GDP per capita. It means that inhabitants of Mazovia communes located near other voivodeship earned close to the other voivodeship (Figure 4).

Figure 4. *Gross Domestic Product per Capita by Region in 2021 (current prices)*
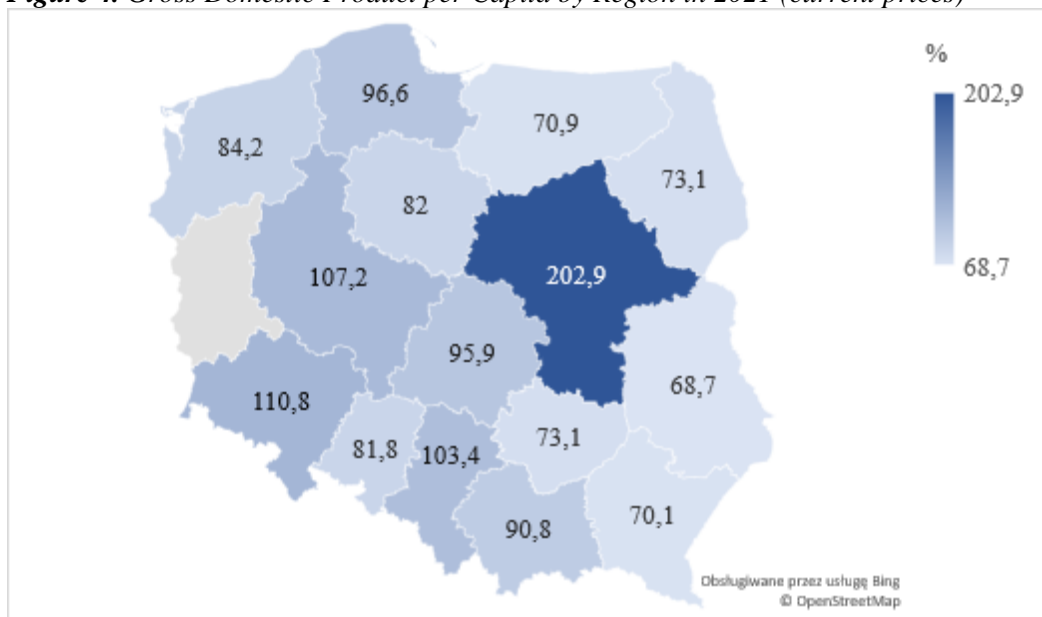
Source: Statistics Poland.

In Table 2 we present the impact of individual categories on real GDP growth (in percentage points). As we can see the most important carrier having impact on GDP in Poland is domestic demand and gross value added.

**Table 2.** *The scale of the impact of individual categories on real GDP growth (in percentage points)*

Specification	2019	2020	2021	2022
GDP	4,4	-2,0	6,8	4,9
Domestic demand	3,2	-2,6	7,8	5,3
Total consumption	3,1	-1,1	4,4	1,6
Including consumption in the household sector	2,0	-2,0	3,5	1,7
Gross fixed capital formation	1,2	-0,4	0,4	0,8
Gross value added	3,8	-1,8	5,8	4,0

Source: *Own calculations based on Statistics Poland.*

4.2 Shadow Economy (SE)

The GDP is not evaluated directly because the shadow economy (SE) is not evaluated. This is an important and contemporary research problem. The assessment of SE is very difficult because there is no official data and methodology which can be used to measure this phenomenon. The SE always existed in the economy in almost all countries, but its value is difficult for elaboration (Brzozowska-Rup *et al.,* 2018). It is not measured exactly what is the value of shadow economy in Poland (Figure 5).

Figure 5. *Value of shadow economy (mln PLN)*
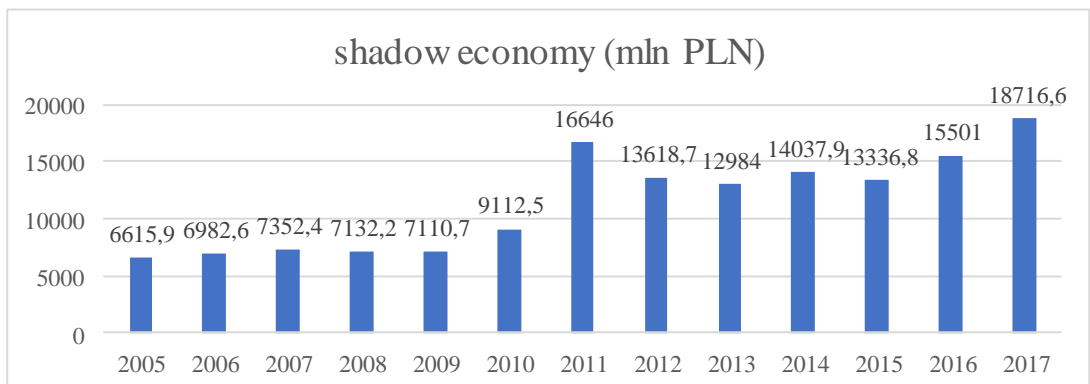

Source: *Own calculations based on Statistics Poland.*

According to Czapkiewicz and Brzozowska-Rup (2021) the shadow economy in Poland in 2017 was 18716,6 mln PLN. Shadow economy is a very important problem for the economy. First, the money from taxes are not sent to budget because this is the most important source of income. Second, people are working in the

market without insurance, what during accidents can be a problem for insurance system. Third, the economy as the whole loses the possibilities of development because of shortage of income. Shadow economy is a very problematic area within European National Accounts (Schneider, 2013).

The size of the shadow economy is not included in Poland's GDP. According to Czapkiewicz and Brzozowska-Rup (2021) the shadow economy in 2021 was 15.1%. According to the data of the Institute of Economic Forecasts and Analyses, this year the shadow economy will once again expand. Analysts estimate that by the end of 2022 it will be as high as 19.4%. For comparison, in 2019 it was about 17.2%, and in 2021, 18.3% (Figure 6).

Figure 6. *Share of the shadow economy in GDP in Poland (%).*
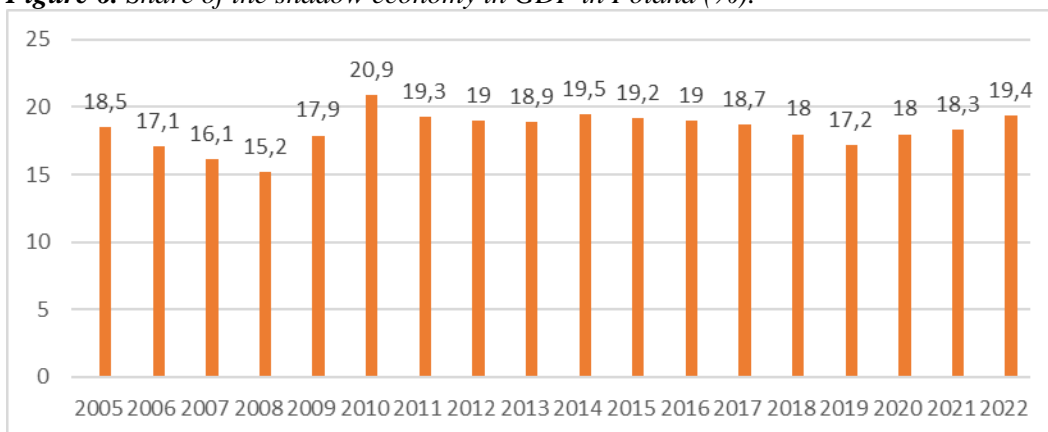
Source: Calculations based on Institute of Economic Forecast and Analyses.

Research done by Achim *et al.* (2024) points out that average levels of the shadow economy in the European Union range between 9.5% and 40% of the official GDP over the analyzed period 2001-2021. Using Schneider method (2019; 2022) the authors pointed out that countries such as Bulgaria, Romania, Croatia and Latvia exhibit a higher percentage of the shadow economy in their GDP (above 35%), while countries like Austria, the Netherlands and Luxembourg have a lower percentage (under 10%).

Such countries as Bulgaria, Croatia, Romania, Poland, and Latvia increased SE in GDP in 2021 compared to 2001. These countries joined the EU and gained access to common market. Old members of EU decreased the SE share in GDP.

5. Conclusions

The aim of this study was to determine the spatial differentiation of Gross Domestic Product (GDP) in Poland. Region with the highest GDP is Mazovia voivodeship where Warsaw, the capital of Poland is located. This situation leads to the biggest

investment and capital in Warsaw. Counties located far from Warsaw achieve smaller gross domestic products which is similar to other voivodeships (Figure 7).

Figure 7. *Share of shadow economy in GDP in EU countries.*
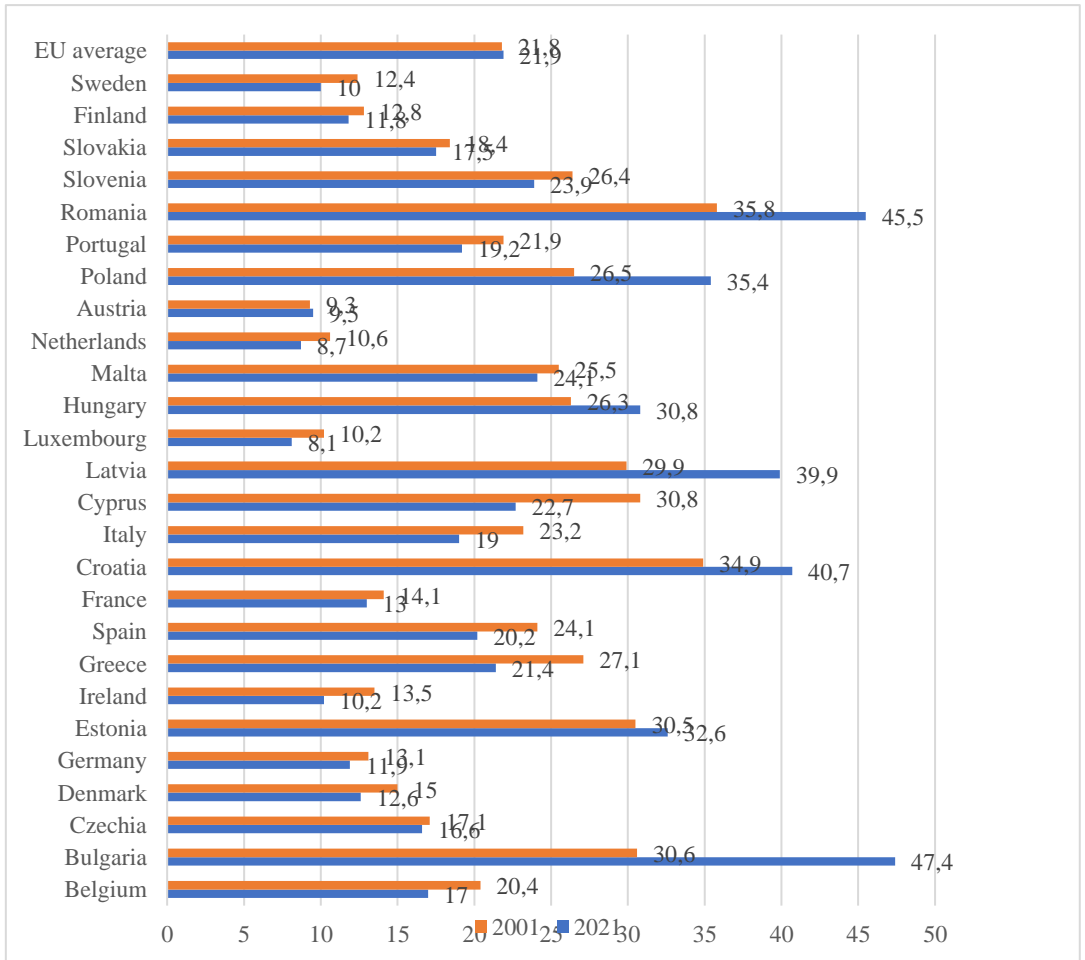
Source: *Achim et al. (2024).*

Poland is a country with a large spatial diversity of GDP. The highest GDP value was achieved in 2021 by the Mazowieckie (PLN 593,814 million), Wielkopolskie (PLN 259,958 million), Dolnośląskie (PLN 222,670 million) and Małopolskie (PLN 215,847 million) voivodeships.

The lowest GDP value was achieved in 2021 in the Opolskie Voivodeship (53,994 million PLN), Podlaskie (PLN 58,369 million), Świętokrzyskie (PLN 60,381 million) and Warmian-Masurian (PLN 67,755 million).

The largest increase in GDP value in the years 2000-2021 was recorded in the Mazowieckie (388.6%), Małopolskie (382.5%), Dolnośląskie (379.8%) and Pomorskie (376.4%) voivodeships. The smallest increase in GDP value in the years 2000-2021 was recorded in the Zachodniopomorskie (293.7%), Świętokrzyskie (303.5%), Opolskie (308.9%) and Warmian-Masurian (313.4%) voivodeships. During this period, Polish GDP increased by 351.6%.

Polish's GDP increased from PLN 748,483 million in 2000 to PLN 3,078,300 million in 2023. Many factors were responsible for GDP growth, including the availability of money.

The research proved that Polish GDP is underestimated because of shadow economy (SE). Bearing in mind that shadow economy in Poland evaluates about 20% the GDP should be increased and should be about 4 trillion PLN. Lower GDP means lower incomes paid to budget.

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