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Spatial Disproportions of the Green Economy and the Financial Situation of Polish Voivodeships in 2010–2020

Paweł Dziekański [1], Piotr Prus [2,*], Piotr Sołtyk [3], Magdalena Wrońska [4], Florin Imbrea [5], Laura Smuleac [6,*], Raul Pascalau [5] and Karolina Błaszczyk [2]

1 Department of Economics and Finance, Jan Kochanowski University in Kielce, Uniwersytecka 15 Str., 25-406 Kielce, Poland
2 Department of Agronomy, Faculty of Agriculture and Biotechnology, Bydgoszcz University of Science and Technology, Al. Prof. S. Kaliskiego 7, 85-796 Bydgoszcz, Poland
3 Department of Economics, Finance and Law, Cracow University of Economics, 27 Rakowicka, 31-510 Krakow, Poland
4 Institute of International Relations and Public Policies, Jan Kochanowski University in Kielce, Uniwersytecka 15 Str., 25-406 Kielce, Poland
5 Department of Agricultural Technologies, Faculty of Agriculture, University of Life Sciences "King Mihai I" from Timisoara, 119 Calea Aradului, 300645 Timisoara, Romania
6 Department of Sustainable Development and Environmental Engineering, Faculty of Agriculture, University of Life Sciences "King Mihai I" from Timisoara, 119 Calea Aradului, 300645 Timisoara, Romania
* Correspondence: piotr.prus@pbs.edu.pl (P.P.); laurasmuleac@usab-tm.ro (L.S.)

Abstract: The provincial government, a separate association of regional communities in the state structure, carries out public tasks that affect the quality of life of the local community and the activities of businesses. Geographical conditions and the effect of socioeconomic factors lead to different levels of development in different regions. The endogenous potential of the local government is the result of a combination of local conditions, determining its opportunities and directions of development. The aim of this article was to assess and identify the spatial differentiation in the relationship between the green economy and the financial situation of voivodeships in Poland using synthetic measures. The choice of variables for the period of 2010–2020 was determined by the availability of the data collected from the regional system in the CSO Local Data Bank. The Technique for Order of Preference by Similarity to the Ideal Solution was used to construct the synthetic measures. Financial resources are the basis for the operation of local government units, conditioning the implementation of their current and developmental tasks. Knowledge of the current state of finances allows authorities to make comparisons with other units and is helpful in making financial decisions. The green economy is one of the paths to sustainable development. The green economy increases the quality of life and social equality while reducing environmental risks and natural resource consumption. As a result of the research procedure, the spatial differentiation of provinces in Poland in 2010–2020 is presented in terms of the level of the synthetic measure of the green economy and financial situation. In 2010, the synthetic measure of the green economy ranged from 0.31 to 0.42, and in 2020, it ranged from 0.40 to 0.53. The synthetic measure of financial risk in 2010 ranged from 0.37 to 0.61, and in 2020, it ranged from 0.40 to 0.77. The measures are shaped by economic activity and working conditions, health, education, leisure and social relations, economic and physical security, and environmental quality. The results of this survey enable local governments to make comparisons. The lessons learned can allow them to identify potential directions for optimizing development policies.

Keywords: green economy; sustainable development; financial situation; rural area; synthetic measure; province

Citation: Dziekański, P.; Prus, P.; Sołtyk, P.; Wrońska, M.; Imbrea, F.; Smuleac, L.; Pascalau, R.; Błaszczyk, K. Spatial Disproportions of the Green Economy and the Financial Situation of Polish Voivodeships in 2010–2020. *Sustainability* **2022**, *14*, 13824. https://doi.org/10.3390/su142113824

Academic Editors: Chengpeng Lu, Ruzi Li, Haoming Guan and Fuyou Guo

Received: 26 September 2022
Accepted: 18 October 2022
Published: 25 October 2022

1. Introduction

Recent years have seen a period of increasing ecological awareness by individual societies. The changes taking place in the world economy, and in particular the relations

between economic, environmental, social, and political aspects, have become the starting point for considering the path of socioeconomic development. One of the new approaches is the concept of a green economy. It aims to achieve measurable progress in the link between the environment and the economy. It also defines a pragmatic approach to the implementation of the concept of sustainable development. Currently, users are obliged to take social responsibility for their actions, including those relating to the environment. Environmental, social, and economic problems are closely intertwined and complex [1]. Such an approach creates many unforeseen side effects, proving the inadequacy of the policy pursued. The complexity of these problems becomes a serious challenge for politicians and decision makers [2]. The voivodeship self-government, a union of the regional community separated in the state structure, carries out public tasks. The factors that affect the different ways of performing individual tasks are the financial possibilities, the actual needs of residents, business entities, the environment, and the availability of natural resources.

The endogenous potential of the local government is the result of a combination of local conditions that determine its possibilities and directions of development. As D. Milczarek pointed out, it is the sum of, inter alia, geographic, demographic, economic, social, and financial elements [3]. The analyses conducted by P. Churski and his co-authors, as well as M. Stanna, showed that an important endogenous element influencing development opportunities is the financial potential [4,5]. The unexpected outbreak of the COVID-19 pandemic resulted in a decrease in the operating surplus, which allowed for the implementation of development initiatives and the adoption of intervention measures in the event of crises. For this reason, cooperation between the government and local authorities is important in order to strengthen financial stability (i.e., the financial situation) [6,7]. Financial situations (as endogenous processes and as the resources of individuals) are complex and affect financial security. They include the ability to perform tasks and pay current as well as future liabilities [8].

A green economy increases the quality of life and social equality while reducing environmental risk and the consumption of natural resources. By contrast, it more clearly emphasizes the importance of preserving natural capital for shaping economic development. Hence, structural transformations play an important role in the economy based on environmentally friendly technologies, i.e., the technologies ensuring greater efficiency in the use of energy and natural resources [9].

Due to these discussions and doubts surrounding the issue of the green economy (GE) and financial situations, the authors decided to formulate the following research questions: How spatially diversified is the implementation of green economies and financial situations? What is the financial situation of territorial units in terms of implementing a green economy? Does the level of the financial situation of a voivodeship depend on the level of variables characterizing the development process (or green economy)? Which variables of the endogenic potentials of a voivodeship shape the level of its green economy and financial situation?

The aim of this research was to assess the spatial differentiation of the green economy in relation to the financial situation in Poland using synthetic measures. This enabled the ranking and grouping of the surveyed units from the point of view of the main criteria (which were the green economy and financial situation). We also analyzed to what extent the variables of the synthetic measure structure determined these criteria as well as the interaction between the areas under study. Therefore, in this study, we also attempted to observe the possible changes resulting from the prevailing pandemic and the actions taken by public authorities. To achieve the goals defined in this way, the authors used the following research methods: first, an analysis of the literature on the subject was conducted, and then, a statistical analysis was carried out using synthetic measures.

2. Literature Review

The local self-government is one of the main pillars of economic development, while also ensuring the majority of public services are provided to citizens. It is a historic,

long-term process of internal, economic, and social transformation, which leads to the emergence of a society looking for ways to improve its situation. T. Kudłacz defined regional development as a permanent increase in the standard of living of the inhabitants and economic potential in the scale of a specific territorial unit. According to A. Klasik, on the other hand, regional development is a permanent growth of three elements: the economic potential of regions, their competitive strength, and the level and quality of life of their inhabitants. The main components of regional development are economic potential, economic structure, natural environment, infrastructure development, spatial order, living standards of inhabitants, and spatial development [10,11].

Sustainable development is the process of building a competitive economy that effectively uses its resources (primarily endogenous), with the aim of benefiting society through innovative processes and technologies [12]. Specifically, it should provide support for the aims of increasing real incomes, raising the level of education, and improving the health of the population and quality of life [13]. It is a process integrating activity in three dimensions: economic, social, and environmental [14,15].

Individual regions are characterized by different levels of development (which are due to their geographic conditions, socioeconomic resources, and location rents). They are also shaped (level of development) by historical conditions, new investments, the creation of new jobs, the inflow (or outflow) of capital, increases in the income of the population, etc. They determine the quality of life and functioning of enterprises [16]. The development factors (endogenous and exogenous) form a network of mutual relations, i.e., a multidimensional space of functioning. They are interdependent and should be considered together. J.J. Parysek indicated that some factors are universal, while others may occur in certain places and at certain moments in time [17].

The contemporary concepts of economic growth and development increasingly accept the so-called environmental element. According to the OECD, sustainable development means promoting economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which people's quality of life is based [18]. A green economy is one of the paths to sustainable development. Its advantage is its concretization of sustainable development. An important aspect of defining the green economy is social references and values. The concept of the green economy is multidimensional (as its assessment and analysis should also be). It includes economic, social, and ecological dimensions [19]. A brown economy is based on the use of fossil fuels and other non-renewable raw materials. By contrast, a green economy (as the new functioning model of the economy) should ensure proper relations between the economy and the environment. The green economy is an economy in which economic growth is combined with ecological responsibility, reinforcing each other in the process of supporting social progress [20]. The primary goal of creating a green economy is to solve the environmental problem in such a way as to obtain added value in the form of economic growth. It is a low-carbon, resource-efficient, and socially inclusive economy [21].

These elements are part of the contemporary regional development trend, largely absorbing endogenous factors, and contributing to the development of technical infrastructure [22]. This is important in the context of providing the inhabitants of a self-governing community with an appropriate standard of living and development. A green economy is characterized, among others, by the ideas of recycling, a sustainable production and consumption process, and increasing resource efficiency. The manner of waste disposal and recycling is a crucial process for the protection of the environment and human health [23]. The multifaceted nature of the problems of the green economy (environmental, social, and economic) becomes a challenge for governments and politicians [24,25]. The elements of the green economy are correlated with each other and the quality of life (which is perceived as one's position in life with respect to aspects such as one's culture, values, and expectations) [26].

At this point, it is worth emphasizing that the concept of fiscal federalism is of significant importance in the current models of financial management in local governments [27]. One of the assumptions of this concept is to draw attention to the importance of the share of

central taxes (i.e., personal income tax (PIT) and corporate income tax (CIT)) in the income of local government units. External transfers constitute an important part of the revenues, which are transformed into investment expenditures related to environmental protection as part of the management of the voivodeship's self-government budget.

Financial resources are the basis of the operation of local government units, conditioning the implementation of their current and future development tasks. Their analysis allows for not only the assessment of the structure of the budget itself but also indirectly provides information on the condition of the local economy. There is a feedback loop between the socioeconomic and financial variables. Finance allows for a comprehensive assessment of the operation of a local government unit and its development possibilities [28]. The financial situation of voivodeships is determined by obtaining the incomes, as well as the size and structure of expenditure needs in the scope of the tasks performed by them. The finances available to voivodeships determine both the degree and quality of the obligatory statutory tasks as well as investment activities. The assessment of the financial situation of voivodeships is a complex process but necessary, especially in terms of financial management and decision making [29].

M. Jastrzębska defined a financial situation as the ability to provide public services, at least at the current level, to obtain funds from returnable and non-returnable sources for the implementation of future tasks [30]. R. Hendrick referred to it as the financial abilities of an individual to fundraise, provide public service, manage debt, etc. [31]. J.W. Douglas and R.K. Gaddies indicated that the financial situation is associated with the possibility of timely fulfillment of financial obligations and ensured continuity in the provision of services [32]. It becomes justified to emphasize that the Polish legislature imposes an obligation on local government units to repay their obligations within the time limits resulting from the incurred obligations. Any deviations from this rule pose a risk of violating public finance discipline.

The financial situation of individual self-governing voivodeships is closely related to the scope of the social services and public tasks they provide. Financing at this level of local government depends on progressive decentralization and financial independence. The problem of equipping a voivodeship self-government entity with an appropriate level of financial resources, similarly to other levels of territorial self-governing units, is related to a limited income with a simultaneously extensive scope of tasks. Speaking of the tasks of self-governing voivodeships, it should be emphasized that, pursuant to the provisions of the law, they perform specific tasks on their own behalf and responsibility [33]. Moreover, a voivodeship board is legally entitled to dispose of the voivodeship's property and to conduct financial management on its own. These features give voivodeship boards full freedom in making financial decisions concerning the conducted regional policy.

R.I. Berne and R. Schramm described the main determinants of financial situations, among others, as the needs reported by the local community, the size of supply structures, the quality and structure of local public goods and services, costs of labor (both local, regional, and national labor markets), the structure of capital and other factors of production, and the wealth of the society [34]. X. Wang, L. Dennis, and Y. Sen indicated that the socioeconomic environment is only one of the factors shaping financial situations, along with, among others, financial revenue, spending, debt, demography, laws, the economy, the size of local government units, investment attractiveness, the condition of public finances, the scope of income and expenditure control of the local government, and economic fluctuations in the country and the world. They interact with each other and should be taken into account together when analyzing financial situations [35]. The level and classification of the development expenditures adopted in local government budgets also have a significant impact on the financial situation of each local government unit. The greater the share of the development and investment expenditure, the greater the impact on the condition of the local economy [36]. When addressing the problem of incurred budget expenditures, in particular, on the investment tasks of local government units, it is reasonable to pay attention to their control and evaluation in the context of effective management. This is an important factor directly related not only to the investment process itself but, considered much more broadly,

in the context of the "public accountability" of the decision makers of local government units in the legal and management aspects of public financial resources. The implementation of this still valid postulate in the entities included in the public finance sector takes place through modern instruments supporting the financial management of local governments, namely internal auditing and management control. Undoubtedly, both of these instruments have a direct impact on the financial situation of local government units [37].

Financial situations are complex and influenced by many factors. They are analyzed in relation to income, expenditures, and debt levels. They cannot be described with a single indicator. Their assessment allows for the determination of not only the efficiency of the operation of municipalities but also the possibility of raising the standard of services provided by municipalities to local communities [8].

3. Materials and Methods

The aim of this article was to assess and identify the spatial differentiation in the relationship between the green economy and the financial situation of voivodeships in Poland using synthetic measures using the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS). This allowed the authors to rank and group the researched units from the point of view of the main criteria of the green economy and financial situations. The results of the analysis may provide a reference for voivodeship authorities to use this method for the socioeconomic diagnosis or evaluation of the effects of pursued policies or to assess the earlier (operational or strategic) actions taken. Descriptive statistics were also used in the study. Correlation analysis was used to determine the relationships between the variables. Scatter plots and maps of the spatial differentiation of the studied areas are presented. The problems encountered in the process of the implementation of this research were, among others, due to the following: the primary situation and scope of the tasks performed by local government units, changes in administrative divisions and their socioeconomic situations, and the lack of data availability for a given level of local government unit (partial or incomplete data).

Empirical data in spatial terms were collected from Polish voivodeships. The choice of variables was determined by the availability of data in the Local Data Bank of the Central Statistical Office (BDL GUS) for the years 2010–2020. A voivodeship is a local government unit (a regional self-governing community) and the highest level of the basic territorial division of the country established to perform public administration [38].

It should be noted that Polish voivodeships are the equivalent of the current Eurostat statistical nomenclature for NUTS 2. This category is the main recipient of the cohesion policy implemented by the EU. Moreover, the nomenclature itself does not indicate local character, as it has its equivalents in individual EU countries such as, e.g., regions in Spain. The areas of this research were arable land (59.9% of the country's area), forests (30.2% of the country's area), as well as residential, industrial, and recreational areas, land under water, and agricultural wasteland (Figure 1).

Synthetic measures based on the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) method were used to assess the spatial differentiation of the green economy and financial situation of voivodeships in Poland. This measure enabled a multidimensional and comprehensive look at the level of the phenomena in individually examined objects, and in conducting comparative analyses of objects (in spatial and temporal terms) and their linear ordering [39].

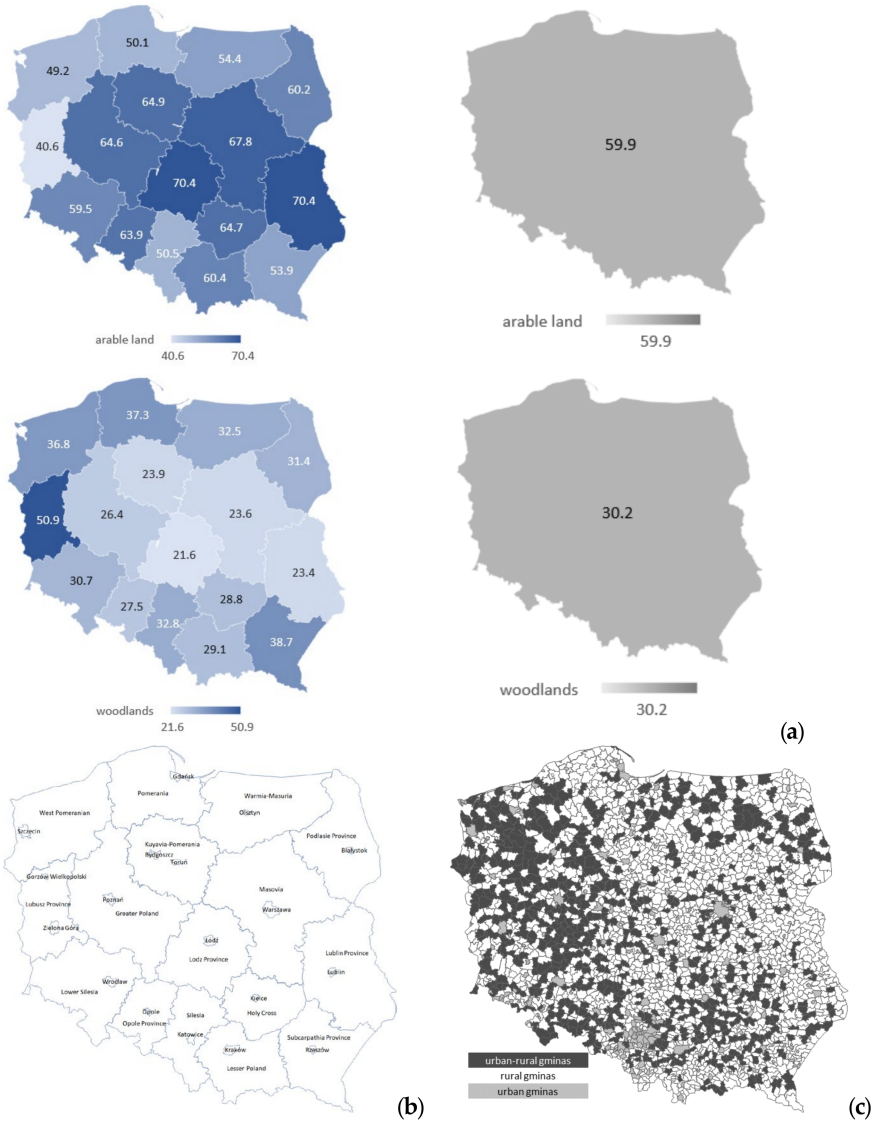

Figure 1. National land use in Poland as a percentage of the total as of 1 January; data as of 2020 (**a**); voivodships in Poland (**b**); rural–urban, rural, urban gminas in Poland (**c**). Source: own study based on BDL CSO data.

In the first stage of this work, simple variables were selected and verified in terms of content and/or statistics. The resulting observation matrix was written as X_{ij}:

$$X_{ij} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1m} \\ x_{21} & x_{22} & \dots & x_{2m} \\ \dots & \dots & \dots & \dots \\ x_{n1} & x_{n2} & \dots & x_{nm} \end{bmatrix}, \quad (1)$$

where X_{ij} denotes the values of the j-th variable for the i-th object in a data matrix of objects, i is the object number (i = 1, 2, . . . , n), and j is the variable number (j = 1, 2, . . . , m). The research was carried out dynamically, determining the values of the min $\{x_{ij}\}$ and max $\{x_{ij}\}$ for the entire period of the years 2010–2020.

In the next stage, the quasi-constant variables were eliminated (using the coefficient of variation), and the strength of the relationship between the variables was determined (Pearson's linear correlation coefficient). In order to select the optimal variables, factor analysis was also used.

After determining and collecting data on the initial set of features, verification activities were undertaken according to the criteria (in the statistical approach). These allowed for the elimination of quasi-constant variables, for which the coefficient of variation was used (the ratio of standard deviation to the mean value), written with the following formula:

$$V_i = \frac{S_i}{\overline{x}};\ \overline{x} \neq 0 \tag{2}$$

where V_i is the coefficient of variation for the i-th variable, and S_i is the standard deviation for the i-th variable [40].

Diagnostic features should show sufficient spatial variability. They should be the carrier of the information differentiating the examined objects. For the analyzed features (selected for this study as diagnostic variables), the coefficient of variation was calculated. From a set of variables, the features satisfying inequality were eliminated according to $|V_i| \leq V^*$, where V* denotes the critical value of the coefficient of variation. The value of V* = 0.10 was adopted as the critical value [41].

The correlation coefficient was also assessed with the use of Pearson's linear correlation coefficients, expressed by the following formula:

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2 \sum_{i=1}^{n}(y_i - \overline{y})^2}}, \tag{3}$$

where r_{xy} is Pearson's linear correlation coefficient, x and y are the measurable statistical features x = (1, 2, . . . , n) and y = (1, 2, . . . , n), and $\overleftarrow{x}$, $\overleftarrow{y}$ are the arithmetic means of the x and y features. In the case of identifying too high of a value of the correlation index between the analyzed features, a representative was selected. This was usually r* = 0.75 and was assumed as the threshold level of the correlation coefficient [42].

The selection of variables was also made on the basis of a factor analysis (performed using the Statistica program). The indicated method allows for the transformation of the original set of objects into a set of their groups; it confirms the validity of the indicated variables in the assessment of the studied phenomenon. Factor analysis is a method of studying the structure of the internal dependencies of multivariate observations. The main advantage of factor analysis is the ability to determine the number of variables that will sufficiently explain the inter-relationship between many variables [43].

Regarding the choice of variables, the direction of the preferences of variables in relation to the general criteria under consideration was determined, dividing them into stimulants and destimulants (the final list of which is presented in Table 1) [44]. A stimulant is understood as one in which high-level results imply the desired state of the phenomenon under study. On the other hand, a destimulant is one in which a high-level value implies an undesirable state of the phenomenon under study. Most variables are obvious, and their determination is intuitive. In doubtful cases, it is worth using Grabiński's procedure, which uses the fact that stimulants should be positively correlated with stimulants (similarly for destimulants) and negatively correlated with destimulants [45,46].

Diagnostic variables usually have different titers and ranges of variation, which make it impossible to compare and add them directly [42,47,48]. The standardization of the selected variables was performed according to the zero unitarization method [49], using the following formula [50]:

$$Z_{ij} = \frac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}},\ \text{when } x_i \in S, \tag{4}$$

$$Z_{ij} = \frac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}},\ \text{when } x_i \in D \tag{5}$$

where S is the stimulant, i = 1, 2 . . . , n; j = 1, 2, . . . , m; $maxx_{ij}$ is the maximum value of the j-th variable; $minx_{ij}$ is the minimum value of the j-th variable; x_{ij} is the value of the j-th variable for the object [29,41,51]; Z_{ij} is the normalized value of the j-th variable for the object.

Its aim was to standardize the nature of the variables, bring the different variables to mutual comparability, and replace the different ranges of the variability of individual variables with a constant range [46,52,53]. The value of Z_{ij} was in the range [0; 1]. A value of 1 meant that the variable obtained the maximum value among all the examined objects in the whole examined period of time. A value equal to 0 meant that the object took the minimum value. All the variables were standardized with regard to the range of variability and their location in the observation space. As a result of unitarization, we obtained a matrix of feature values Z_{ij}:

$$Z_{ij} = \begin{bmatrix} z_{11} & z_{12} & \dots & z_{1m} \\ z_{21} & z_{22} & \dots & z_{2m} \\ \dots & \dots & \dots & \dots \\ z_{n1} & z_{n2} & \dots & z_{nm} \end{bmatrix}, \quad (6)$$

where Z_{ij} is the unitary value of the j-th variables for the i-th object.

The first synthetic measure of development was proposed by Z. Hellwig to evaluate the economic development of selected countries [49]. The synthetic measure made it possible to order the examined objects according to the level of phenomena. By comparing multifeature objects according to the established criteria, the measure also allows for the indication of the weaker and stronger areas of a unit's operation. Moreover, it enables grouping the analyzed units into groups with a similar level of development.

In our analysis of the spatial differentiation of the green economy and financial situation of Polish voivodeships, synthetic measures based on the Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS) method were used. This is the benchmark method. The reference points of the objects in the multidimensional space were the patterns and anti-patterns [54–56]. The Euclidean distances of individual objects from these patterns and anti-patterns were successively calculated according to the following formulas:

$$d_i^+ = \sqrt{\frac{1}{n}\sum_{j=1}^{m}\left(z_{ij} - z_j^+\right)^2} \quad (7)$$

$$d_i^- = \sqrt{\frac{1}{n}\sum_{j=1}^{m}\left(z_{ij} - z_j^-\right)^2} \quad (8)$$

where $n \neq 0$ is the number of variables forming the pattern or anti-pattern, z_{ij} is the unitized value of the j-th feature for the tested unit (or the normalized value of the j-th variable of the same object), and z_j^+ / z_j^- is the template or anti-pattern object.

The synthetic measure for individual objects was determined on the basis of the following formula:

$$q_i = \frac{d_i^-}{d_i^- + d_i^+}, \text{ where } 0 \leq q_i \leq 1, \ i = 1, \ 2, \ \dots, \ n \quad (9)$$

where $q_i \in [0; 1]$ is the value of the synthetic measure, d_i^- is the distance of the object from the anti-pattern (from 0), and d_i^+ is the distance of the object from the pattern (from 1). A higher value of the measure indicated a better situation for an individual in the analyzed area. This method makes it possible to carry out assessments with the use of an unlimited number of criteria. An important advantage of the classic method is its computational simplicity and the indication of a positive and negative model [57,58].

In the last stage of research, a division into typological groups was used to interpret the obtained measures. The first, second, and third quartiles were adopted as threshold

values. The size of the synthetic measure in the first group meant a better unit, and in the following groups, weaker units. A dendrogram and a scatter plot with a line of best fit are also presented, as well as linear regression and autocorrelation analyses [59,60].

In the assessment of the synthetic measure, cluster analysis using Ward's minimum variance method with the Euclidean distance was also used, and its results are presented in the form of a dendrogram [61]. In order to assess the impact of the endogenous potentials of voivodeships on the differentiation in the synthetic measures of their green economy and financial situation, a regression model was estimated. Regression analysis (implemented using the Gretl program) was used to examine the relationship between the variables of interest [62,63].

The presence of spatial autocorrelation means that geographically close objects are more similar to each other in terms of the analyzed variable and have the ability to form clusters; therefore, they can combine and form spatial clusters [64,65]. By analyzing the result of autocorrelation, it is possible to determine clusters of objects similar to each other. Knowing and understanding the structures of space enables better anticipation of changes and facilitates taking action in development policy [66].

The global and local Moran's I spatial correlation coefficients can be used to investigate spatial relationships [67]. Moran's I made it possible to check whether the adjacent plots formed clusters with similar values of the synthetic measure and was determined on the basis of the following formula [68,69]:

$$I = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} wij(x_i - \overline{x})(x_j - \overline{x})}{S_o\ \sigma^2}, \quad (10)$$

The local Moran's I statistics took negative values when a given area was surrounded by regions with significantly different values of the studied variable. The positive values of the statistics were interpreted as the region being surrounded by similar regions [70,71]. The local form of the Moran's I coefficient was determined by the following formula:

$$I_i = \frac{(x_i - \overline{x}) \sum_{j=1}^{n} wij\ (x_j - \overline{x})}{\sigma^2}, \quad (11)$$

where n is the number of spatial objects (number of points or polygons), x_i, x_j are the values of the variable for the compared objects, $\overline{x}$ is the average value of the variable for all the objects, and w_{ij} are the elements of the spatial weight matrix (weight matrix standardized with rows to one). Thus,

$$S_0 = \sum_{i=1}^{n} \sum_{j=1}^{n} wij\ ,$$

$\sigma^2 = \frac{\sum_{j=1}^{n} (x_i - \overline{x})^2}{n}$ $(n \neq 0)$,-variance [72].

Moran's I statistics took values from the interval $(-1, 1)$, where the value of "0" meant no spatial autocorrelation, negative values represented negative autocorrelation, and positive values signaled a positive spatial correlation [73,74].

To illustrate the spatial dependence of the green economy in voivodeships in Poland, Moran's I statistics were calculated, using the Queen matrix, standardized by rows to one. The calculations were made in the PQStat program.

The green economy and financial situation were described by means of the variables illustrating, among others, resource management; the conservation of biodiversity; the sustainable consumption and production model; renewable energy sources; energy and material efficiency; income, expenditure, and financial surplus aspects; and subsidies. The subject of spatial dependencies was dealt with, among others, by Kopczewska (2006) [64]. The determinants of the operation of voivodeships are interactive. They should be seen as a set of interdependent elements that occur in the same time and space horizon. A green economy impacts, among others, the quality of life of inhabitants, reducing the risks to the natural environment and ecological shortages. It is described by variables describing the state of the natural environment, such as production efficiency; the relations between the natural environment, economy, and society; the quality of life of the population; and the

instruments of impact on the economy and society. The main role in this respect is played by the necessity to carry out the qualitative transformations of the processes and to relieve the burden on the physical environment [75].

The financial situation comprises the timely fulfillment of obligations, as well as the continuity, quality, and proper structure of the provision of services. In terms of finance, an assessment is made of the community's activities and its development possibilities or the implementation of public tasks. There is a feedback loop between the socioeconomic and financial variables.

The determinants characterizing the green economy and the financial situation, verified in terms of content and form and measurable, available, and interactive, are presented in Table 1.

Table 1. List of variables describing the green economy and financial situation.

	Variables	Unit
	Variables of the Green economy	
X1	Total expenditures on healthcare	PLN/PC
X2	Expenditures on fixed assets for environmental protection expenditures on waste management	PLN/PC
X3	Expenditures on fixed assets for environmental protection and water management	PLN/PC
X4	Rural electricity consumption	kWh/PC
X5	Total electricity production	GWh/PC
X6	Electricity production from renewable sources	GWh/PC
X7	Share of agricultural land in total area	%
X8	Share of forests in total area	%
X9	Share of legally protected areas in the total area	%
X10	Share of ecological in total area	%
X11	Share of the area of active landfills (where municipal waste is disposed of) in the total area (as of December 31)	%
X12	Selectively collected waste as a proportion of total waste	%
	Variables of the financial situation	
X13	Share of own income in total income	%
X14	Share of operating surplus in total income	%
X15	Share of operating surplus and income from the sale of assets in total income	%
X16	Current transfers from the state budget per capita	PLN/pc
X17	Operating surplus per capita	PLN/pc
X18	Total liabilities per capita	PLN/pc
X19	Share of total liabilities in total income	%
X20	Burden of total income with debt service expenses	%
X21	Burden of own income on debt service expenses	%
X22	Personal and corporate tax revenue per capita	%
X23	Debt service expenses/own income	%
X24	Expenditures on education and upbringing/number of inhabitants	PLN/pc
X25	Expenditures on healthcare/number of residents	PLN/pc

For the construction of the synthetic measures, a set of about 50 potential diagnostic variables collected by public statistics and related to the analyzed phenomenon was originally adopted. Source: own study based on BDL CSO data.

The eigenvalue gives (factor analysis) information about the extent to which the total variation results from a given principal component. The first principal component explains the largest proportion of the variance. The second component explains the largest part of this variance that was not explained by the previous component. The next component explains the largest part of this variance that was not explained by the previous components. As a result, the cumulative volatility and the cumulative percentage of the variation can also be calculated for the successive components.

The eigenvalues of the reduced correlation matrix, defining the variances of successive factors and their percentage share in the overall variability of the entire set, are presented in Table 2. Five factors were identified for both the green economy and the financial situation.

Together, they explained about 80% of the total variance for the variables of the green economy and 91% of the total variance for the financial situation.

Table 2. Groups of factors and their own values in areas of green economy and financial situation.

Factor Green Economy	Own Value	% of Total (Variance)	Cumulative (Own Value)	Cumulative (%)
1	2.857542	23.81285	2.857542	23.81285
2	1.877181	15.64318	4.734724	39.45603
3	1.747900	14.56583	6.482623	54.02186
4	1.498547	12.48789	7.981170	66.50975
5	1.394346	11.61955	9.375516	78.12930
Factor Financial Situation	**Own Value**	**% of Total (Variance)**	**Cumulative (Own Value)**	**Cumulative (%)**
1	4.535288	34.88683	4.53529	34.88683
2	3.039740	23.38262	7.57503	58.26944
3	2.381616	18.32012	9.95664	76.58957
4	1.223472	9.41132	11.18012	86.00089
5	1.002598	7.71230	12.18271	93.71319

Source: own study based on BDL CSO data, using the Statistica program.

Based on the information in this Table 3, it can be noticed that the first factor (variables X3 (0.79367), X5 (0.851986), and X11 (0.799676, characterizing positive factor loadings)) was the main factor for the green economy, accounting for 23.81% of the total variability resource, and its eigenvalue was 2.857 (in the case of the financial situation, 34.88, 4.53–X13, X16, and X22–0.953368). The second factor (X4 (0.709152); X10 (0.798215); and X9 (−0.824414 negative factor load)) explained 15.64% of total volatility resources, and the eigenvalue of this factor was 1.887 (23.38, 3.03–X18, X19, X20, X21, and X23). The third factor (X1 (0.881583) and X2 (−0.764322)) accounted for 14.56% of the common volatility of all the variables, and its eigenvalue was 1.747 (18.32, 2.38–X14, X15, and X17). The fourth factor (X7 (−0.936067) and X8 (0.892843)) accounted for 12.48% of common variations in all the variables, and its eigenvalue was 1.498 (9.41, 1.22–X25). The fifth factor (X6 (0.797653) and X12 (−0.859925)) exhausted 11.61 %% of the resources of common variations, and its value eigenvalue was 1.394 (7.71, 1.00–X24).

Table 3. Results of the factor analysis: values of factor loadings after rotation with the "Varimax" method.

Variables Green Economy	Factor (1)	Factor (2)	Factor (3)	Factor (4)	Factor (5)
X1	−0.143276	0.128156	**0.881583**	0.017401	−0.068299
X2	−0.184982	0.167122	**−0.764322**	−0.067812	0.022102
X3	**0.79367**	−0.169386	−0.202206	0.083876	−0.274714
X4	0.053925	**0.709152**	0.207174	−0.20246	−0.077207
X5	**0.851986**	0.068818	0.146057	−0.294654	0.132247
X6	0.090339	0.08785	−0.284885	0.204509	**0.797653**
X7	0.065306	−0.02629	0.066754	**−0.936067**	0.029624
X8	−0.139252	−0.066946	0.137482	**0.892843**	0.183865
X9	−0.322972	**−0.824414**	0.059446	0.023931	0.26792
X10	−0.160593	**0.798215**	−0.036159	0.107778	0.250253
X11	**0.799676**	0.323046	−0.031227	−0.085543	0.001719

Table 3. *Cont.*

Variables Green Economy	Factor (1)	Factor (2)	Factor (3)	Factor (4)	Factor (5)
X12	0.116638	0.145109	−0.105057	0.005631	−0.859925
Condition, output, and contributions	2.228451 0.185704	2.03579 0.169649	1.587888 0.132324	1.8745 0.156208	1.648887 0.137407
Variables Financial situation	**Factor (1)**	**Factor (2)**	**Factor (3)**	**Factor (4)**	**Factor (5)**
X13	**−0.951753**	−0.146408	0.169859	0.112815	0.017182
X14	−0.219681	0.029010	**0.957455**	−0.087787	0.094419
X15	−0.197394	−0.025739	**0.970150**	−0.089200	0.015301
X16	**0.979674**	−0.030505	−0.052617	0.036531	0.106403
X17	0.059372	−0.167467	**0.925159**	0.146503	0.189716
X18	0.255902	**0.744655**	−0.232736	0.276807	−0.394350
X19	0.070876	**0.852573**	−0.164790	0.116689	−0.394635
X20	−0.113292	**0.907094**	0.003380	−0.260253	0.205430
X21	0.262914	**0.900766**	−0.077986	−0.179485	0.191036
X22	**−0.953368**	−0.085944	0.147253	0.165562	0.074170
X23	−0.071544	**0.810750**	0.174244	0.155927	−0.157481
X24	0.053646	−0.033828	0.201302	0.174422	**0.926454**
X25	−0.205003	−0.050050	−0.045255	**0.932786**	0.150660
Condition, output, and contributions	3.067745 0.235980	3.635858 0.279681	2.927480 0.225191	1.193610 0.091816	1.358021 0.104463

Principal components were extracted; (marked loads are >0.700000). Source: own study based on BDL CSO data, using the Statistica program.

The analysis of the coefficients of variations and the correlation matrix led to the conclusion that the selected variables were slightly correlated with the others. All the variables (as shown in Table 1) for the analysis were characterized by sufficient discriminant ability. The values of the coefficients of variations ranged from 0.14 (X4) to 1.01 (X2) (in the case of the financial situation, from 0.31 (X24) to 0.94 (X21)) in 2010 and from −1.76 (X7) to 1.75 (X5) (in the case of the financial situation, from −0.36 (X16) to 2.08 (X23)) in 2020. It should also be noted that the variables were characterized by a positive asymmetry (X4, X7, and X12 in 2010 showed a negative asymmetry, while in 2020, no negative correlation was found; in the case of the financial situation, this was observed in 2010 between X14, X16, X15, X17, and X19 but none in 2020), which in the case of the stimulants is not a favorable situation, as it means that a greater number of municipalities have values of these variables lower than their average value (Table 4).

Table 4. Statistical characteristics of diagnostic variables.

	R	$\bar{x}$	V_i	A_s		R	$\bar{x}$	V_i	A_s
	Green Economy					**Financial Situation**			
						2010			
X1	52.23	13.85	0.56	1.48	X13	0.5	0.15	0.44	0.97
X2	0.1	0.02	1.01	2.93	X14	0.18	0.06	0.56	−0.16
X3	500.12	117.97	0.3	2.23	X15	0.18	0.06	0.52	−0.15
X4	413.6	108.18	0.14	−0.62	X16	183.46	62.65	0.38	−0.2

Table 4. *Cont.*

	R	$\bar{x}$	V_i	A_s		R	$\bar{x}$	V_i	A_s
	Green Economy					**Financial Situation**			
						2010			
X5	0.0114	0.0033	0.8518	1.0423	X17	64.86	20.18	0.53	−0.06
X6	0.00099	0.00024	0.80101	2.06287	X18	266.77	73.04	0.68	0.59
X7	30.5	8.61	0.14	−0.59	X19	0.57	0.16	0.57	−0.16
X8	29.3	7.41	0.24	1.28	X20	0.08	0.02	0.8	0.71
X9	46.38	13.02	0.39	1.01	X21	0.36	0.1	0.94	1.23
X10	0.0025	0.0007	0.6797	0.9374	X22	0.46	0.14	0.5	0.88
X11	0.00012	0.00003	0.40119	0.79527	X23	0.02	0.01	0.68	0.16
X12	7.3	1.88	0.23	−0.04	X24	24.35	6.45	0.31	1.21
					X25	52.23	13.85	0.56	1.48
						2020			
X1	29.67	0.48	0.92	111.86	X13	0.16	0.36	1.09	0.56
X2	0.01	0.49	0.1	0.03	X14	0.05	0.25	0.08	0.17
X3	68.96	0.19	−0.65	236.55	X15	0.05	0.24	0.06	0.16
X4	119.67	0.14	−0.76	466.5	X16	88.37	0.41	−0.36	266.04
X5	0.0038	0.8883	1.7483	0.0128	X17	27.55	0.25	0.08	94.25
X6	0.00073	0.82694	1.71364	0.00274	X18	70.33	0.42	0.88	248.22
X7	12.86	0.22	−1.76	50.3	X19	0.13	0.45	1.49	0.53
X8	7.43	0.24	1.24	29.3	X20	0.03	0.64	1.33	0.11
X9	13.06	0.39	1.09	46.3	X21	0.1	0.83	2.06	0.37
X10	0.0008	0.6194	0.7407	0.0025	X22	0.17	0.47	1.16	0.63
X11	0.00003	0.48695	0.79546	0.0001	X23	0	0.58	2.08	0.01
X12	4.93	0.13	0.63	17.3	X24	7.91	0.32	0.81	33.59
					X25	0.16	0.36	1.09	0.56

Range R; mean $\bar{x}$; standard deviation S_i; coefficient of variation V_i; asymmetry (skewness) A_s Source: own study based on BDL CSO data, using the Statistica program.

4. Results

The multifaceted nature of the concept of a green economy and financial situation directly results from the multiplicity and diversity of the factors shaping it (see Table 1). In their description and assessment, the importance of the endogenous factors that indicate the specificity and distinction of the territory should be emphasized. Mobilizing endogenous potential ensures permanent dynamics of local processes. It also affects the factors influencing the level of development diversification in individual voivodeships. Natural and socioeconomic factors mean that individual voivodeships are characterized by different economic situations and different levels of management and development, living conditions, and prosperity of the inhabitants. The indicated elements shape uneven development, processes of polarization, and depopulation and degradation in some areas.

As a result of the research procedure, the spatial differentiation of voivodeships in Poland in 2010–2020 was presented in terms of the levels of the synthetic measures for the green economy and financial situation. In 2010, the synthetic measure (qi) of the green economy ranged from 0.31 (Silesia) to 0.42 (Holy Cross), and in 2020, from 0.40 (Silesia) to 0.53 (Lubusz Province). Among the best units were the Lubusz Province, as well as Kuyavia–Pomerania and West Pomeranian provinces. The synthetic measure of the financial risk (qi) in 2010 ranged from 0.37 (Opole Province) to 0.61 (Silesia), and in 2020, from 0.40 (Lubusz Province) to 0.77 (Masovia) (Table 5). The group of the best units included the Masovia, Greater Poland, and Lower Silesia voivodeships.

This differentiation is determined by the regional differentiation of voivodeships, the diversification of the industry structure in terms of sectors, the levels of development or endogenous resources, infrastructure, and demographic structure. The voivodeship's potential is also built by the professional activity of inhabitants, the local labor market, entrepreneurship, infrastructure, and the condition of the natural environment. Its appropriate level

affects, among others, improvement in the standard of living, increased production, and a better social situation. The potential of voivodeships is the result of a combination of local conditions, and it determines its possibilities and directions of development.

Table 5. Synthetic measures of the green economy and the financial situation of voivodeships in Poland in 2010, 2020.

q Green Economy	**2010**		**2020**		**2020/2010**
Voivodeship	**p**	**q**	**p**	**q**	
Lubusz Province	3	0.4	1	0.53	0.33
Kuyavia–Pomerania	2	0.4	2	0.51	0.28
West Pomeranian	5	0.38	3	0.49	0.29
Podlasie Province	9	0.36	4	0.48	0.33
Holy Cross	1	0.42	5	0.48	0.14
Masovia	11	0.35	6	0.47	0.34
Lodz Province	6	0.37	7	0.46	0.24
Opole Province	12	0.35	8	0.46	0.31
Lublin Province	14	0.34	9	0.45	0.32
Lesser Poland	7	0.36	10	0.45	0.25
Lower Silesia	13	0.34	11	0.44	0.29
Subcarpathia Province	8	0.36	12	0.44	0.22
Pomerania	4	0.38	13	0.44	0.16
Warmia–Masuria	10	0.36	14	0.44	0.22
Greater Poland	15	0.33	15	0.44	0.33
Silesia	16	0.31	16	0.4	0.29
q financial situation	**2010**		**2020**		**2020/2010**
voivodeship	**p**	**q**	**p**	**q**	
Masovia	12	0.45	1	0.77	0.71
Greater Poland	2	0.6	2	0.73	0.22
Lower Silesia	3	0.56	3	0.64	0.14
Kuyavia–Pomerania	13	0.42	4	0.63	0.5
Pomerania	7	0.53	5	0.63	0.19
Holy Cross	6	0.55	6	0.61	0.11
Silesia	1	0.61	7	0.6	−0.02
Opole Province	16	0.37	8	0.59	0.59
Subcarpathia Province	8	0.51	9	0.58	0.14
Lodz Province	4	0.56	10	0.57	0.02
Lesser Poland	11	0.45	11	0.57	0.27
West Pomeranian	9	0.51	12	0.55	0.08
Lubusz Province	14	0.42	13	0.53	0.26
Podlasie Province	5	0.55	14	0.5	−0.09
Warmia–Masuria	10	0.49	15	0.45	−0.08
Lublin Province	15	0.41	16	0.4	−0.02

Sorted by 2020; p position, q synthetic measure. Source: own study based on BDL CSO data.

Figure 2 shows the classification of the provinces according to the financial risk measure (dark color means the best units, and lighter color means weaker units). The classification of voivodeships was carried out on the basis of quartiles, which constituted the threshold values for subsequent groups. The best voivodeships were characterized by a high financial potential, a higher level of financial independence, better development potential, and a higher potential for the green economy. The weaker economic and financial

situation of the voivodships does not allow them to quickly recover and may be one of the reasons for the higher level of financial risk in the voivodeships in the coming years.

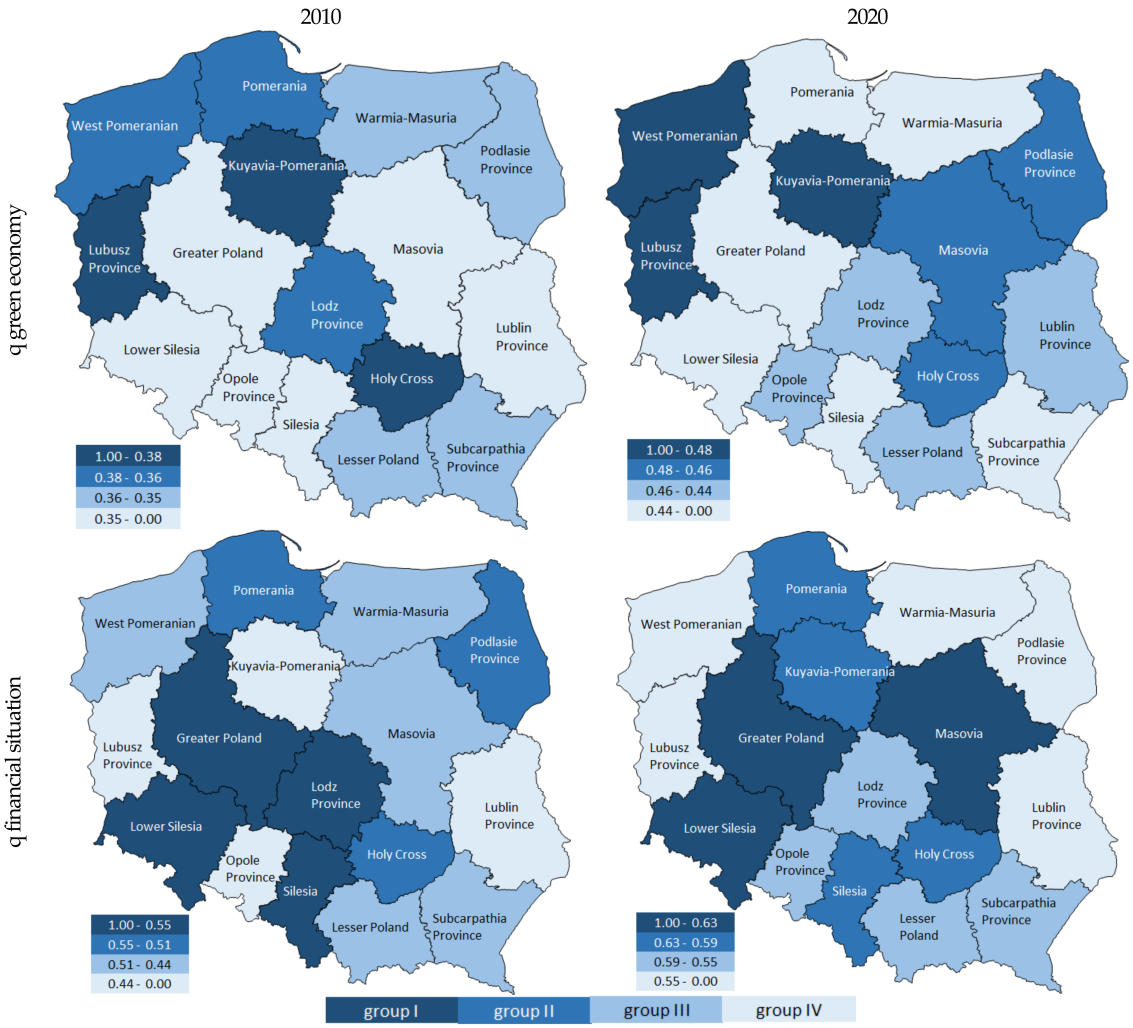

Figure 2. Spatial differentiation of green economy (q) and financial situation (q) in voivodeships in Poland (in 2010 and 2020) Source: own study based on the BDL CSO data.

On the basis of the values for the synthetic measures of the green economy and financial situation, the voivodeships were grouped using the cluster method (Ward's method, taking into account the Euclidean distance; Figure 3). In the case of binding at the level of 0.1 qi, the green economy, the individual clusters included the following voivodeships: Group I: Lower Silesia, Lublin Province, Greater Poland, and Silesia; Group II: Lesser Poland, Warmia–Masuria, Subcarpathia Province, Pomerania, Masovia, and Opole Province; Group III: Kuyavia–Pomerania, West Pomeranian, Lodz Province, Podlasie Province, and Lubusz Province; Group IV: Holy Cross. In the case of binding at the level of 0.25 qi, the financial situation, the individual clusters included Group I: Lower Silesia, Silesia, Greater Poland, and Masovia; Group II: Lodz Province, West Pomeranian, Lesser Poland, Subcarpathia Province, Pomerania, Holy Cross, and Podlasie Province; Group III: Kuyavia–Pomerania, Lubusz Province, and Opole Province; Group IV: Lublin Province and Warmia–Masuria.

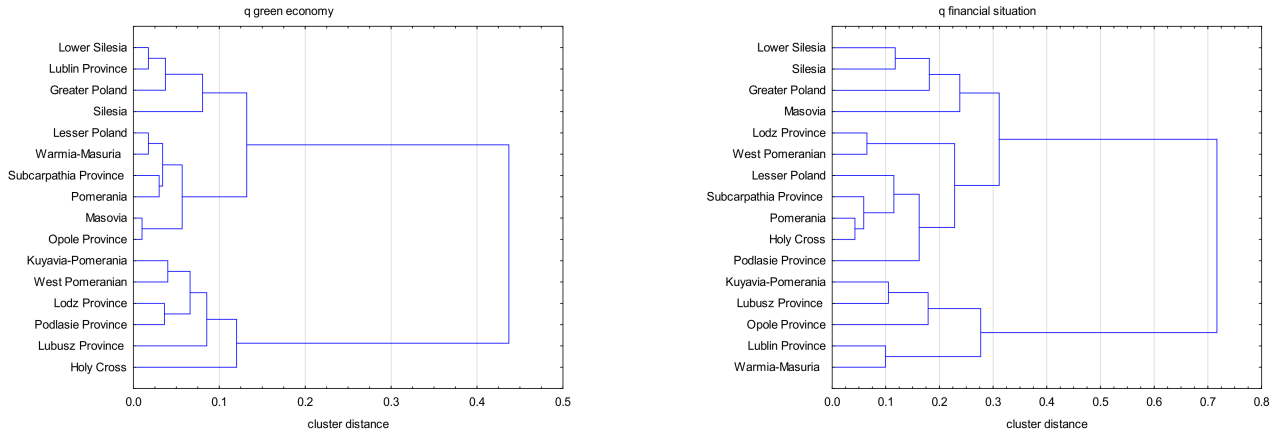

Figure 3. Clusters of Polish voivodeships with similar levels of the synthetic measures of green economy and financial situation in Poland in 2010 and 2020 (Ward's method, Euclidean distance). Source: own study based on BDL CSO data.

The statistical characteristics of the synthetic measures of the green economy and financial situation of the voivodeships indicated both a decrease and an increase in the disproportions of the analyzed phenomena (see Table 6). The increase in the diversification of the green economy was indicated by the range, the coefficient of variation, and the positional coefficient of variation; in the case of the financial situation, the increase was indicated by the growth, the coefficient of variation, the decline in the quartile deviation, and the quartile range.

Table 6. Statistical characteristics of the synthetic measures of green economy and financial situation in voivodeships in Poland in 2010 and 2020.

	2010	2020	2010	2020
	q Green Economy		q Financial Situation	
min	0.31	0.4	0.37	0.3
max	0.42	0.53	0.61	0.55
range	0.11	0.13	0.24	0.25
average	0.36	0.46	0.5	0.45
median	0.36	0.45	0.51	0.46
standard deviation	0.03	0.03	0.07	0.07
quartile deviation	0.02	0.02	0.06	0.05
coefficient of variation	0.08	0.07	0.14	0.15
positional coefficient of variation	0.05	0.04	0.11	0.11
quartile range	0.04	0.04	0.11	0.1
skewness (asymmetry)	0.43	0.53	−0.21	−0.47
kurtosis (measure of concentration)	−0.02	0.67	−0.97	−0.34

Source: own study based on BDL CSO data, using the Statistica program.

The Pearson correlation coefficient between the values for the synthetic measures of the green economy for 2010 and 2020 was r = 0.765 (r^2 = 0.586) and for financial situation, r = 0.261 (r^2 = 0.068). In the case of the measure-to-measure correlation, in 2010, r = −0.263 (r^2 = 0.069), and in 2020, r = −0.068 (r^2 = 0.04). The measure of the green economy was positively correlated with X1 (0.425), X6 (0.5724), X9 (0.2296), X10 (0.2113), and X12 (0.5654), minus X7 (−0.0111) and X11 (−0.36). The financial situation measure was positively correlated with X13 (0.5438), X14 (0.6808), X15 (0.6758), X17 (0.6209), X25 (0.4343), X22 (0.5428), X16 (−0.388), X18 (−0.5434), X19 (−0.5554), X20 (−0.3865), X21(−0.6904), and X23 (−0.5902). These indicators revealed the possibility of generating income from own

sources. They can be indicators of sustainable development and allow for more flexible spending of funds, including for investment or current purposes.

Pearson's correlation coefficient between the values of the synthetic measures in 2010 in relation to 2020 according to the financial situation measure was 0.261 (low divergence), and between 2020 and 2020/2010, was −0.643 (high level of divergence). The outliers resulting from the analysis of Figure 4 can be divided into two groups. The first was formed by Lubusz Province, Opole Province, while the second group included Greater Poland, Masovia, and Silesia provinces; they are characterized by industrial function, good labor market, and a higher level of development.

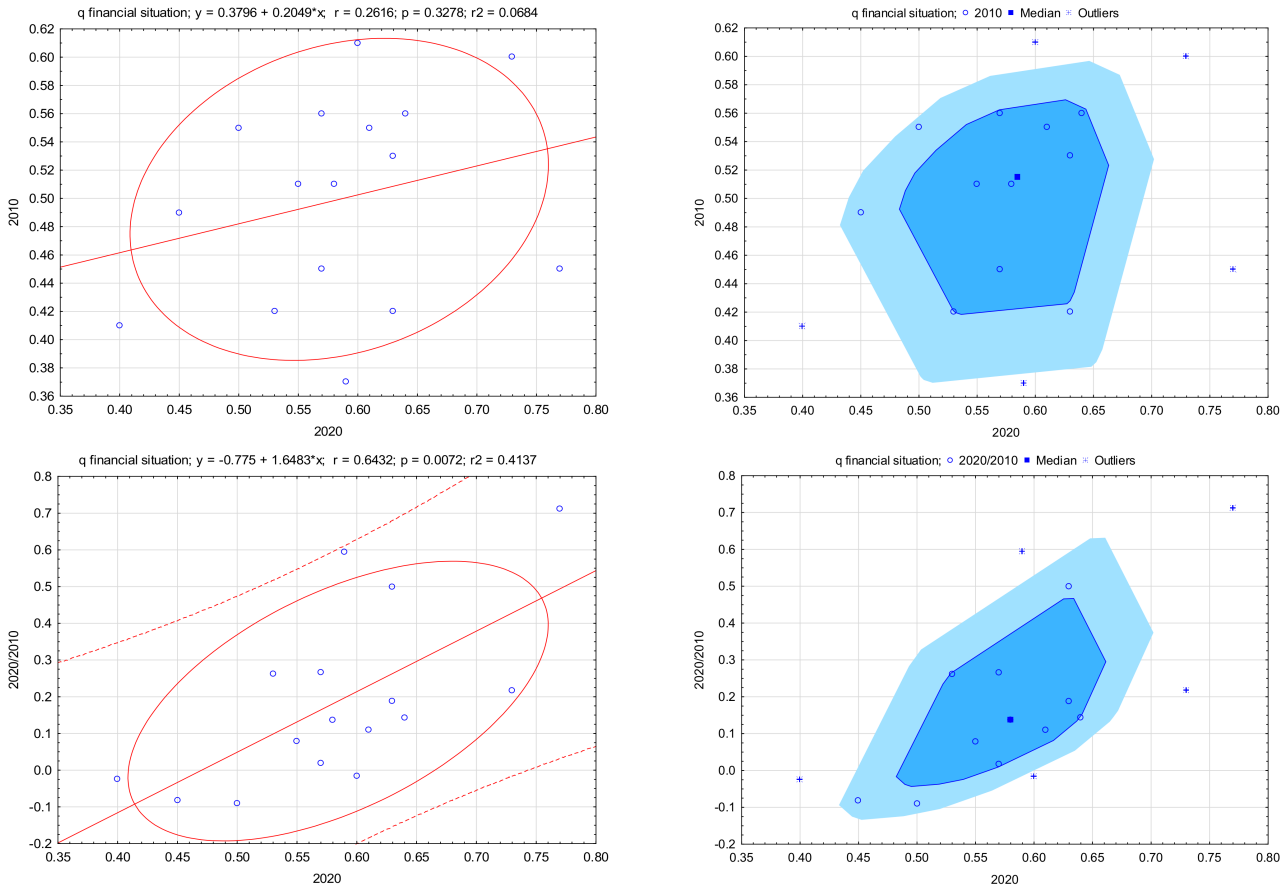

Figure 4. Scatter plot with the fit lines of synthetic measures of the financial situation of voivodeships in Poland. Source: own study based on BDL CSO data.

As Figure 5 indicates, the Pearson correlation coefficient between the values of the synthetic measure of the green economy in 2010 in relation to 2020 was 0.765, and in the case of the relationship 2020/2010, it was 0.169. The outlier units were the provinces of Lublin Province, Holy Cross, Kuyavia–Pomeranian, Silesian, and Pomeranian.

Pearson's correlation coefficient between the values of the synthetic measures of the financial situation and the green economy in 2010 was −0.263, and in 2020, it was −0.068. The outlier units can be divided into two groups. The first was Mazovia, Silesia, and Greater Poland, and the second group included Kuyavia–Pomerania, Lubusz Province, Lublin Province, and Warmia–Masuria (Figure 6).

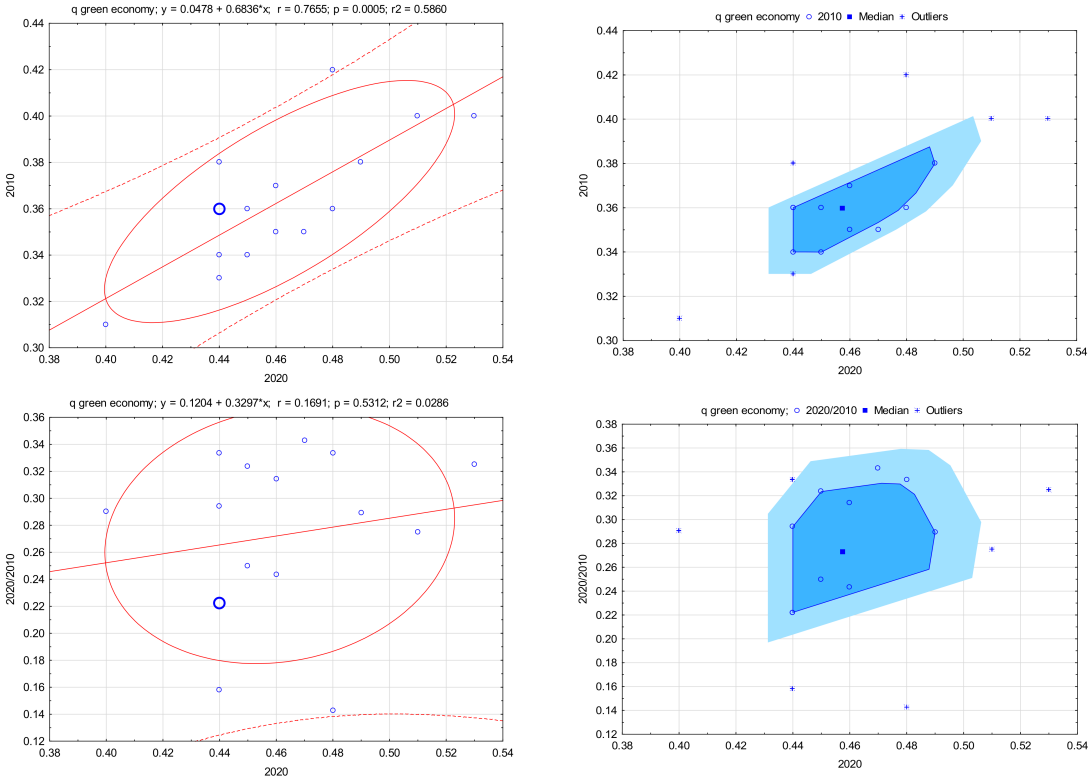

Figure 5. Scatter plot with the fit lines of synthetic measure of green economy of voivodeships in Poland. Source: own study based on BDL CSO data.

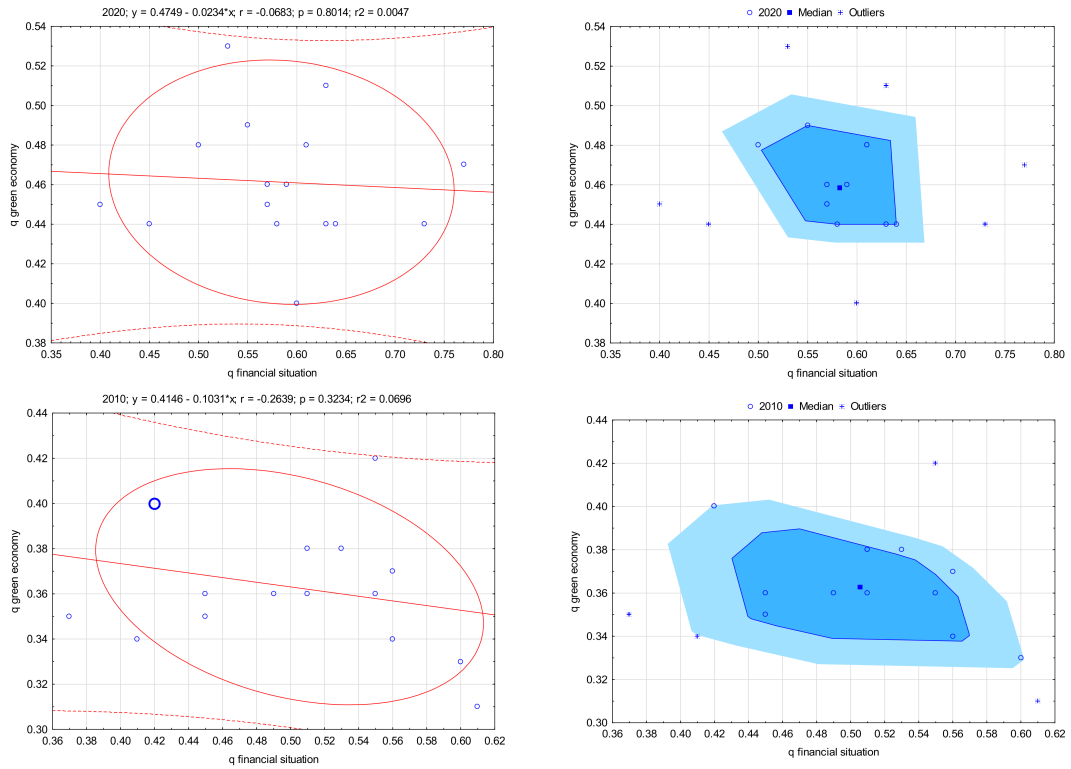

Figure 6. Scatter plot with fit line and bag chart of synthetic measures of green economy and financial situation of provinces in Poland. Source: own study based on BDL CSO data.

The results of Moran's I analysis in relation to 2020 and 2010 for the synthetic measures of the green economy and financial situation are presented in Table 7. It can be noticed that, in the analyzed period, there was a decrease in the negative autocorrelation. The decreasing value of the considered statistics indicated a weakening spatial dependence. There was a tendency to concentrate similar values (high or low) in the area of the green economy or financial situation in a given voivodeship.

In the next step of the analysis, the local Moran's I statistic was determined for each voivodeship. The obtained statistical values are presented in Figure 7. High positive values for the local Moran's I statistics of the synthetic measure green economy in 2010 were obtained in Opole Province (0.422), West Pomeranian (0.146), and Pomerania (0.093), and negative values were obtained for Lubuskie (−0.608), Silesian (−0.792), and Holy Cross (−1.057). In 2020, positive statistics were obtained in West Pomeranian (0.252), Lesser Poland (0.239), and Masovia (0.077), and negative values were revealed for Lubusz Province (−0.316), Lower Silesia (−0.328), and Kuyavia–Pomerania (−0.549). In the case of the financial situation measure, in 2010, the West Pomeranian (0.0352), Pomerania (0.0330), and Masovia (0.0256) had positive values, while Lesser Poland (−0.5419), Lubusz Province (−0.8712), and Opole Province (−2.0603) indicated negative values; in 2020, Podlasie Province (0.4401), Kuyavia–Pomeranian (0.2447), and Lower Silesia (0.2111) revealed positive values, whereas Lublin Province (−0.6638), Warmia–Masuria (−0.7602), and Masovian (−1.2593) had negative values. The voivodeships with positive values of local statistics can be treated as outliers. At the same time, the decreasing tendency of the values of the considered statistics means a weakening spatial dependence (the calculations were made in PQStat software).

Table 7. Values of the global Moran's I statistics for the synthetic measures of green economy and financial situation in voivodeships in Poland (in 2010 and 2020).

Variables	2010	2020	2010	2020
	q Green Economy		q Financial Situation	
Moran's I	−0.195193	−0.130118	−0.379643	−0.150688
Oczekiwane I	−0.066667	−0.066667	−0.066667	−0.066667
Under the assumption of normality				
Wariancja I	0.022125	0.022125	0.022125	0.022125
Statystyka Z	−0.864075	−0.426577	−2.104116	−0.56487
Wartość p	0.387546	0.669688	0.035368	0.572162
Assuming randomness				
Wariancja I	0.022013	0.021184	0.02354	0.021183
Statystyka Z	−0.866271	−0.435951	−2.039909	−0.577291
Wartość p	0.386341	0.662872	0.041359	0.563743

Source: own study based on BDL CSO data.

In order to assess the impact of financial variables of the voivodeships on the diversification of the green economy, a regression model was estimated. The fit of the model was measured by the indicators of R-squared determining a coefficient of 0.522908 and the adjusted R-squared of 0.497042, which confirmed that the model could explain only 52.29% of the variance in the variables. The model did not correctly describe the phenomenon, which may indicate that the variables should be extended to other scopes (i.e., demography, economy, natural environment, and infrastructure).

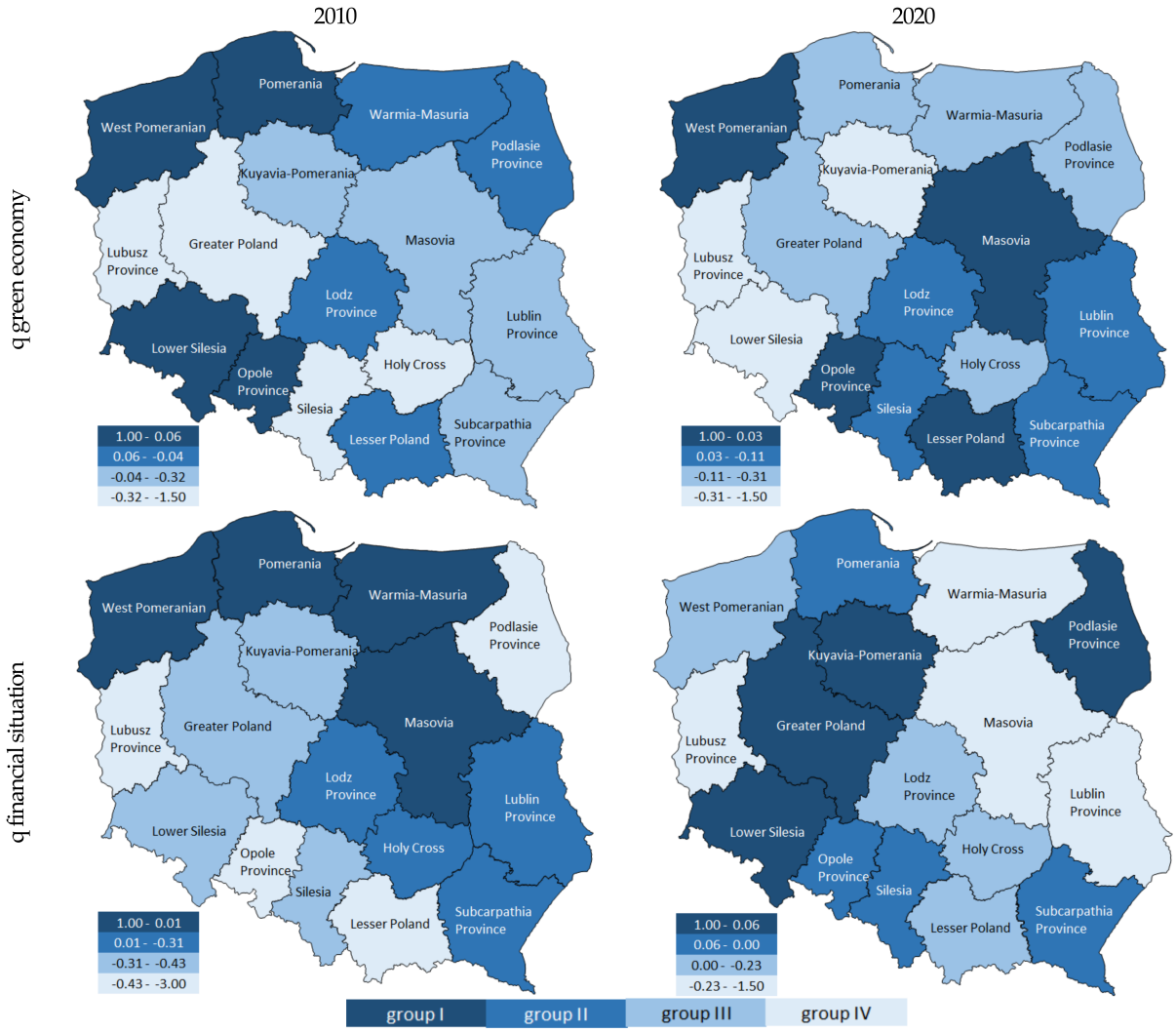

Figure 7. Spatial differentiation of the value of the local Moran's I statistics for the synthetic measure of green economy and financial situation in voivodeships in Poland (in 2010, 2020). Source: own study based on BDL CSO data.

5. Discussion

The concept of the green economy [76–78] contributes to the growth of prosperity and social equality for future generations while ensuring the right balance between the economy and environmental ecosystems. The shift in the concept toward green growth is observed not only in highly developed countries but also in developing countries. The idea is also evident in the Visegrad Group (V4) countries. The four countries and their regions face common processes of transforming the economy toward green growth. The countries had to make deep structural changes, but the scale of change was not equal [79].

Development is a multidimensional process that should be based on the rational use of local resources. The various directions of the municipalities' activities prove the multidimensionality of the development process. These activities most often focus on the optimal use of endogenous resources and building social, economic, and territorial cohesion. They depend, to a large extent, on their financial situation. The financial situation is the foundation for functioning and conditions the implementation of all kinds of tasks, including those of an investment nature. The level and structure of income affect the pace of socioeconomic development, determining their investment activity [80].

The concept of green growth is in line with the assumptions of the Europe 2020 strategy. It is based on smart, sustainable, and inclusive growth, as well as the synergies between

smart and green growth. This should enable regions to better cope with climate change, environmental and energy challenges, or the increase in natural resource scarcity [81].

The diversification of the level of socioeconomic development of regions is a natural phenomenon. It results from unequal access to the basic factors of work, capital, or natural resources [82]. The diversification of the region's internal potentials may concern demographic issues, the labor market, the level of entrepreneurship, infrastructure, the natural environment, and many other conditions affecting development opportunities. Therefore, the specific, individual features of the region and the external conditions determine the possibilities of their development.

The multifaceted nature and individualism of the region in the study area are presented in Table 1 (12 variables in the area of green economy and 13 in the aspect of financial situation; these variables resulted from statistical and content analyses, as originally, the authors selected a total of 50 variables for the study). The obtained results confirmed the spatial differentiation in both aspects of the financial situation and green economy of the provinces in Poland. The authors, indicating the importance of the financial situation in the process of transformation to a green economy, used the synthetic measure method. This method indicated significant disparities between the financial situation and the green economy of Poland's provinces. The analysis made it possible to classify the provinces according to the adopted criteria (green economy and financial situation). The obtained results confirmed the usefulness of synthetic measures for assessing complex phenomena.

The green economy refers to the issues of economic development in terms of sectors, regions, and cities and is perceived as an element of the ecosystem. The essence of this approach is to create solutions that enable greater adaptation of the economy to the specificity of the environment [83]. The advantage of the concept is that the innovations generated within it can be used in both modern (e.g., passive construction) and traditional industries (e.g., photovoltaic cells in traditional construction). This increases the application value of this concept in terms of the ability of territories and sectors to initiate adaptive changes to contemporary globalization and environmental challenges [84].

The concept of GE is multilayered, and it covers all aspects of the economy (social, infrastructural, financial, etc.). The transition from a traditional economy to a green economy is a major change and will certainly affect almost all sectors of the economy (industry, trade, agriculture, and tourism) [85]. Despite the general acceptance of the concept of the green economy, there are also criticisms in the literature in this regard. It may not necessarily concern the concept itself, but most of all, how it is implemented. The obtained results confirmed the authors' initial assumptions as to the diverse nature of GE in Poland. This differentiation was observed not only in terms of the effects of environmental policy but also in terms of municipal management and industrial activities.

The financial situation of self-governing voivodeships is of fundamental importance in shaping the possibility of carrying out investment activities, the admissibility of indebtedness, or the ability to obtain EU support. The voivodeships are characterized by a lower level of independence compared with communes and poviats, which results from the structure of their budget supply system. The growing budget deficit and the level of debt are worrying [86]. Moving to the subject of the financial situation of the voivodeship self-government, it becomes necessary to explain the essence of financial independence. The independence of the authorities in the area of income can be contingent upon the improvements that these authorities make in fiscal policies in the area where the local government unit operates [87]. The subject of independence in the sphere of income in the context of the financial situation of the voivodeship self-government is definitely limited, compared with the income independence of the basic level of local self-government, which is the commune. The data published by the Central Statistical Office show that in 2020, own income constituted the largest item in the structure of the voivodeships' revenues, as they accounted for 50.9% of the total revenues. In the previous budget years, the level of own revenues of the voivodeship self-government was at a similar level. Financial transfers from the state budget in the form of targeted subsidies play significant roles in

the structure of own revenues. According to L. Patrzałek, subsidies are the transfers of funds to the budgets of the voivodeship self-government for specific purposes or under strictly defined conditions for their use [88]. A targeted subsidy, as a special type of public financial resource, has a significant impact on shaping regional policies, including the implementation of various investment projects. A large part of the earmarked subsidies is allocated to financing or co-financing the so-called "green economy".

When analyzing the economic structure of earmarked subsidies received by local government voivodeships, it can be seen that the largest share was the subsidy transferred to government administration tasks, i.e., 64.7% in 2020, while in a previous study, it was 6.0% [89]. Pointing to the problem of the financial situation of the voivodeship self-government in the context of the tasks carried out, such a high share of total subsidies in the total revenues of the budgets of self-governing voivodeships may constitute the basis for formulating the thesis on the progressive phenomenon of limiting the financial independence of this level of local self-government.

The financial situation of the self-governing voivodeship is also greatly influenced by other financial transfers to the budgets of this level of the territorial self-government, namely the general subsidy. According to A. Wernik, the use of subsidies and general subsidies is the basic form of regulating the financial supply of public finance sector units by the state budget, in other words, the transfer of purchasing power within the sector, and in some cases also beyond the sector boundaries [90]. The financial dimension of the general subsidy in the case of a self-governing voivodeship, similarly to the earmarked subsidy, should be considered in the context of the current financing tasks. The general subsidy transferred to the budgets of voivodeship self-governments is also a financial contribution through which the voivodeship authorities create regional policies.

The problem of the financial situation of the voivodeship self-government should be considered, apart from the typical macroeconomic phenomena, also in the light of solutions of fiscal federalism. Briefly referring to this theory, it should be noted that the level of the socioeconomic development of regions, and within them subregions, is extremely diverse and at the same time is determined by geographic, cultural, and historical conditions that build a centralized concept, consistent with the objectives of the regional policy of the state. Determining the objectives of the regional policy of the voivodeship self-government regarding the supply system in the form of transfers to the budgets of self-governing regional authorities is not an easy task. Only the actions taken by the decision makers of the voivodeship self-government to increase the government's own income may allow the regional policy to be implemented to a greater extent, including the so-called "green spending" [88].

As J. Zawora (2018, 2019) pointed out that the financial situation plays an important role among the factors influencing local development. The disproportional regional development affects the spatial differentiation of the financial situation, the state of socioeconomic development, the income situation of the commune, and their lower scope of financial independence [91,92]. Additionally, the authors in the presented article indicated that the process of the green economy is interdependent with the level of the entity's financial situation, also indicating the process of slight divergence in both research areas.

Development and changes in the aspect of the natural environment (constant introduction of the green economy) ensure the improvement of the standard of living of the inhabitants and economic potential. Development factors change over time; therefore, they should be subjected to constant and ongoing analysis [93,94]. Local authorities should consider, first of all, improving the balanced economic potential and the environmental conditions, which will increase the attractiveness of the area and attract new entrepreneurs, create new jobs, and improve the quality of life of residents.

The financial sector provides the necessary funding to develop environmental technologies. They should help to implement renewable energy projects [95]. The deployment of renewable energy not only supports the environment but also brings socioeconomic benefits. The use of renewable energy helps reduce the depletion of natural resources (or the use of fossil fuels) in economies. The financial sector plays a key role in supporting the development

of investment in green technologies (and renewable energy development). Financial capital (and directions for its disbursement) is key to protecting the environment, particularly for those regions following the path of sustainable development [96,97]. The transition to a green economy requires a stable and growing financial sector (appropriate financial capital). The financial crisis (the growing strength of the Braun economy) has created concerns about pollution and the green economy. Green bonds are essential to reduce environmental degradation and pollution [98]. The COVID-19 pandemic has increased green financing for renewable energy development. Private investment has been recognized as the dominant driver of the renewable energy industry and a necessary and critical step in preventing greenhouse gas emissions. The results indicate that the global financial situation, legislative support policies, feed-in tariffs, and economic stability are strong drivers of green financing for renewable energy investment development in China [99].

Green financial products (green bonds, green investments, green insurance, carbon financing, and green loans) are effective means of directing investment capital to climate change mitigation [100,101]. Different regions are currently undergoing a process of transformation toward a sustainable energy transition. Nevertheless, in a large group of regions, we are (still) observing economies prioritize growth over environmental quality and a high level of mineral (natural resource) consumption [102]. Environmental degradation and global climate change threaten growth and human sustainability goals in developed and developing economies. Today, leading economies are relying on green innovation, clean energy production, and the efficient use of resources to meet environmental challenges while keeping economic goals intact. Despite intensive initiatives, the results of environmental efforts are not satisfactory [103–105].

6. Conclusions

1. An assessment of the spatial variation in the level of the green economy and the financial situation of provinces in Poland indicated the existence of a negative relationship with the financial situation. Thus, an aspect that may be a barrier to the transition to a green economy is the financial condition. Necessary at this stage of the transformation to a green economy is the slowing down of natural resource consumption. This should bring social, economic, economic, and environmental benefits to the economy.
2. The GE concept is viewed in a multifaceted way. Economic, technological, and social progress has an impact on the environment. The rational management of natural resources and environmental protection has become the impetus for a new model of economic management. The green economy points toward a new model of management, in which the scope of ecological solutions is increased. At the same time, the green economy becomes a means of preserving the independent position of European countries and societies on the world stage while promoting efficiency and rationality in the use of economic resources. The green economy serves to improve the quality of life and social equality and reduce the risk to the natural environment and ecological deficiencies. The main role in this respect is played by the necessity to carry out qualitative transformations of the processes and to relieve the burden on the physical environment. The green economy is characterized by variables describing the state of the natural environment, production efficiency, the relations between the natural environment and the economy, the quality of life of the population or the relationship between the natural environment and society, the economic policies, and the instruments of impact on the economy and society. The transition to a green and resource-efficient economy is mainly driven by a long-term global trend of resource scarcity and rising energy and raw material prices.
3. Voivodeships are centers of economic, social, and cultural life. They bring together economic and social activities, and it is in these entities that disproportions in terms of their potential were observed. Synthetic measures enabled the assessment of a multidimensional phenomenon, as well as a linear ordering of the studied units. The evaluation of the spatial differentiation of the measures of the green economy and the

financial situation showed the impact of natural, social, and economic conditions on the studied area. Mobilizing endogenous potential ensures permanent dynamics of local/regional processes and influences the level of differentiation of voivodeships.

4. On the basis of the synthetic measures, the spatial differentiation of the provinces, both in terms of green economy and financial situation, was analyzed. In 2010, the synthetic measure (qi) of the green economy ranged from 0.31 (Silesia) to 0.42 (Holy Cross), while in 2020, it ranged from 0.40 (Silesia) to 0.53 (Lubusz Province). Among the best units were the Lubusz Province, as well as Kuyavia–Pomerania and West Pomeranian provinces. The synthetic measure of the financial risk (qi) in 2010 ranged from 0.37 (Opole Province) to 0.61 (Silesia), and in 2020, from 0.40 (Lubusz Province) to 0.77 (Masovia). The group of the best units included the Masovia, Greater Poland, and Lower Silesia voivodeships.
5. The changes taking place in today's economy (their dynamics and scope) require a wealth of information about the economy to support current and strategic actions or the information necessary for the authorities to evaluate and correct the pursued policies and assess the effects of regional development management.
6. The obtained results confirmed the usefulness of synthetic measures for the assessment of complex phenomena. They may provide a source of information for local government authorities on the disproportional differences between units. For comparison between regions, the same variables should be included in the indicated research areas. The increase or decrease in synthetic measures must be considered as a way of assessing the effects of the region's management to date. The obtained results can provide an important source of information for local governments on the disparities that exist between units. The indicated procedure can be applied to other regions (countries).
7. The obtained results of the evaluation of the relationship between the green economy and the financial situation point to new directions of research, e.g., considering new relations (of the main criterion) with demography, environment, ecology, (green) infrastructure, and entrepreneurship, taking into account further diagnostic variables in the study (increasing or decreasing their number), building a synthetic measure based on a different method, or assessing the direction and strength of the influence of outlier variables on the main criterion. The added value of the article is that it provides an analysis of the relationship between the green economy and the financial situation of voivodeships in Poland for the period of 2010–2020.

Author Contributions: Conceptualization, P.D., P.P., P.S. and M.W.; methodology, P.D., P.P., P.S. and M.W.; software, P.D., P.P., P.S. and M.W.; validation, P.D., P.P., P.S. and M.W. formal analysis, P.D., P.P., P.S. and M.W.; investigation, P.D., P.P., P.S. and M.W.; resources, P.D., P.P., P.S. and M.W.; data curation, P.D., P.P., P.S., M.W. and K.B.; writing—original draft preparation, P.D., P.P., P.S., M.W., F.I., L.S. and R.P.; writing—review and editing, P.D., P.P., P.S., M.W., F.I., L.S. and R.P.; visualization, P.D., P.P., P.S., M.W. and K.B.; supervision, P.D., P.P., P.S., M.W., F.I., L.S. and R.P.; project administration, P.D., P.P., P.S. and M.W.; funding acquisition, P.D., P.P., P.S. and M.W. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data sharing is not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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