DOI: 10.20472/EFC.2023.019.016

STEFAN RAYCHEV
University of Plovdiv Paisii Hilendarski, Bulgaria

YULIYAN MOLLOV
University of Plovdiv Paisii Hilendarski, Bulgaria

DECENTRALIZATION, GREEN ECONOMICS, AND COHESION: A COMPREHENSIVE ANALYSIS OF EUROPEAN REGIONAL DEVELOPMENT

Abstract:

This article presents the cohesion policy in the EU and analyzes the role of decentralization for the sustainable development of the European regions at the NUTS 2 level. It examines the regional policy in the EU member states and its relationship with the decentralization and social progress of the regions. The study also covers sustainable urban development in Europe. Trends and effects of decentralization on economic growth and regional inequalities are discussed. A methodology based on statistical analysis is used to compare the social progress of European regions. A comprehensive approach is applied to reveal relationships and dependencies between indicators of a socio-economic nature within EU NUTS 2 level regions. In this sense, the methodology uses statistical software tools to reveal trends in the structural aspect of regional development and thus draw conclusions and recommendations for policies and measures aimed at increasing the effectiveness of fiscal regionalization. Incorporating principles of green economics into regional policy and decentralization efforts can drive the adoption of sustainable practices, such as renewable energy deployment, eco-friendly infrastructure development, and the promotion of green industries. The integration of green economic strategies within regional governance structures empowers regions to pursue environmentally conscious initiatives, contributing to the overall transition towards a low-carbon and resource-efficient economy.

Keywords:

Green transition, Region development, Social-progress index of regions, Decentralization, Cohesion, Sustainable development

JEL Classification: R11, Q01, R58

1 Introduction

This article delves into the multifaceted relationship between regional policy, decentralization, and sustainable development of European regions at the NUTS 2 level within the framework of the EU cohesion policy. It aims to shed light on the interplay between these factors and their implications for achieving global sustainable development goals and address the philosophy of green economics. Furthermore, it explores the integration of principles from green economics into regional policy and decentralization efforts, emphasizing their potential to drive the adoption of sustainable practices and contribute to the transition towards a low-carbon and resource-efficient economy.

While discussing the EU cohesion policy's role in economic growth and social development, the article highlights the impact of governance quality and institutional factors on regional outcomes. It addresses the challenges faced by completely rural regions, which do not benefit from urban dynamics, and examines the European Commission's initiatives to address disparities between remote/peripheral and urban/metropolitan regions. The conflicting results of the cohesion policy underscore the need to reassess spatial economic growth concepts and reconcile them with traditional regional development goals.

Additionally, the article explores the pivotal role of regional policies in promoting economic, social, and territorial cohesion among regions. It emphasizes the significance of decentralization as a governance process that enables localized decision-making and tailored policies for each region. Furthermore, it underscores the substantial investments made by decentralized governance authorities, indicating their influence in implementing public investments.

By addressing the intertwined topics of regional policy, decentralization, and sustainable development, this article contributes to the ongoing discourse on achieving balanced regional growth and advancing the objectives of green economics. Its findings offer valuable insights for policymakers and stakeholders seeking to navigate the complexities of regional development and foster sustainable practices in the pursuit of a prosperous and environmentally conscious future.

2 Literature review

2.1. The EU cohesion policy in the context of economic growth and social development

In the context of the leading economic theories that underpin the cohesion policy of the EU, it is crucial to examine the results of their application in European regions. Several studies indicate that there is no correlation between urban concentration and economic growth (Frick & Rodríguez-Pose, 2018), and significant investments in transportation and infrastructure, supported by the cohesion policy, do not have an effect on economic growth (Crescenzi & Rodríguez-Pose, 2012). What appears to have the greatest impact on economic growth is the quality of governance and the institutional factors (Rodriguez-Pose & Garcilazo, 2015; Farole, Rodríguez-Pose, & Storper, 2011). Ederveen et al. (2006) also emphasize stable institutions as a crucial prerequisite for the success of cohesion policy and stimulating economic growth.

The introduction of the European Perspective on Spatial Development and the focus on the role of cities do not provide the necessary economic convergence for surrounding regions. Urbanized (adjacent) regions and smaller cities near megacities are progressing, but completely rural regions are not benefiting from urban dynamics (Meijers & Burger, 2016). Furthermore, regional authorities tend to concentrate their efforts on the core of their regions rather than the hinterlands. As a result, EU funding does not spread beyond the cores of peripheral regions (Nagy & Benedek, 2018). The European Commission's political initiatives for Integrated Territorial Investments (ITI) and Urban and Metropolitan Areas (UMA) partly aim to counteract the growing disparities between remote/peripheral and urban/metropolitan regions. In practice, ITIs are closely linked to the implementation of urban programs (Isola, Leone, & Pira, 2017). Recent studies also question the extent to which the implementation of UMA can address the structural problems in less-developed areas, as it depends on the specific administrative and governance arrangements in individual member states (Servillo, 2019).

The conflicting results of the cohesion policy raise doubts about the applicability of the widely proclaimed concept of spatial economic growth, which relies on the theory of polarization with a suction effect. Policy interventions in urban centers do not effectively promote convergence among regions. Focusing interventions on urban areas contradicts traditional public regional policies that strive for balanced regional development and equalizing living standards across all regions (Rauhut D. & Humer A., 2020).

2.2. Regional policies and decentralization

Regional policies play a crucial role in promoting economic, social, and territorial cohesion among regions, which is essential for achieving global sustainable development goals. On the other hand, decentralization as a governance process is also of vital importance in fostering regional development as it allows for more local decision-making and the development of specific policies tailored to each region. Within the European Union, a variety of institutional structures related to different models of multi-level governance and forms of decentralization are observed among member states. Accordingly, different approaches and development policies are implemented for regional development.

In 2019, decentralization of expenditures in countries covered by the cohesion policy was significantly lower (23%) compared to countries outside this policy (34%). Expenditures of subnational authorities are concentrated in specific policy areas. Regional and local authorities in the EU have directed nearly 50% of their expenditures towards education, healthcare, environmental protection, and economic matters (primarily transportation). This is much higher than the expenditures for the same policies at the national level (36%). Similarly, in 2019, subnational authorities accounted for over 80% of total public expenditures on environmental protection, over 65% of expenditures on education, as well as 47% of expenditures on economic matters and over one-third of expenditures on healthcare. (EC, 2022).

At the same time, decentralized governance authorities play a leading role in implementing public investments. In 2019, their investment expenditures (gross fixed capital formation) accounted for 1.7% of GDP in EU-27 or 58% of total public investments. Public investments conducted by

subnational authorities in 2019 were particularly high (around 3% of GDP) in Sweden and Finland (EC, 2022).

These data raise numerous questions regarding the relationship between decentralization, multi-level governance, and regional development policies. So, the methodology and conclusions of this article tries to explore the potential dependency between the autonomy of subnational authorities in member states to develop and implement policies that impact the sustainable and balanced development of their respective regions.

3. Methodology

In this article, we employ a comprehensive methodology to analyse economic data and uncover the intricate connections and dependencies between socio-economic indicators in the context of EU regions. Our approach combines both supervised and unsupervised machine learning techniques, specifically leveraging polynomial regression and a range of clustering algorithms. The overarching objective is to gain a holistic understanding of regional development patterns, enabling us to draw meaningful conclusions and provide targeted recommendations for enhancing fiscal regionalization efficiency.

The dataset used in our analysis pertains to the year 2019, representing the pre-pandemic period. By focusing on this period, we capture the economic landscape before the significant changes triggered by the global health crisis. The dataset encompasses two distinct dimensions: regional and national. The regional data comprises a collection of economic and social indicators that are specific to individual regions, while the national data provides an overview at the country level.

The analysis centres around the following regional indicators:

- Social Progress Index of Regions (EU-SPI 2020) - The EU regional Social Progress Index aims to measure social progress for each EU region as a complement to traditional measures of economic progress, such as the Gross Domestic Product (GDP). Define in the framework of the "Beyond GDP" discussion as an alternative to traditional measures built with economic indicators, the EU-SPI is constructed using only social and environmental indicators to better reflect societal development.[1]

Additionally, we consider the following national indicators:

- Share of municipal expenditure in total public expenditure (% of GDP, 2019)
- Range of the Social Progress Index of the regions (EU-SPI 2020), which denotes the disparity between the lowest and highest values observed across regions.

To carry out the analysis, the power of Python is used, a widely used programming language renowned for its robust capabilities in data processing, modelling, and analysis.

The methodology encompasses a range of analytical techniques, including:

[1] https://ec.europa.eu/regional_policy/information-sources/maps/social-progress_en

- Descriptive analysis, where we employ fundamental statistical indicators to provide a comprehensive overview of the data.
- Graphical analysis, utilizing visualizations to effectively depict the intricate relationships and dependencies between the indicators.
- Variation analysis, which enables us to examine the extent of data variation across different regions.
- Regression analysis, where we leverage polynomial regression to determine the most appropriate model for capturing and describing the complex relationships and dependencies between the indicators.
- Cluster analysis, a technique that encompasses various clustering algorithms such as hierarchical clustering, K-means, Agglomerative Clustering, Affinity Propagation, and Spectral Clustering. By applying these algorithms, we aim to identify distinct groups of countries based on the values of the indicators.

By employing this comprehensive methodology, our study aims to unlock profound insights into the dynamics of regional development. Ultimately, we strive to provide valuable and targeted recommendations for policymakers and stakeholders, enabling them to enhance the efficiency of fiscal regionalization effectively.

4. Conducting research and results

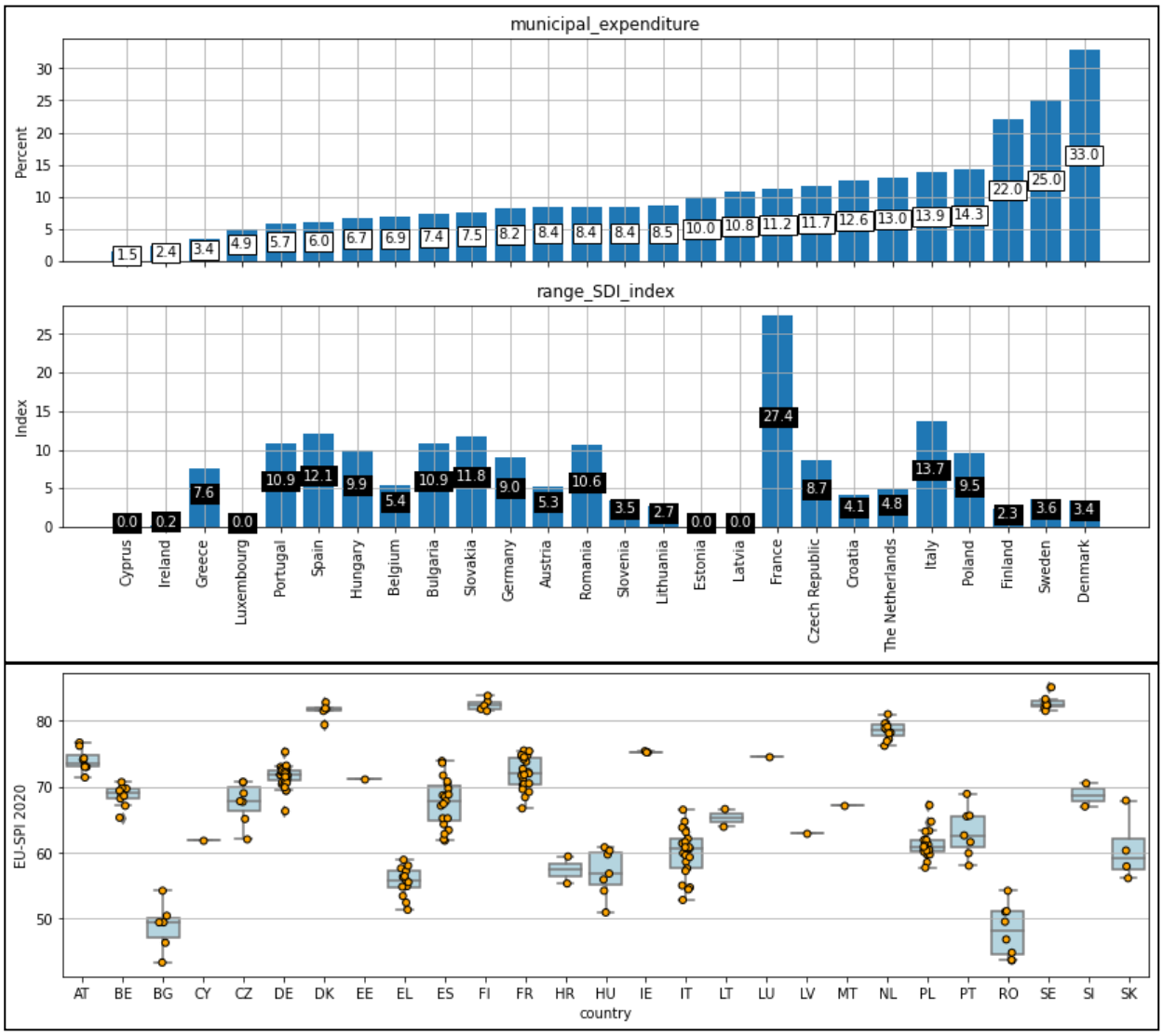
As an initial step, we will examine the relationship between the EU-SPI 2020 range and the share of municipal expenditure in total public expenditure (% of GDP). The underlying hypothesis of this study is that increased fiscal decentralization impacts regional development in countries.

This hypothesis can be tested by investigating whether countries with a high percentage of expenditure exhibit similar values of the social indicator index across individual regions. Conversely, we need to explore whether countries with a low percentage display significant variations among regions, as indicated by the range between the lowest and highest index values.

Figure 1 illustrates the national indicators utilized in this study, represented as subplots. The first subplot visualizes the distribution of the "Share of municipal expenditures in total public expenditures (% of GDP, 2019)" indicator. The lowest value is observed in Cyprus at 1.5%, while Denmark exhibits the highest value at 33%.

In the third subplot, we depict the distribution of the "Scale of the social Progress index of the regions (EU-SPI 2020)" indicator. Cyprus and several other countries have the lowest value at 0 percentage points, while France demonstrates the highest value at 27.4 percentage points.

Figure 1 Variation of share of municipal expenditure in total public expenditure (% of GDP) and Range of the Social Progress Index of the regions (EU-SPI 2020)

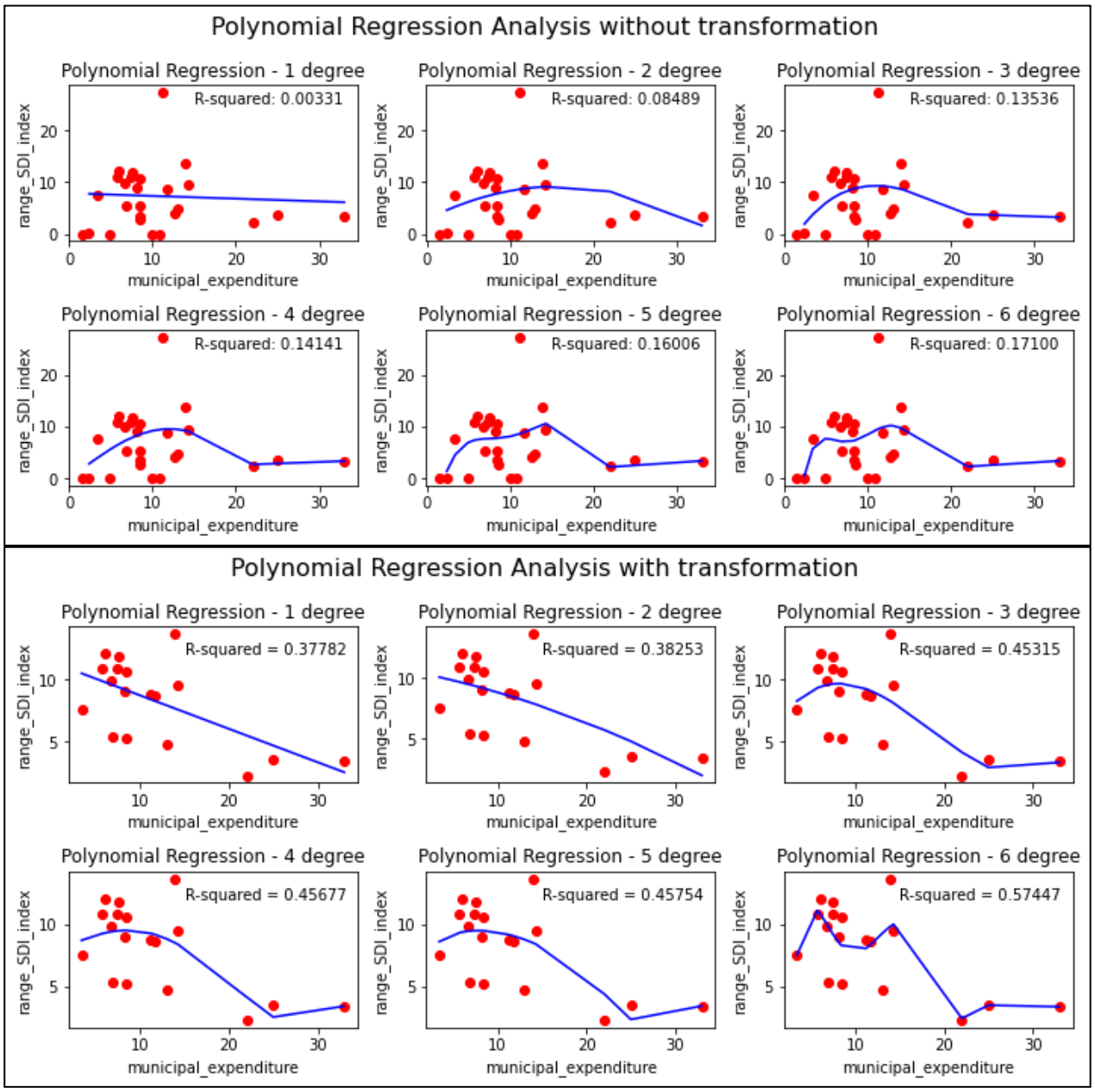


Source: European commission.

To provide a clear visualization of both the number of regions per country and the scale represented by the distance between regions, the third subplot displays the values of individual regions based on the "Scale of the Social Progress Index of the Regions (EU-SPI 2020)" indicator.

The figure 2 represents an analysis of the potential connection and modelling between the range of the social Progress index of the regions (EU-SPI 2020) indicator and the share of municipal expenditure in total public expenditure (% of GDP). It consists of six scatterplots, each accompanied by a regression line and the corresponding coefficient of determination (r2). Polynomial regression is applied using degrees ranging from 1 to 6. The graph is divided into two subplots, presenting the results before and after data transformation.

Figure 2 Regression analysis of share of municipal expenditure in total public expenditure (% of GDP) and Range of the Social Progress Index of the regions (EU-SPI 2020)



Source: Own calculations.

In the first subplot, which showcases the results without data transformation, the r2 values range from 0.003 for the 1st-degree polynomial regression to 0.17 for the 6th-degree polynomial regression. These scores indicate relatively weak correlation and limited predictive power between the two indicators.

In the second subplot, the six scatterplots are displayed after data transformation. The same polynomial regression models from 1st to 6th degree are applied. The results show a noticeable

improvement in the regression and correlation scores. The r2 values range from 0.37 for the 1st-degree polynomial regression to 0.57 for the 6th-degree polynomial regression. This suggests a stronger relationship and enhanced predictive capability between the indicators after the data transformation.

The data transformation methodology employed in this analysis involves two steps:

Exclusion of countries with regional divisions consisting of only one or two regions. This exclusion criterion eliminates the following countries: Cyprus, Luxembourg, Estonia, Latvia, Croatia, Ireland, Lithuania, Malta, and Slovenia.

Removal of overseas regions of France (Guyane, Mayotte, La Réunion, Martinique, Guadeloupe). Although administratively classified as regions, they exhibit distinct characteristics in terms of governance, social structure, and economic factors within the regional framework of France.

By applying these data transformations, the analysis achieves improved regression performance and correlation scores, enhancing the understanding and interpretation of the relationship between the indicators.

After the data transformation, which aimed to objectively refine the country's leading to conclusive results regarding fiscal decentralization and regionalization in the form of regional and national indicators, the next analysis will be conducted.

In the current step, the attempt to identify a group of countries that exhibit distinct patterns based on the selected indicators, clustering them accordingly will be done. Figure 3 has two subplots. The first one presents a dendrogram that helps determine the number of clusters to be specified in the subsequent clustering algorithms. The second one search number of clusters based on the following algorithms:

K-means: This algorithm aims to partition the countries into a predefined number of clusters based on the similarity of their indicator values. It assigns each country to the cluster with the nearest mean, minimizing the within-cluster sum of squares.

Agglomerative Clustering: This hierarchical clustering algorithm starts by considering each country as an individual cluster and then merges the clusters based on their similarity. The process continues until a desired number of clusters is obtained.

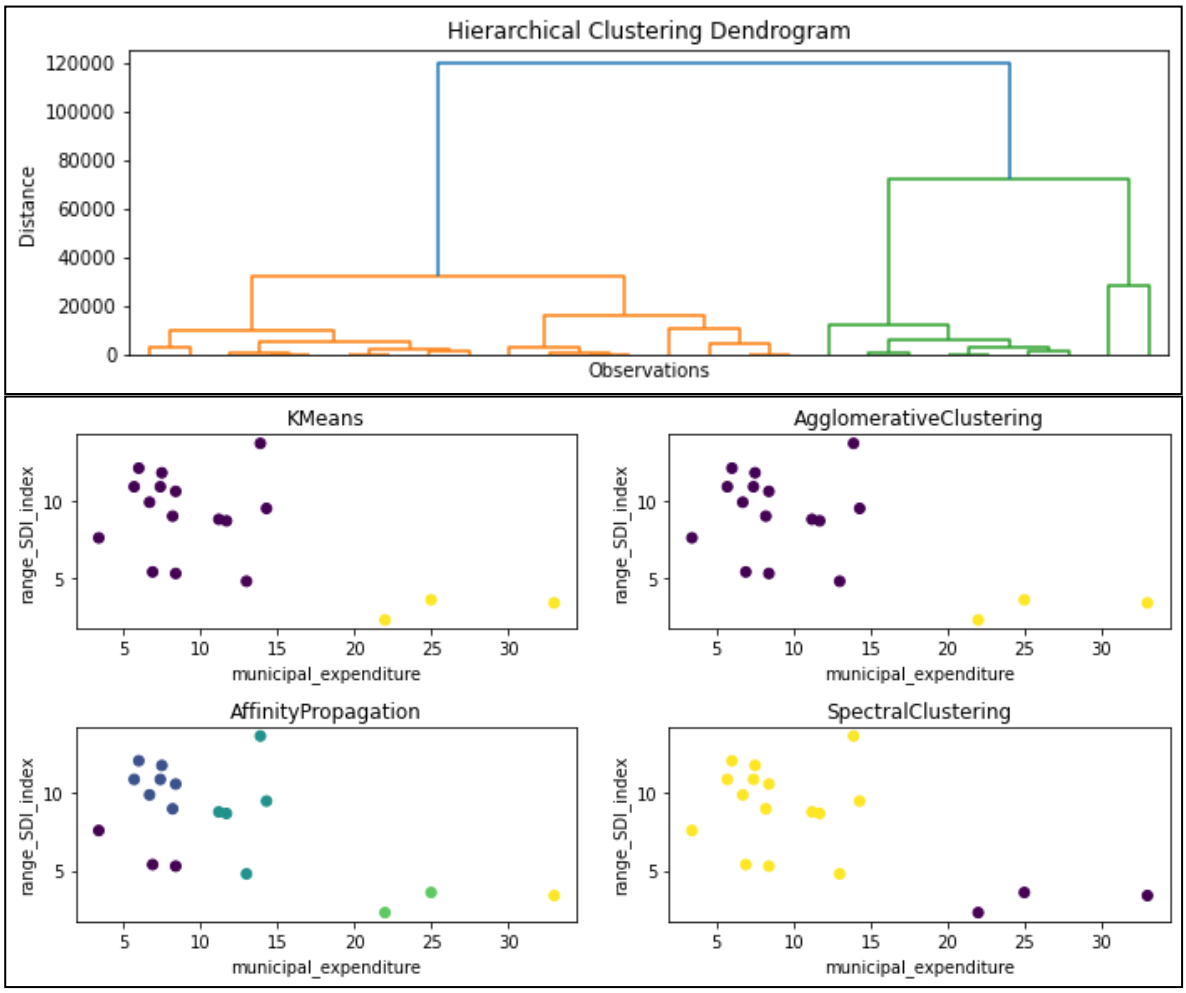
Affinity Propagation: This algorithm determines clusters by passing messages between data points, iteratively updating the "responsibility" and "availability" matrices. It identifies exemplars, which are representative data points within each cluster.

Spectral Clustering: This algorithm combines spectral graph theory and clustering techniques to cluster the countries based on the similarity of their indicator values. It first constructs a similarity matrix and then performs dimensionality reduction before applying traditional clustering methods.

While other density-based algorithms like DBSCAN or OPTICS were not utilized due to the apparent lack of density-based relationships, the chosen clustering algorithms provide different

approaches to capturing the inherent patterns and similarities among the countries based on the indicators.

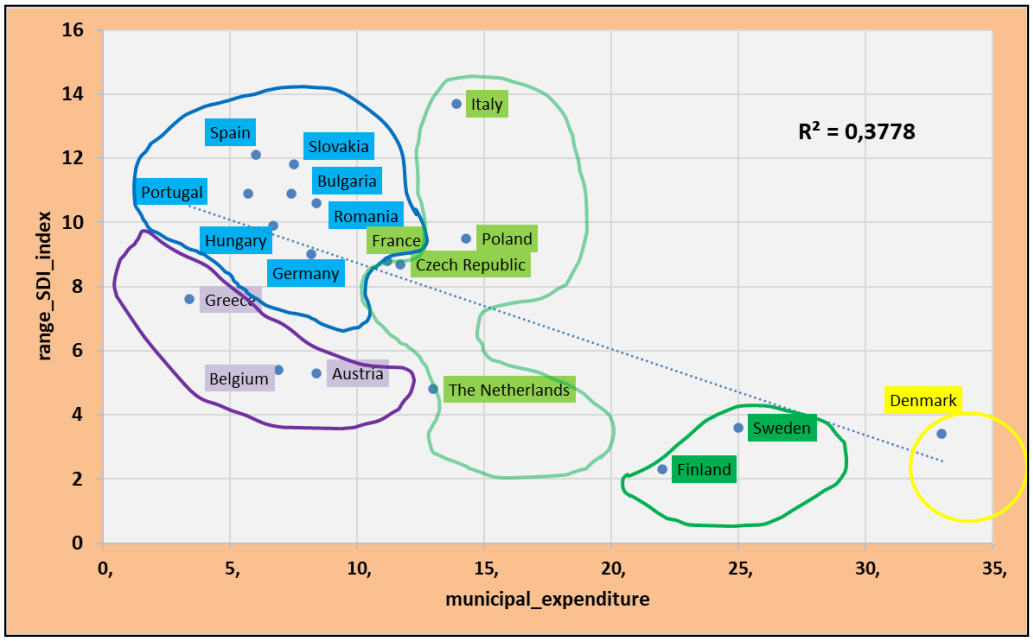
Figure 3 Cluster analysis of share of municipal expenditure in total public expenditure (% of GDP) and Range of the Social Progress Index of the regions (EU-SPI 2020)



Source: Own calculations.

The results of Fig. 3 clearly show the separation of two visible clusters. The first is three countries - Finland, Sweden and Denmark with yellow color. The second cluster is all other countries. Also, the Affinity Propagation algorithm shows the nuances between the countries in the two clusters. According to this algorithm, five groups of countries can be distinguished according to the two indicators, which are colored and visualized in fig. 4

Figure 4 Cluster groups according to the Affinity Propagation algorithm for the countries by share of municipal expenditure in total public expenditure (% of GDP) and Range of the Social Progress Index of the regions (EU-SPI)



Source: European commission and own calculations.

Fig 4. Gives the following information:

- First group (blue colour): Germany, Hungary, Portugal, Spain, Slovakia, Bulgaria and Romania. These countries have a low percentage of the share of municipal expenses in the total public expenses and a high scope in the social indicator;

- Second group (purple): Greece, Belgium and Austria. These countries have a low percentage of the share of municipal expenses in the total public expenses and a low value of scope in the social indicator;

- Third group (light green): France, Czech Republic, Poland, Netherlands and Italy. These countries have an average percentage of the share of municipal expenditure in total public expenditure and a full range in the value of the range in the social indicator from low to high;

- Fourth group (dark green): Sweden and Finland. These countries have a high percentage of the share of municipal expenses in total public expenses and a low value of the range in the social indicator from low to high;

- Fifth group (yellow): Denmark. This country has the highest percentage of the share of municipal expenses in total public expenses and a low, but not the lowest value of the range in the social indicator from low to high;

As a general conclusion from the cluster analysis, the following main points can be outlined:

- Bulgaria stands out in a group of countries that have a low level of share of municipal expenses and suffer from a high value in the scope of the social indicator in their regions. Here, in addition to other countries close to us, such as Romania, Hungary, Slovakia, the countries of the Iberian Peninsula, together with Germany, fall.

- Italy, Poland, France, despite the high share of municipal expenses, again fail to achieve a low range in the values of the social indicator by region.

- On the other hand, countries such as Belgium, Austria and the Netherlands, despite their low to average values of share of municipal expenses, manage to do very well in achieving similar values between regions expressed with a low scope of the social indicator.

- Sweden, Finland and Denmark are indicative of how the high share of municipal expenditure corresponds to regional social cohesion.

To achieve social cohesion and diminish regional disparities in Bulgaria, the results shows that it is crucial to increase the share of municipal expenses in the total public expenses, allocating more funding to address the specific needs of each region. This increased funding should be directed towards sectors such as education, healthcare, infrastructure, and environmental protection. Strengthening regional governance is also important. Empowering local authorities with decision-making powers and providing them with the necessary resources can enhance their ability to drive regional development effectively. This decentralization of power enables regions to make decisions that are in line with their unique circumstances and priorities.

All this should complement the conclusions from the correlation-regression analyzes in support of the author's thesis about the importance of fiscal decentralization as a tool for regional efficiency, economic development and social prosperity.

5 Conclusion

The results shows that the social progress of regions in the EU demonstrate a significant correlation between decentralized multi-level governance and sustainable development of these regions, as measured by the Regional Social Progress Index. The results of the comparative analysis clearly demonstrate that decentralization is crucial for the effectiveness and success of regional Progress policies and should be considered in the planning and programming of regional policy, as well as in the construction of the institutional framework of multi-level governance. Bulgaria can draw upon the experience of decentralized unitary states in the EU when considering potential reforms related to regionalization and the implementation of fiscal decentralization.

6 References

Frick, S. A., Rodríguez-Pose, A. (2018). Change in urban concentration and economic growth. World Development, 105, 156–170. doi:10.1016/j.worlddev.2017.12.034

Crescenzi, R., Rodríguez-Pose, A. (2012). Infrastructure and regional growth in the European Union. Papers in Regional Science, 91(3), 487–513. doi:10.1111/j.1435-5957.2012.00439.x

Rodríguez-Pose, A., & Garcilazo, E. (2015). Quality of Government and the Returns of Investment: Examining the Impact of Cohesion Expenditure in European Regions. Regional Studies, 49(8), 1274–1290. doi:10.1080/00343404.2015.1007933

Farole, T., Rodríguez-Pose, A., & Storper, M. (2011). Cohesion Policy in the European Union: Growth, Geography, Institutions. JCMS: Journal of Common Market Studies, 49(5), 1089–1111. doi:10.1111/j.1468-5965.2010.0216

Ederveen, S., Groot, H. L. F., & Nahuis, R. (2006). Fertile Soil for Structural Funds?A Panel Data Analysis of the Conditional Effectiveness of European Cohesion Policy. Kyklos, 59(1), 17–42. doi:10.1111/j.1467-6435.2006.00318.x

Meijers, E. J., & Burger, M. J. (2016). Stretching the concept of “borrowed size.” Urban Studies, 54(1), 269–291. doi:10.1177/0042098015597642

Nagy, J., Benedek, J., & Ivan, K. (2018). Measuring Sustainable Development Goals at a Local Level: A Case of a Metropolitan Area in Romania. Sustainability, 10(11), 3962. doi:10.3390/su10113962

Isola, F., Leone, F., & Pira, C. (2017). Towards a regional urban agenda: approaches and tools. Regional Studies, Regional Science, 4(1), 181–188. doi:10.1080/21681376.2017.1356238

Servillo, L. (2019). Tailored polities in the shadow of the state’s hierarchy. The CLLD implementation and a future research agenda. European Planning Studies, 27(4), 678–698. doi:10.1080/09654313.2019.1569595

Rauhut, D., & Humer, A. (2020). EU Cohesion Policy and spatial economic growth: trajectories in economic thought. European Planning Studies, 1–18. doi:10.1080/09654313.2019.1709416

ACKNOWLEDGMENTS

This research was funded by The department for scientific and applied activities (SAA) within the Plovdiv University “Paisii Hilendarski” (the project No. FP23--FISN-011 «The Green Transition and the Role of the Recovery and Resilience Plan"»).