

Literature Review of Economic and Regional Development through Quantitative Methods and Social Network Analysis

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Abstract

Economic and Regional Development is a subject of research that is not recent in the international literature. The unequal spatial distribution of income, economic opportunities and activities has attracted the interest of a large number of researchers in recent decades. The studies focused on the spatial disparities between the regions and their evolution over time using statistical analysis methods. In this paper we present a systematic review of the existing literature of economic and regional development through quantitative methods and social network analysis. Via research questions we summarize the different research approaches and offer a discussion and suggestions for future research. To what extent has regional development been studied by quantitative methods? How is research evolving in regional development of the European Union? Has Social Network Analysis been used in the context of regional development? This paper attempts to go one step further and introduce the use of techniques and methods of Social Network Analysis in Economic and Regional Development.

Keywords: economic development; regional analysis; quantitative methods; social network analysis;

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1. Introduction

The purpose of this paper is to provide with scientific empirical research of the regional analysis in the EU, through quantitative methods and Social Network Analysis. The concept of regional development refers to the geography of prosperity and its evolution and it plays a significant role in areas such as economic geography, regional economics, regional science theory and economic development. It is important to emphasize that regional development is not a static concept, as it studies complex dynamics of regions (Nijkamp and Abreu, 2009). In the context of statistical analysis, the per capita GDP and its fluctuations is often used because the change in prosperity is not easy to measure. Alternatively, indexes such as per capita consumption, poverty rate, unemployment rate, labor force participation rate, or access to public services can be used, namely social indicators that allow comparisons between states and regions (Nijkamp and Abreu, 2009).

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Local and regional development is an unequal process, producing disproportionate economic, social and environmental outcomes as regions face development and adaptation processes. In recent decades, international and cross-border flows of trade, capital, people and culture have accelerated, leading to the formation of the scenario for the rise of regions (Pike et al., 2017).

Regional disparities in the EU territory represent a question that has been studied in depth by many scholars with rich literature (Petraikos and Saratsis, 2000). Regional development policies have been in place for almost fifty years, but regional imbalances remain. The issue of convergence-divergence is no longer just an academic debate when it comes to issues related to the economic development of a region and the reduction of interregional disparities (Alexiadis, 2020). According to the theory of economic and regional development, convergence can be defined as the process in which a less developed region develops at a faster rate than a developed region (Koudoumakis et al., 2019).

The collection and analysis of quantitative data and their evaluation mainly help in the formulation of cohesion policy, which leads to the elimination of inequalities and regional development (Cuadrado-Roura, 2001; Widuto, 2019; Annoni et al., 2019). The majority of studies focus on the spatial and structural inequalities of the regions through various methods of quantitative and statistical analysis.

In this study, a systematic review of the literature on economic and regional development through quantitative methods and social network analysis is carried out, focusing on empirical studies conducted from 1995 onwards. First of all, this paper examines the question of the extent to which economic and regional development has been researched through quantitative methods. Specifically, we analyze the articles per year of publication, per scientific journal, per subject area and report the number of citations of the articles. The question then arises as to how economic and regional development research has evolved, namely which methodology, sizes or indicators have been used, as well as the research periods and the number of Member States and regions included. Finally, potential gaps are identified in the research. In particular, the question arises whether the analysis of social networks has been used in the context of regional development. Many corresponding systematic literature reviews contributed to the analysis. The work of Nerantzidis et al. (2020), Henttonen (2010), Afro and Leitao (2020), Nguyen (2011), Ahmed et al. (2021) could be mentioned.

According to Moher et al. (2009): "*A systematic review is an overview of a clearly worded question that uses systematic and explicit methods to identify, select and critically evaluate relevant research and to collect and analyze data from the studies included in the review.*"

In summary, the study focuses on the following research questions:

RQ1. To what extent has regional development been studied through quantitative methods?

RQ2. How is research evolving in the regional development of the EU?

RQ3. Has Social Network Analysis been used in the context of regional development?

The structure of this paper is as follows. The second part describes in detail the methodology followed in the analysis of EU regional development. The third part presents the results which attempt to answer the research questions. Finally, the fourth and final part present the conclusions of the review.

2. Methodology of Systematic Literature Review

The purpose of a literature review is to summarize and classify previous works on key issues and suggestions for future study (Seuring et al., 2005). In addition, it can provide with a solid foundation for advancing knowledge, enhancing theoretical development and identifying gaps where further research is needed (Webster and Watson, 2002). However, during the preparation of a systematic review, difficulties in the synthesis and analysis of data may occur. The large volume of work to be investigated and the synthesis of research approaches that differ from each other, are potential problems that may arise. The research process includes three phases: data collection, analysis and completion (Omerzel, 2016).

2.1 The literature protocol

The literature review protocol is a useful guide for conducting a systematic review, determining the methodology to be followed during the research (Busalim and Hussin, 2016). It includes research questions, article search strategy, the selection and evaluation process of the quality of appropriate articles, and the conduct of conclusions (Moher et al., 2009). *Figure 1* shows in detail the protocol followed for this review.

2.2 Criteria for including articles

The purpose of determining the criteria for inclusion or exclusion of articles is to ensure that the author selected studies that are relevant to his research. When searching and evaluating the appropriate articles in the present work, the following criteria were initially set (Henttonen, 2010):

- a. The EU regions under study are of the NUTS 2 level. The majority of studies in their attempt to assess the regional imbalances of the EU use NUTS level 2 regions and not smaller than NUTS 3. The smaller the geographical area of a region, the more difficult it is to interpret per capita GDP (Monfort, 2008).
- b. The scientific field in which research moves is "Economic and Regional Development."
- c. The articles have been published in scientific journals. The majority of journals are in the Chartered Association of Business Schools (Academic Journal Guide), which serves to identify top journals in the fields of economics (Preuss and Koenigsgruber, 2020). It was considered a means of ensuring sample quality.
- d. The articles include empirical research, namely they use statistical analysis.

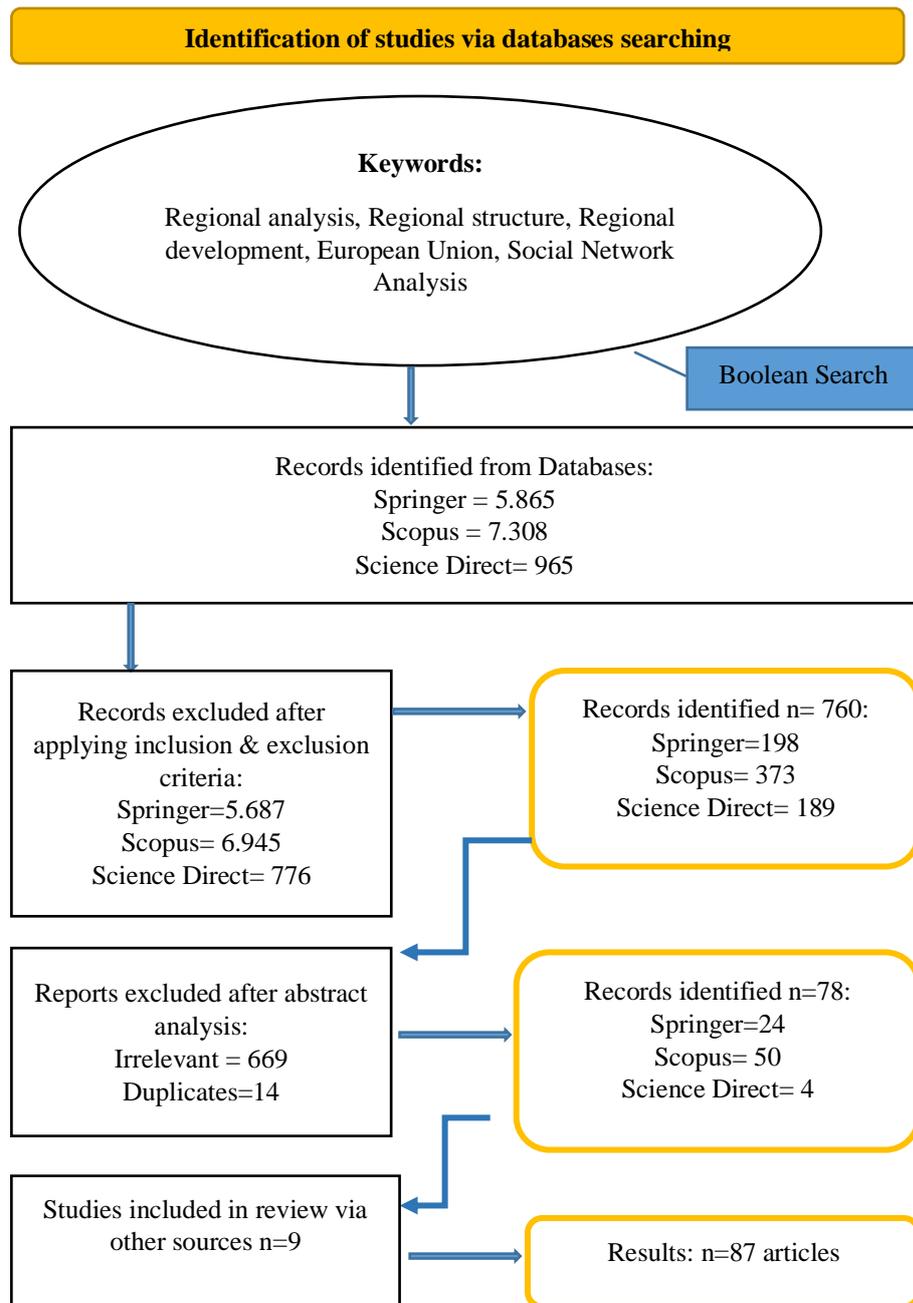
2.3 Literature search strategy

During the search process, the authors performed a Boolean search using the following keywords: "Regional analysis" OR "Regional structure" OR "Regional development" AND "European Union" AND "Social Network Analysis." These terms should be in the title, abstract, or keywords of a scientific article (Krupoderova and Portnov, 2020; Omerzel, 2016). Combining the above terms in the Databases "Scopus", "Springer Link" and "Science Direct" 14,138 articles were identified. The filtering process based on the criteria follows. After that, the sample included articles from the scientific field "Economic and Regional Development", in which the research focused on NUTS 2 areas and articles that are published in scientific journals (conference proceedings, book chapters, etc. have been excluded) (Nerantzidis et al., 2020).

The next step was to remove duplicate articles and articles dating before 1995 because it is the year of the union's third enlargement, where the Member States increased from 12 to 15. Also, papers that did not include statistical analysis, papers that are in another language except English and German, and some other articles that were not considered appropriate have been removed.

The filtering process yielded 78 articles. Finally, another 9 papers were added, as they were identified through other sources during the research process, leading to the result that the systematic review includes 87 studies.

Figure 1. Review protocol



Source: Adapted from PRISMA search flow summary diagram (Prisma Statement, 2021)

3. Results

The next section presents the descriptive statistics of the 87 papers included in the literature review (Tseng et al., 2019).

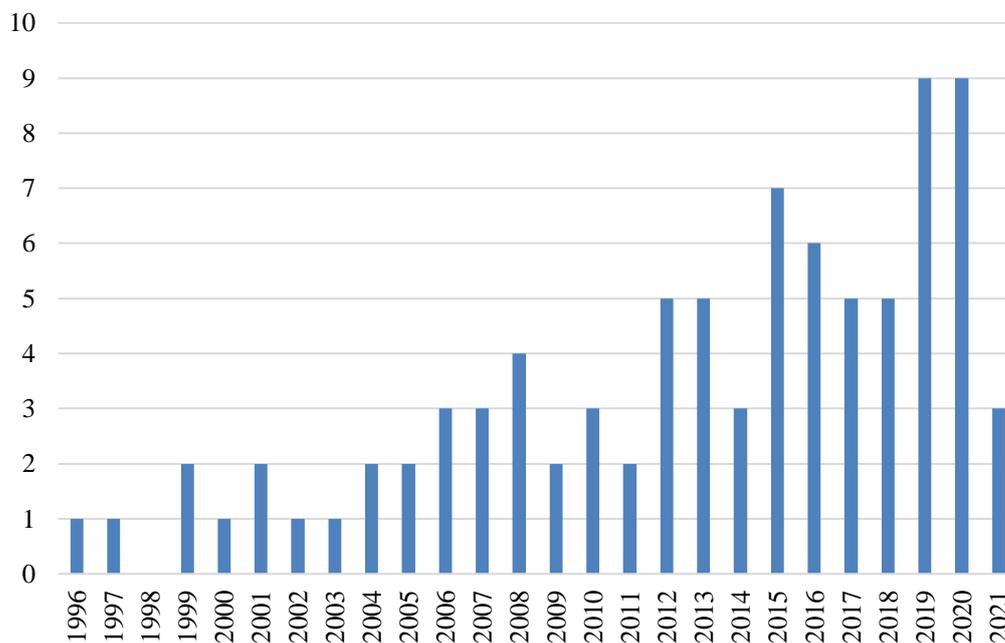
3.1. Research Question 1

To what extent has regional development been studied by quantitative methods? In recent decades, the issue of regional economic development and convergence has become particularly important, not only for European policymakers (Rogge, 2018). The empirical literature that has studied the analysis of regional economic inequalities in Europe is significant so that numerous studies have emerged (Ayouba et al., 2020).

3.1.1. Publications per Year

The first research question focuses on the extent to which the economic development of a region or group of regions has been studied using statistical analysis. This first criterion attempts to summarize the volume of articles per year that have studied regional development in the EU. *Figure 2* shows the number of scientific articles used in the review per year. The annual distribution of articles shows a slight fluctuation in the first years of the study, namely until 2011. After that there is a small increase. However, a large number of articles are concentrated in 2015, 2016, 2019, and 2020.

Figure 2. Publications per Year



Source: own elaboration

3.1.2. Publication by journals

As mentioned earlier, the papers included in the review have been published in scientific journals. The contribution of the Academic Journal Guide of CABS (Chartered Association of Business Schools, 2021), which serves to identify top journals in the field of Economics was considered useful, as a means of ensuring sample quality (Preuss and Koenigsgruber,

2020). **Table 1** includes the top 5 journals and the journals in which the most cited articles have been published. There is also the ranking of journals according to the Academic Journal Guide of CABS, the metrics of each journal in terms of references to the total articles published per scientific journal, the number of review articles per journal and their publisher

Table 1. Journals

Journal	AJG 2021- Ranking	AJG 2018- Ranking	Cite Score 2020	SJR 2020	SNIP 2020	Number of papers	Publisher
The Annals of Regional Science	2	2	3,2	0.722	1,236	20	Springer Nature
Regional Studies	4	3	7	1,844	2,237	7	Taylor and Francis
European Urban and Regional Studies	3	3	6,5	1,393	2,413	3	SAGE
International Regional Science Review	-	-	4,7	0,839	1,487	3	SAGE
Journal of Geographical Systems	1	-	2,4	0,507	0,938	3	Springer Nature
Networks and Spatial Economics	2	2	4,6	0,983	1,376	2	Springer Nature
Papers in Regional Science	3	-	3,8	0,937	1,429	2	Wiley- Blackwell
Environment and Planning A	3	4	5,6	1,740	1,964	2	SAGE
European Economic Review	3	3	3	1,905	1,663	1	Elsevier

Source: own elaboration

3.1.3. Publication by citations

Another criterion that the authors took into consideration while collecting and processing information, is the number of citations of each scientific article. **Table 2** lists the top 10 most mentioned articles, their domains and the journals they were published in. It can be seen that the article published by Rodriguez-Pose and Creszeni (2008) is the one with the highest number of citations (414), followed by Ter Wal and Boshma (2009) with 371 citations. Each author in **Table 2** has been mentioned between 91-414 times. Some of these articles (Gardiner et al., 2004; Petrakos et al., 2005; Ter Wal and Boschma, 2009; Ducruet and Beauguitte, 2014) were added to the literature as they were identified through sources

other than the research methodology analyzed. The criterion to be included in the review is the number of their citations.

Table 2. Top 10 most cited articles

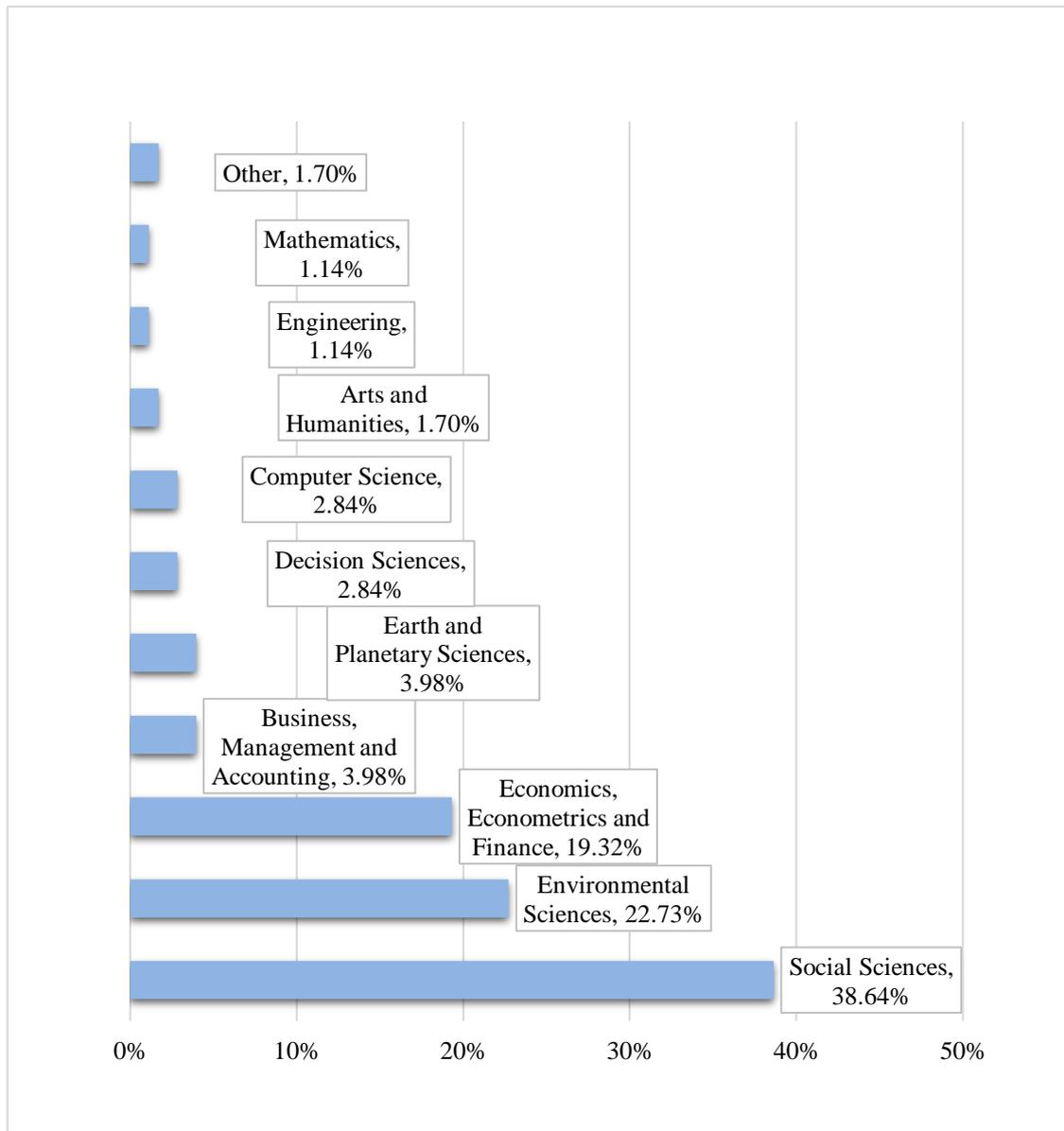
	Authors	Title	Citations	Domain	Journal
1	Rodríguez-Pose and Crescenzi (2008)	Research and development spillovers innovation systems and the genesis of regional growth in Europe	414	Social Sciences/ Environmental Science	Regional Studies
2	Ter Wal and Boschma (2009)	Applying Social Network Analysis in Economic Geography: Framing Some Key Analytic Issues	371	Social Sciences/ Environmental Science	Annals of Regional science
3	Lopez-Bazo et al. (1999)	Regional economic dynamics and convergence in the European Union	237	Social Sciences/ Environmental Science	Annals of Regional science
4	Rodríguez-Pose and Garcilazo (2015)	Quality of Government and the Returns of Investment: Examining the Impact of Cohesion Expenditure in European Regions	163	Social Sciences/ Environmental Science	Regional Studies
5	Gardiner et al. (2004)	Competitiveness, Productivity and Economic Growth across the European Regions	152	Social Sciences/ Environmental Science	Regional Studies
6	Ducruet and Beauguitte (2014)	Spatial Science and Network Science: Review and Outcomes of a Complex Relationship	120	Computer Science	Networks and Spatial Economics
7	Pellegrini et al. (2013)	Measuring the effects of European Regional Policy on economic growth: A regression discontinuity approach	112	Social Sciences/ Environmental Science	Papers in Regional Science
8	Petrakos et al. (2005)	Growth, integration, and regional disparities in the European Union	109	Social Sciences/ Environmental Science	Environment and Planning A
9	Dall'erba (2005)	Distribution of regional income and regional funds in Europe 1989-1999: An exploratory spatial data analysis	95	Social Sciences/ Environmental Science	Annals of Regional science
10	Henrekson et al. (1997)	Growth effects of European integration	91	Economics, Econometrics and Finance	European Economic Review

Source: own elaboration

3.1.4. Subject areas

The literature on Economic and Regional Development covers many different subject areas and research fields. The authors decided to rank the articles by subject area (Tseng et al., 2019). Of course each paper belongs to more than only one subject area.

Figure 3. Articles by subject areas



Source: own elaboration

The paper of von Lyckner and Thoennesen (2017) moves in the subject areas of Social Sciences, Economics, Econometrics and Finance, whereas Agasisti and Bertolotti (2020) moves respectively in the areas of Social Sciences, Economics, Econometrics and Finance, Decision Sciences and Business Management and Accounting. Studying **Figure 3**, it can be seen that the most number of papers are contributed by the areas of Social Sciences, which covers 38% of the literature review (Canaleta et al., 2002; Cuadrado-Roura et al., 2000; Brunow and Hirte, 2006; Capello and Caragliu, 2021), following by Environmental Sciences with 23% (Stavropoulos et al., 2020; De Graaf 2020; Šídlo et al., 2019; Ramos, 2007; Geppert and Stephan, 2008), and Economics, Econometrics and Finance with 19%

(Kokocinska and Puziak, 2020; Graziano et al., 2019; Kogler et al., 2017). Other subject areas, such as Business Management and Accounting (Hiadlovsky et al., 2018; Tijanic and Obadic, 2015; Polyanzky, 2012; Simionescu, 2015), Decision Sciences (Di Pietro et al., 2021; Fiaschi et al., 2017), Computer Science (Borsenova et al., 2021; Postiglione et al., 2013), Arts and Humanities (Aria et al., 2019; Ezcurra, 2019), Engineering (Luceno-Monedero et al., 2021), Mathematics (Rogge, 2018; von Lyckner and Thoennesen, 2017) etc. have small participation in this review.

3.1.5. Research periods

The authors made an attempt to analyze the periods over which the studies have analyzed the regions. Given, that the selected articles for the present bibliographic review were published from 1995 onwards (as it is the year of the third enlargement of the European Union), the research time span covers the period between 1983 and 2017. For example, the article of Philip Abraham (1996) “Regional adjustment and wage flexibility in the European Union” refers to a period, which dates back to the 1980s, specifically, to the period 1983-1989.

In a total of 87 scientific articles included, 19 of them study periods from 1980-1999 (Abraham, 1996; Canaleta, Arzoz and Garate, 2002). The majority of the articles (30/87) refer to a period between 1990-2014 (Simionescu, 2015; Andreoni and Galmarini, 2016). Furthermore, 24 articles cover a period after 2000 (De Graaf, 2020; Sardadvar and Vakulenko, 2021) and 7 cover a period after 2010 (Formánek, 2019; Weziak-Bialowska, 2015). Finally, the article which covers the longest period is Arbia et al. (2008), which studies the regional economic convergence in the European Union between 1977 to 2002.

3.2. Research Question 2

How is research evolving in the regional development of the EU? For the second research question, an attempt was made to organize the articles to extract relevant information from the publications. Therefore, the following information proved useful: (1) the quantities, (2) the methodology and indicators (quantitative methods), (3) the sample size of each empirical study.

3.2.1 What sizes are being studied?

Initially, an attempt was made to analyze the quantities that are the subject of study in the papers. A common feature of the majority of the papers is that they focus heavily on per capita GDP because it is the basic factor studied by many growth models (Casellas and Galley, 1999; Arbia and Paelinck, 2003; Crespo-Cuaresma et al., 2011; Fotopoulos, 2012). In this bibliographic review, in 61 of the 87 works included, the subject of study was GDP (Lopez-Rodriguez and Faina, 2007; Scheider and Wagner, 2012; Corradini and De Propris, 2015). The work of Lopez-Bazo et al. (1999), where the methodology is based on GDP per employee, as an index of measuring labor productivity, but also GDP per capita, as a means of studying regional inequalities due to changes in the socio-economic environment (Lopez-Bazo et al., 1999) are some examples. Also, the article of Capello et al. (2017) measures regional development as a result of total national development and the difference in the development of a region compared to its country, using regional GDP (Capello et al., 2017). Rodriguez-Pose and Ketterer (2020) attempt to assess whether the levels and the change in the quality of governance of a country affect the economic performance of the regions of the EU, emphasizing on the lagging regions. Also, they explored the physical and human capital and the different levels of innovation of the NUTS 2 regions, taking among other quantities the real GDP per capita (Rodriguez-Pose and Ketterer, 2020).

Another measure that prevails in economic and regional development research is the employment/unemployment rate (Niebuhr, 2006; Elhorst, 2008; Andersson and Andersson, 2014; Fratesi and Rodriguez-Pose, 2016). In 31/86 papers, the specific measure is studied. Sardadvar and Vakulenko (2021) investigated the general unemployment rate and the youth unemployment rate in 51 NUTS 2 regions for the period 2000-2011. Also Becker et al. (2018) have analyzed the effects of the regional policy of the EU from 1989 to 2013, including the average annual increase of employment for 25 Member States.

Education level and population are also measures of economic and regional development (Doran et al., 2016; Dima et al., 2018; Aria et al., 2019). Rios and Gianmoena (2020) attempted to analyze the robustness of the relationship between quality governance and financial resilience during the Great Recession of 2008. They used demographic characteristics, such as population density and demographic composition, which are directly related to the labor market. They also refer to factors leading to invention and innovation, such as RandD expenditure and the percentage of the population that has completed higher education (tertiary education). Weziak-Bialowska D. (2015) developed a Regional Human Poverty Index (RHPI), focusing on four areas: social exclusion, knowledge, a decent standard of living and a long and healthy life. She studied measures such as the long-term unemployment rate, life expectancy at a given age, the percentage of the population between 24 and 65 years old who leave education and training early (Weziak-Bialowska, 2015). Population development as a measure of economic and regional development has been studied in 24/86 articles and the level of education in 14/86 articles.

Other sizes that in the review articles are transportation infrastructure data (Formánek, 2019), motorways and railways network (Rios and Gianmoena, 2020), Hospital beds per 100,000 inhabitants demography (Ayouba et al., 2020), life expectancy (Rizzi et al., 2018), wage flexibility (Abraham, 1996), inflation rate (Capello, 2007) etc.

3.2.2 Which methodology and indicators have been used (quantitative methods)?

In a total of 87 scientific articles included in the literature review, there are different approaches and methodologies in the analysis of the quantities listed in the previous research sub-question.

Exploratory Spatial Data Analysis (ESDA), used in 6/87 scientific articles, is a technique that describes and visualizes spatial distributions (Ertur and Koch, 2006; Chapman et al., 2012), and investigates the change in the percentage of GDP per capita in an area due to the corresponding percentage of neighboring regions (Chocholata and Furkova, 2016). ESDA defines two separate spatial regimes, a core and a periphery and it classifies the regions into spatial regimes according to the economic development (Annoni et al., 2019).

Beta-convergence is a method of economic analysis between regions. In particular, it refers to the process by which lagged regions develop rapidly to reach the more developed regions, according to the neoclassical theory of the development of Solow (1956). This process directs the regions to a stable state for a long time, with the basic feature that development depends only on technological development and change of human resources (Monfort, 2008). As beta-convergence focuses on the growth process, sigma-convergence focuses on reducing imbalances between regions over time (Chocholata and Furkova, 2016). Degree of convergence is a widespread method of assessing economic and regional development (Petraikos et al., 2011; Arbia et al., 2008). Specifically, in the present literature, 16/87 articles used beta-convergence (Guastella and Timpano, 2016; Wagner and

Zeileis, 2019, Baumont et al., 2001), while only 3/87 sigma-convergence (Marelli, 2004; Markowska and Strahl, 2012; Bal-Domanska, 2016).

The development of a region can be directly affected by the neighboring region, due to the interaction between regions belonging to the same economic union and the growing relations between regions of different Member States (e.g. transport networks, trade and technology). The distribution of regional production is unusual to be independent and random (Lopez-Bazo et al., 1999). The measurement of total spatial autocorrelation is usually based on certain statistical variables (Ertur and Koch, 2006) and represents the interaction between regions based on their geographical proximity (Mora and Moreno, 2010). Statistical indexes that measure spatial autocorrelation are the Moran's I and Geary's C indices (Lopez-Bazo et al., 1999). Using them, Dallerba (2005) analyzed the spatial distribution of regional income and regional funds, while Mora and Moreno (2010) used the indicators to check for spatial dependence on certain variables (GDP, agricultural sector, patents, etc.). Throughout the review, 12/87 articles use Moran's I index (Bracalente and Perugini, 2010) and only 1/87 Geary's C index (Lopez-Bazo et al., 1999)

Other indicators used are the Gini, Atkinson, and Theil indexes, which assess economic inequality. The Gini index is used as a measure of income or wealth inequality and can compare these figures across populations, in different regions (Monfort, 2008). The Gini index is a more sensitive measure to changes around the median income distribution (Rodriguez-Pose and Tselios, 2009b). The Atkinson Index measures income inequality and attempts to determine which end of distribution has contributed most to inequality (Monfort, 2008). In this review, the Gini index was used in 5/87 articles (Tselios, 2014; Charron, 201; Andreoni and Galmarini, 2016), the Theil index in 7/87 articles (Doran and Jordan, 2013; Van Oort and Bosma, 2013) and finally the Atkinson index in only 1 article (Rodriguez-Pose and Tselios, 2010).

3.2.3 What is the sample size of NUTS 2 of the empirical studies?

According to this criterion, the authors attempt to give a geographical representation of the sample size of the empirical studies (Ahmed et al., 2021; Guthrie et al., 2012). From the 87 articles studied, a different sample size of NUTS 2 was observed. In other words, there is a variety of sample sizes ranging from 50 to over 250 regions. More specifically, only 5 papers include in their sample from 51 to 100 regions (5.8%), 12 papers from 101 to 150 regions (13.9%), 21 articles from 151 to 200 regions (24.1%), 8 articles from 201 to 250 (9.2%). Finally 25 papers study all the NUTS 2 regions (28.6%) and in 16 of the 87 papers the number of regions is not mentioned at all (18.4%).

3.2.4. What is the sample size of Member States of the empirical studies?

Similarly as the previous criterion, an overview of the geographic areas could be given (Guthrie et al., 2012; Dumay et al., 2016). This criterion shows the number of the Member states studied in the articles. Only 6/87 papers study less than 9 Member States (6,9%), 29/87 papers research between 10 to 19 Member States (33.3%) and finally, 39 papers study almost all Member States (44.8%). 13/87 articles do not explicitly list the Member States surveying, but only mention the number of NUTS 2 regions (15%).

3.3. Research Question 3

Has Social Network Analysis been used in the context of regional development? The last research question was studied with great care and diligence. The majority of the articles

using Social Network Analysis focus on other scientific areas and not on "Economic and Regional Development". Some articles that study the transfer of knowledge in various scientific areas through social networks could be mentioned (Vittoria and Lavadera, 2014). There are articles about financial leaders (workforce innovation) (Dziadkowiec et al., 2015) and articles about RandD knowledge networks (Gama et al., 2018). Consequently, after applying the appropriate filters and studying the articles, only four articles (4/86) were included in this paper about social network analysis in the area of regional analysis.

The article "Spatial Science and Network Science: Review and Outcomes of a Complex Relationship" by Ducruet and Beauguitte (2014) moves to a theoretical level without including any statistical analysis. In particular, it includes an extensive report on the evolution of network analysis and its integration into geography and regional science, adds a brief overview of the emergence of complex networks, and finally examines how scientific geographers and regional analysts have used indicators and concepts in their research either independently or in collaboration with other scientific fields (Ducruet and Beauguitte, 2014).

A second article on social network analysis by Berman and Maier (2008): "Network central: regional positioning for innovating advantage" focuses on trying to understand how the regions achieved important central positions in knowledge networks, as the central position in a social network offers greater knowledge transfer, innovation, and competitiveness. They also attempted to identify local and spatial factors, which explain the achievement of node centrality of a network (Berman and Maier, 2008).

Also, the article by Ter Wal and Boschma (2009) on the use of social network analysis in economic geography attempts to emphasize the role of a dynamic network. According to the article, social network analysis is a suitable tool for economic geographers in the empirical study of the structure and evolution of inter-organizational interaction, as well as knowledge flows both within and between regions. Static network surveys involving social network analysis techniques have been implicated in the area of economic geography, but dynamic spatial network studies are virtually non-existent. Therefore, there are still many challenges in the area of static and dynamic network research (Ter Wal and Boschma, 2009).

Finally, Cidell (2020) surveyed twenty-five municipalities in the area of greater Melbourne to assess which organizations are more central in the local government's effort for the environment and its sustainability. She conducted a social network analysis based on twenty-five municipalities, which was based on official documents of local government on climate change, water, fire management, pedestrian safety, and other data. The analysis revealed the existence of many external organizations in cooperation with the municipalities to achieve sustainability, such as sub-regional groups fulfilling the functions for which they were designed, as well as significant state and federal government authorities (Cidell, 2020).

As can be concluded, surveys in the context of economic and regional development, which are based on static studies, exist, while corresponding studies based on statistical analysis in combination with dynamic networks, are virtually non-existent (Ter Wal and Boschma, 2009). So, to the third research question "Has Social Network Analysis been used in the context of regional development?" the answer is negative, it has not been used before. In other words Social Network Analysis is not a traditional and common method of analyzing the economic and regional development.

4. Conclusions

This study includes a systematic literature review of economic and regional development through quantitative methods and social network analysis. The extent to which regional development has been studied using quantitative methods for EU regions was initially examined. The analysis concerned the number of articles per year, the scientific journals, the subject areas and the citations per article. Subsequently, a thorough investigation was carried out about the evolution of the economic and regional development research, namely the indices and the methodology used in the articles, the sample sizes and geographical areas included in the studies were studied. Finally, the third research question attempted to answer whether the analysis of social networks has been used in the context of regional development. As can be concluded, surveys in the context of economic and regional development, which are based on static studies, exist, while corresponding studies based on statistical analysis in combination with dynamic networks, do not exist. It could be a suggestion for researchers to introduce Social Network Analysis in the study Economic and Regional Analysis as an alternative method of statistical analysis.

In conclusion, Economic and Regional Development refers to the process of development of a region to improve the economic, political and social prosperity of a region. The unequal spatial distribution of income, economic opportunities and activities has attracted the interest of a large number of scholars in recent decades, who focus on the spatial and structural differences of regions using various quantitative methods and statistical analysis. It is important to note that Economic and Regional Development is not about a static picture. Instead, it studies complex dynamics of regions. Social Network Analysis could be proposed in the context of Economic and Regional Analysis because it is a process that enables the exploration of social structures using networks and graph theory, which means that the element of visualization could be applied. The techniques of SNA are useful while examining the structure of the effect between regions and geographical clusters. There are metrics and centrality measurements to calculate, to conclude the interaction, convergence or divergence of regions. The application of the Social Network Analysis in Economic and Regional Analysis could be a reliable methodology for future research.

References:

- Abraham, F. (1996). Regional adjustment and wage flexibility in the European Union. *Regional Science and Urban Economics*, 51-75.
- Afro, F.; Leitao, J.C.C. (2020). Leadership and Organizational Innovation in the Third Sector: A Systematic Literature Review, *International Journal of Innovation Studies*, 4(2): 51-67.
- Agasisti, T.; Bertolotti, A. (2020). Higher education and economic growth: A longitudinal study of European regions 2000–2017. *Socio-Economic Planning Sciences*, 81:100940.
- Ahmed, R.; Philbin, S.P.; Cheema, F. (2021). Systematic literature review of project manager's leadership competencies. *Engineering, Construction and Architectural Management*, 1-30.
- Alexiadis S.(2020). Regional Convergence: Theory and Empirics. *Regional Science Inquiry*, XII (1): 245-252.
- Andersson, D.E.; Andersson, A.E. (2014). Unemployment in European regions: Structural problems versus the Eurozone hypothesis. *Journal of Economic Geography*, 15(5): 883-905.
- Andreoni, V.;Galmarini S. (2016). Mapping socioeconomic well-being across EU regions. *International Journal of Social Economics*, 43: 226-243.
- Annoni, P.; Dominicis L.; Khabirpour N. (2019). Location matters: A spatial econometric analysis of regional resilience in the European Union. *Growth and Change*, 50(1):1-32.

- Arbia, G.; Paelinck L. (2001). Economic convergence or divergence? Modeling the interregional dynamics of EU regions, 1985-1999. *Journal of Geographical System*, 5(3): 291-314.
- Arbia, G.; Gallo J.; Piras G. (2008). Does evidence on regional economic convergence depend on the estimation strategy? outcomes from analysis of a set of NUTS2 EU regions. *Spatial Economic Analysis*, 3(2): 209-224.
- Aria, M.; Gaeta, G.; Marani. U. (2019) Similarities and Differences in Competitiveness Among European NUTS2 Regions: An Empirical Analysis Based on 2010–2013 Data. *Social Indicators Research*, 142(1): 431-450.
- Arkhipova L. (2020). Territorial Differentiation of Labor as a Factor of Sustainability of Regional Economies. *Regional Science Inquiry*, XII(2): 165-178.
- Ayoub, K.; Le Gallo J.; Vallone A. (2020). Beyond GDP: an analysis of the socio-economic diversity of European regions. *Applied Economics*, 52(9): 1-20.
- Bal-Domanska, B. (2016). The impact of economic crisis on convergence processes in European union regions. *Prague Economic Papers*, 509-526.
- Baumont, C.; Ertur, C.; Le Gallo, J. (2001) A Spatial Econometric Analysis of Geographic Spillovers and Growth for European Regions, 1980-1995. *European Regional Growth*, 99-129.
- Becker, S.; Egger, P.; Ehrlich, M. (2018). Effects of EU Regional Policy: 1989-2013. *Regional Science and Urban Economics*, 69: 143-152.
- Bergman, E.; Maier, G. (2009). Network central: Regional positioning for innovating advantage. *The Annals of Regional Science*, 43(3): 615-644.
- Borsenova, K.; Korony, S.; Nijkamp, P. (2021). In Search of Concerted Strategies for Competitive and Resilient Regions. *Networks and Spatial Economics*.
- Bracalente, B.; Perugini, C. (2008). The components of regional disparities in Europe. *The Annals of Regional Science*, 44(3): 621-645.
- Brunow, S.; Hirte, G. (2006). Age structure and regional economic growth. *Jahrbuch für Regionalwissenschaft*, 226: 3-23.
- Busalim, A.; Hussin, A. (2016). Understanding social commerce: A systematic literature review and directions for further research. *International Journal of Information Management*, 36 (6): 1075-1088.
- Canaleta, C.G.; Pascual, P.; Rapun, M. (2002). Structural change, infrastructure and convergence in the regions of the European Union. *European Urban and Regional Studies*, 9(2): 115-135.
- Capello, R. (2007). A forecasting territorial model of regional growth: the MASST model. *The Annals of Regional Science*, 41: 753-787.
- Capello, R.; Caragliu, A. (2021). Merging macroeconomic and territorial determinants of regional growth: the MASST4 model. *Annals of Regional Science*, 66(1): 19-56.
- Capello, R.; Caragliu, A.; Fratesi, U. (2017). Modeling Regional Growth between Competitiveness and Austerity Measures: The MASST3 Model. *International Regional Science Review*, 40: 38-74.
- Casellas, A.; Galley C.C. (2010). Regional definitions in the European Union: A question of disparities? *Regional Studies*, 551-558.
- Chapman, S.A.; Cosci, S.; Mirra L. (2012). Income dynamics in an enlarged Europe: the role of capital regions. *The Annals of Regional Science*, 48: 663-693.
- Charron, N. (2016). Diverging cohesion? Globalisation state capacity and regional inequalities within and across European countries. *European Urban and Regional Studies*, 23(3): 355-373.
- Chartered Association of Business Schools. *Academic journal guide*. (2018). <https://charteredabs.org/academic-journal-guide-2018/> (accessed 04 15, 2021)
- Chocholata, M.; Furkova, A. (2016). Does the location and the institutional background matter in convergence modelling of the EU regions?" *Central European Journal of Operations Research*, 25: 679-697.

- Cidell, J. (2020). Coopeating on Urban Sustainability: A Social Network Analysis of Municipalities across Greater Melbourne. *Urban Policy and Research*, 38(2): 150-172.
- Corradini, C.; De Propris, I. (2015). Technological diversification and new innovators in European regions: evidence from patent data. *Environment and Planning A*, 47.
- Crespo-Cuaresma, J.; Foster, N.; Stehrer, R. (2020). Determinants of regional economic growth by Quantile. *Regional Studies*, 809-826.
- Cuadrado-Roura, J.; Mancha-Navarro, T.; Garrido-Yserte, R. (2000). Regional productivity patterns in Europe: An alternative approach. *Annals of Regional Science*, 34(3): 365-384.
- Cuadrado-Roura, J. (2001). Regional convergence in the European Union: From hypothesis to the actual trends.» *The Annals of Regional Science*, 35: 333-356.
- Dall'Erba, S. (2005). Distribution of regional income and regional funds in Europe 1989-1999: An exploratory spatial data analysis. *The Annals of Regional Science*, 39: 121-148.
- De Graaf, T. (2020). On the estimation of spatial stochastic frontier models: an alternative skew-normal approach." *Annals of Regional Science*, 64: 265-285.
- Di Pietro, F.; Lecca P.; Salotti, S. (2021). Regional economic resilience in the European Union: a numerical general equilibrium analysis. *Spatial Economic Analysis*, 16(3): 287-312.
- Dima, A.M.; Begu, L.; Vasilescu, M.D.; Alexandra Maassen, M. (2018). The Relationship between the Knowledge Economy and Global Competitiveness in the European Union." *Sustainability*, 10(6): 1706.
- Doran, J.; Jordan D. (2013). Decomposing European NUTS2 regional inequality from 1980 to 2009. *Journal of Economic Studies*, 40(1): 22-38.
- Doran, J.; McCarthy, N.; O'Connor, M. (2016). Entrepreneurship and employment growth across European regions. *Regional Studies, Regional Science*, 3(1): 121-128.
- Ducruet, C.; Beauguitte, L. (2014) Spatial Science and Network Science: Review and Outcomes of a Complex Relationship. *Network and Spatial Economics*, 14(3): 297-316.
- Dumay, J.; Bernardi, C.; Guthrie, J.; Demartini, P. (2016). Intergrated reporting: a structured literature review. *Accounting Forum*, 40(3): 166-185.
- Dziadkowiec, O.; Wituk, S.; Franklin, D. (2015). A social network analysis of south central Kansas workforce innovations in regional economic development. *Journal of Place Management and Development*, 20158(1) 6-22.
- Elhorst, J.P. (2008). A spatiotemporal analysis of aggregate labour force behaviour by sex and age across the European Union. *Journal of Geographical Systems*, 10: 167-190.
- Ertur, C.; Koch, W. (2006). Regional disparities in the European Union and the enlargement process: an exploratory spatial data analysis, 1995–2000. *The Annals of Regional Science*, 40(4): 723-765.
- European Union. *The history of the European Union*. (2020). https://europa.eu/european-union/about-eu/history_el (accessed 4 24, 2021).
- Eurostat. *History of NUTS*. (2020). <https://ec.europa.eu/eurostat/web/regions-and-cities/overview> (accessed 4 26, 2021).
- Ezcurra, R. (2019). Regional Disparities and Within-Country Inequality in the European Union. *Revista De Economia Mundial*, 51: 139-162.
- Fiaschi, D.; Gianmoena, L.; Parenti, A. (2017). Asymmetric macroeconomic volatility in European regions. *Spatial Economic Analysis*, 12: 251-278.
- Formánek, T. (2019). GDP per capita in selected EU countries: Economic growth factors and spatio-temporal interactions examined at the NUTS2 level. *Journal of International Studies*, 12(1): 119-133.
- Fotopoulos, G. (2012). Nonlinearities in regional economic growth and convergence: the role of entrepreneurship in the European union regions. *The Annals of Regional Science*, 48(3): 1-23.

- Fratesi, U. (2015). Regional Knowledge Flows and Innovation Policy: A Dynamic Representation. *Regional Studies*, 49(11): 1859-1872.
- Fratesi, U.; Rodriguez-Pose A. (2016). The crisis and regional employment in Europe: What role for sheltered economies? *Cambridge Journal of Regions, Economy and Society*, 9(1): 33-57.
- Gama, R.; Barros C.; Fernandes R. (2018). Science Policy, R&D and Knowledge in Portugal: an Application of Social Network Analysis. *Journal of Knowledge Economy*, 9: 329-358.
- Gardiner, B.; Martin, R.; Tyler P. (2004). "Competitiveness, Productivity and Economic Growth across the European Regions. *Regional Studies*, 1045-1067.
- Geppert, K.; Stephan A. (2008). Regional disparities in the European Union: Convergence and agglomeration. *Papers in Regional Science*, 87(2): 193-217.
- Graziano, P.; Rizzi, P.; Piva, M. Barbieri, L. (2019). A Regional Analysis of Well-Being and Resilience Capacity in Europe. *Scienze Regionali*, 551-574.
- Guastella, G.; Timpano, F. (2016). Knowledge, innovation, agglomeration and regional convergence in the EU: motivating place-based regional intervention. *Review of Regional Research*, 121-143.
- Guthrie, J.; Ricceri, F.; Dumay, J. (2012). Reflections and projections: A decade of Intellectual Capital Accounting Research. *The British Accountig Review*, 44: 68-82.
- Henrekson, M.; Torstensson, J.; Torstensson, R. (1997). Growth effects of European integration. *European Economic Review*, 41(8): 1537-1557.
- Henttonen, K. (2010). Exploring social networks on the tem level-A review of the empirical literature. *Journal of Engineering and Technology Management*, 27(1-2): 74-109.
- Hiadlovsky, V.; Hunady, J.; Orviska, M.; Pisar, P. (2018). Research Activities and their Relation to Economic Performance of Regions in the European Union. *Business System Research*, 9: 44-54.
- Kogler, D.F.; Essletzbichler, J.; Rigby, D.L. (2017). "The evolution of specialization in the EU15 knowledge space." *Journal of Economic Geography*, 17(2): 345-373.
- Kokocinska, M.; Puziak, M. (2020). Evolution of regional income disparities in large European economies." *Revista de Economia Mundial*, 54: 129-150.
- Koudoumakis, P.; Botzoris, G.; Protopapas, A.; Profillidis, V. (2019). The Impact of the Economic Crisis In the Process of Convergence of the Greek Regions. *Regional Science Inquiry*, 0(1): 25-32.
- Krupoderova, A.; Portnov, B. (2020). Eco-innovations and economic performance of regions: a systematic literature review.» *Regional Studies, Regional Science*, 7(1): 571-588.
- Lopez-Bazo, E.; Vaya, E.; Mora, A.; Surinach, J. (1999). Regional economic dynamics and convergence in the European Union. *The Annals of Regional Science*, 33: 343-370.
- Lopez-Rodriguez, J.; Faina, A. (2007). Regional disparities in Europe: What role for market access? *Investigaciones Regionales*, 5-23.
- Luceno-Monedero, A.L.; Ruiz-Rodriguez, F.; Gonzalez-Relano, F. (2021). Measuring the digital divide at regional level. A spatial analysis of the inequalities in digital development of households and individuals in Europe. *Telematics and Informatics*, 41: 197-217.
- Marelli, E. (2004). Evolution of employment structures and regional specialisation in the EU. *Economic Systems*, 28(1): 35-59.
- Markowska, M.;Strahl, D. (2012). Evaluation of the European Union regions convergence regarding innovation. *Argumenta Economica*, 28(1): 41-61.
- Moher, D.; Liberati, A.; Tetzlaff, J.; Douglas A. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Research Methods & Reporting. BMJ* 339.
- Monfort, P. (2008). Convergence of EU regions- Measures and evolution. https://ec.europa.eu/regional_policy/sources/docgener/work/200801_convergence.pdf (accessed 05 2021).

- Mora, T.; Moreno R. (2010). Specialisation changes in European regions: the role played by externalities across regions. *Journal of Geographical Systems*, 12(3): 311-334.
- Nerantzidis, M.; Pazarskis, M.; Drogalas, G.; Galanis, S. (2020). Internal auditing in the public sector: a systematic literature review and future research agenda. *Journal of Public Budgeting Accounting and Financial Management*, 34: 189-209.
- Nguyen, Q.T.K. (2011). The empirical literature on multinational enterprises, subsidiaries and performance. *The Multinational Business Review*, 19(1): 47-64.
- Niebuhr, A. (2006). Market access and regional disparities. *The Annals of Regional Science*, 40(2): 313-334.
- Nijkamp, P.; Abreu, M. (2009). Regional Development Theory. *International Encyclopedia of Human Geography*, 202-207.
- Omerzel, D. G. (2016). A systematic review of research on innovation in hospitality and tourism. *International Journal of Contemporary Hospitality Management*, 28(3): 516-558.
- Pellegrini, G.; Terrible, F.; Tarola, O.; Muccigrosso, T.; Busillo, F. (2013). Measuring the effects of European Regional Policy on economic growth: A regression discontinuity approach. *Papers in Regional Science*, 92(6/10): 217-233.
- Petrakos, G.; Kallioras, D.; Anagnostou, A. (2011). Regional convergence and growth in Europe: Understanding patterns and determinants. *European Urban and Regional Studies*, 18(4): 375-391.
- Petrakos, G.; Rodriguez-Pose, A.; Rovolis, A. (2005). Growth, integration, and regional disparities in the European Union. *Environment and Planning A*, 37(10): 1837-1855.
- Petrakos, G.; Saratsis, Y. (2000). Regional inequalities in Greece. *Papers in Regional Science*, January 79: 57-74.
- Pike, A.; Rodriguez-Pose, A.; Tomaney, J. (2017). *Local and Regional Development*. second edition. New York: Routledge.
- Polyanzky, Z. (2012). Central and Eastern Europe: Catching up or lagging behind? *Society and Economy*, 34(3): 399-421.
- Postiglione, P.; Andreano, M.S.; Benedetti, R. (2013). Using Constrained Optimization for the Identification of Convergence Clubs. *Computational Economics*, 42: 151-174.
- Preuss, S.; Koenigsgruber, R. (2020). "How to corporate political connections influence financial reporting? A synthesis of the literature." *Journal of Accounting and Public Policy*, 40(1).
- Prisma Statement. (2021). PRISMA Transparent Reporting of Systematic Reviews and Meta-Analysis. <http://prisma-statement.org/prismastatement/flowdiagram.aspx> (accessed 6 15, 2021).
- Ramos, P. (2007). Does the trade balance really matter for regions? *The Annals of Regional Science*, 41(1): 229-243.
- Rios, V.; Gianmoena, L. (2020). The link between quality of government and regional resilience in Europe. *Journal of Policy Modeling*, 42(5): 1064-1084.
- Rizzi, P.; Graziano, P.; Dallara, A. (2018). A capacity approach to territorial resilience: the case of European regions. *The Annals of Regional Science*, 60: 285-328.
- Rodriguez-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.
- Rodríguez-Pose, A.; Crescenzi, A. (2008). Research and development spillovers innovation systems and the genesis of regional growth in Europe. *Regional Studies*, 42(1): 51-67.
- Rodriguez-Pose, A.; Tselios, V. (2009). Mapping regional personal income distribution in Western Europe: income per capita and inequality. *Czech Journal of Economics and Finance*, 59(1): 41-70.
- Rodriguez-Pose, A.; Ketterer, T. (2019). Institutional change and the development of lagging regions in Europe. 54: 974-986.

- Rodriguez-Pose, A.; Tselios, V. (2010). Inequalities in income and education and regional economic growth in western Europe. *The Annals of Regional Science*, 44: 349-375.
- Rogge, N. (2018). Regional productivity growth in the EU since 2000:something is better than nothing. *Empirical Economics*, 56: 423-444.
- Sardadvar, S.; Vakulenko, E. (2021). Does migration depress regional human capital. *Review of Regional Research*, 41: 95-122.
- Scheider, U.; Wagner, M. (2012). Catching Growth Determinants with the Adaptive Lasso. *German Economic Review*, 13(1): 71-85.
- Seuring, S.; Mueller, M.; Westhaus, M.; Morana, R. (2005). Conducting a Literature Review — The Example of Sustainability in Supply Chains. *Research Methodology in Supply Chain Management*, 91-106.
- Sevinongse, C.; Bennet, A.; Mariano, S. (2017). Utilizing a systematic literature review to develop an integrated framework for information and knowledge management systems. *Journal of Information and Knowledge Management Systems*, 47(2): 250-264.
- Šídlo, L.; Klapková, M.; Sprocha B. (2019). Regional differences in population aging in Europe viewed through prospective indicators. *Erdkunde*, 73(3): 225-240.
- Simionescu, M. (2015). About regional convergence clubs in the European Union. *Zbornik Radova Ekonomskog Fakultet au Rijeci*, 33(1): 67-80.
- Stanickova M.; Melecký L. (2018). Understanding of resilience in the context of regional development using composite index approach: the case of European Union NUTS-2 regions. *Regional Studies, Regional Science*, 5(1): 231-254.
- Stavropoulos, S.; van Oort F.G.; Burger, J. (2020). Heterogeneous relatedness and firm productivity. *The Annals of regional science*, 65: 403-437.
- Ter Wal, A.; Boschma, R. (2008). Applying social network analysis in economic geography: framing some key analytic issues. *The Annals of Regional Science*, 43: 739-756.
- Tijanic, L.; Obadic, A. (2015). Can we boost the competitiveness of the european union through reducing regional inequalities in human capital? *Engineering Economics*, 26(3): 295-305.
- Tselios, V. (2014). The Granger-causality between income and educational inequality: a spatial cross-regressive VAR framework. *The Annals of Regional Science*, 53(1): 221-249.
- Tseng, M.; Islam, S.; Karia, N.; Fauzi, F.; Afrin, S. (2019). A literature review on green supply chain management: Trends and future challenges. *Resources, Conservation and Recycling*, 141: 145-162.
- Van Oort, F.G.; Bosma, N. (2013). Agglomeration economies inventors and entrepreneurs as engines of European regional economic development. *The Annals of Regional Science*, 51(1): 213-244.
- Vasylytsiv, T.; Mulska, O.; Panchenko, V.; Kohut, M.; Zaychenko, V.; Levytska, O. (2021). Technologization Processes and Social and Economic Growth: Modeling the Impact and Priorities for Strengthening the Technological Competitiveness of the Economy. *Regional Science Inquiry*, XIII, (1): 117-134.
- Vittoria, P.; Lubrano Lavadera, G. (2014). Knowledge networks and dynamic capabilities as the new regional policy milieu. A social network analysis of the Campania biotechnology community in southern Italy. *Entrepreneurship and Regional Development*, 26(7-8): 594-618.
- Lyckner, K.; Thoennessen, R. (2016). Regional club convergence in the EU: evidence from a panel data analysis. *Empirical Economics*, 52(2): 525-553.
- Wagner, M.; Zeileis, A. (2019) Heterogeneity and Spatial Dependence of Regional Growth in the EU: A recursive Partitioning Approach. *German Economic Review*, 20(1): 67-82.
- Webster, L.; Watson, R. (2002) Analyzing the Past to Prepare for the Future: Writing a Literature Review. *Management Information Systems Research Center, University of Minnesota*, 26(2): 13-23.

Weziak-Bialowska, D. (2015). Poverty in the Regions of the European Union – Measurement with a Composite Indicator. 9(2): 113-154.

Widuto, A. (2019). *EPRS, European Parliamentary REsearch Service*. May 2019. [https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/637951/EPRS_BRI\(2019\)637951_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/637951/EPRS_BRI(2019)637951_EN.pdf) (accessed 02 13, 2020).

Zijlstra, H.; McCullough R. (2016). *CiteScore: a new metric to help you track journal performance and make decisions*. <https://www.elsevier.com/connect/editors-update/citescore-a-new-metric-to-help-you-choose-the-right-journal> (accessed 08 25, 2021).