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The European Cohesion Funds Policy in the Regional Science Literature: A Systematic Review

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Abstract

This paper employs a top-down methodological approach to identify the most relevant contributions in the literature on the impact of European Cohesion Policy and European Structural and Investment Funds (ESIFs) on regional development. After a broad-spectrum bibliometric review, identifying the overall structure of research in this field, we systematically narrow its focus to quantitative studies and, ultimately, to econometric analyses of ESIF effectiveness. The results indicate that empirical research on ESIFs has grown in complexity, with increasing reliance on advanced econometric techniques such as spatial econometrics, difference-in-differences, and regression discontinuity designs. While a large portion of the literature finds positive effects on economic growth, employment, and regional convergence, these effects are frequently conditional on governance quality, institutional frameworks, and regional characteristics. In contrast, some studies report insignificant or even negative impacts, highlighting inefficiencies in fund allocation and policy implementation. The findings emphasize the necessity for context-specific policy adaptations, ensuring that ESIFs continue to support the evolving needs of regional economies in the European Union.

Keywords: EU structural funds; regional growth; EU Cohesion Policy; bibliometric analysis

1. Introduction

European Cohesion Policy (ECP) constitutes the European Union's main territorial development policy, aimed at reducing economic, social, and territorial disparities arising from market integration and structural asymmetries across regions. Implemented primarily through the European Structural and Investment Funds (ESIFs), it affects more than one hundred and fifty million citizens across hundreds of regions and accounts for approximately one-third of the EU's Multiannual Financial Framework, making it the largest place-based regional development policy in the world [1].

The international scientific community has shown increasing interest in assessing the impact of European Structural and Investment Funds (ESIFs) on regional development. This interest aligns with the growing financial dimensions of these funds and the evolving significance of the ECP, which, since its consolidation as a formal EU policy framework in the late 1980s, has evolved from a predominantly redistributive mechanism into a more complex, multi-objective investment framework, integrating new strategic objectives, instruments, and funding mechanisms, with an expanding thematic scope and assuming



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an increasingly central role in the EU's development strategy. This evolution has been paralleled by advances in data availability and econometric techniques, enabling more sophisticated analyses of regional impacts.

While many studies have provided valuable insights, there remain opportunities to consolidate findings and explore emerging areas, particularly in aligning evaluation methods with the increasingly multifaceted goals of the ECP. For instance, some quantitative studies on the impact of ESIFs, such as Pinho Varum [2] and Butkus, Mačiulytė-Šniukienė [3], as well as meta-analyses like Dall'Erba and Fang [4], provide traditional bibliometric reviews of econometric studies but do not employ structured search methodologies such as Systematic Literature Review (SLR). Conversely, works like [5,6], which conducted large-scale bibliometric analyses of ECP-related publications (identifying 1255 and 170 studies, respectively), provide valuable insights into the scientific production in this domain. However, these studies neither emphasize the methodologies employed nor focus on the identification and analysis of quantitative approaches in detail.

This paper seeks to address these gaps by conducting a phased “top-down” bibliometric analysis, beginning with a broad-spectrum SLR to identify and characterize scientific studies addressing the ECP in its various dimensions, irrespective of methodology or geographical scope. Subsequently, the focus narrows to quantitative methodologies, culminating in an in-depth analysis of econometric studies evaluating the regional impact of structural funds. The process is further refined to include a more traditional bibliometric review of econometric studies, with the distinct advantage of being firmly grounded in systematic bibliometric review methodology. This layered approach aims to consolidate the state of knowledge, identify critical research gaps, and underscore the policy implications of econometric evaluations, emphasizing the need for continuous assessment and adaptation to ensure that Cohesion Policy effectively addresses the evolving needs of the EU.

By combining a systematic and phased bibliometric approach with a focused synthesis of quantitative and econometric studies—rather than providing a purely descriptive or thematic survey—the paper adds a methodological contribution and explicitly positions econometric impact evaluation within the broader and evolving research landscape on European Cohesion Policy. The paper, thus, provides a structured reference for scholars interested in the quantitative and econometric assessment of European Structural and Investment Funds by consolidating the core set of empirical studies that directly estimate policy impacts using comparable quantitative methods and offering a systematic review of influential contributions in this field.

The paper is structured as follows: Section 2 presents the SLR methodology, detailing the search strategy, inclusion criteria, and data processing. Section 3 describes the descriptive analysis, outlining key publication trends, authorship patterns, and journal distribution. Section 4 provides the results of the bibliometric analysis, identifying major themes, clusters, and evolving research trends on ESIFs. Section 5 reviews econometric studies assessing ESIF impact, summarizing their methodologies, temporal and geographical scope, and key findings. Finally, Section 6 discusses the broader implications of these findings, identifies gaps in the literature, and situates this research within the wider context of European Cohesion Policy studies.

2. The Systematic Literature Review Methodology

The systematic literature review employed in this study aims to provide a structured and transparent approach to identifying, selecting, and analyzing the existing body of research on the European Cohesion Policy (ECP) and its instruments. Given the complexity and breadth of this policy field, the SLR ensures a comprehensive and unbiased assessment of the scientific literature, capturing both the evolution of research themes and method-

ological approaches. This process allows for a more precise identification of knowledge gaps, particularly concerning the impact of ESIFs on regional development. The review follows a multi-step approach, refining the scope from a broad bibliometric analysis to a focused selection of quantitative and econometric studies, ensuring a robust foundation for subsequent empirical investigations. Accordingly, the review focuses on quantitative and econometric studies that estimate the impact of ESIFs on regional outcomes and does not aim to assess qualitative or mixed-method contributions, which address complementary dimensions of cohesion policy beyond the scope of impact evaluation.

2.1. Methodological Approach

Bibliometrics, a term initially suggested by Pritchard in 1969 to replace the term statistical bibliography, is defined by this author as the application of mathematics and statistical methods to books and other media of communication [6]. Bibliometric studies grew exponentially in the 1970s [7], and, since then, the methods and the databases used have allowed the development of sophisticated analysis, solidifying its status as an instrument to measure science's output.

Kitchenham [8] published influential guidelines for conducting systematic literature reviews (SLR) in the domain of software engineering, contributing to the widespread adoption of this methodology. An SLR is a comprehensive analysis of scientific publications with the aim of identifying, reviewing, and characterizing the scientific knowledge published in a particular domain, which, in our case, is the ECP and its strategic instruments. This analysis seeks to identify the evolution and trend of this topic in the specialized journals under analysis, including research focused on the impact of the ECP on the growth and convergence of the European regions. Unlike a traditional literature review, by adopting explicit, replicable, and transparent criteria, SLR allows the selection of relevant articles with strategies that minimize bias and random error [9]. This involves developing a clear research question, defining precise search terms, and systematically searching across multiple academic databases relevant to regional development, economics, and European policy. Through this process, the SLR will critically appraise the relevance of the studies identified, categorize them by methodology, and ultimately present an organized and insightful analysis of the current state of knowledge on ECP's impact on regional development.

The planning and development of the review protocol is a critical step for an SLR. A pre-defined protocol is necessary to reduce the possibility of researcher bias and ensure transparency and replicability of the review process. The protocol should include elements like the background and the research question, the search strategy and terms used, study selection criteria, and procedures for including or excluding a study [8]. By adhering to a pre-defined protocol, researchers can minimize the risk of selectively including or excluding studies based on their findings or preconceptions.

On the basis of a review protocol, a database was built, and then the papers that presented studies based on quantitative empirical analyses were identified. In this way, it was possible to assess the dynamics of research on the subject of the ECP and, in particular, to identify the distinctive characteristics of the subset of studies classified as quantitative in nature.

The definition of a review protocol began with the definition of the research question. The object of the study of the SLR is to identify and characterize the scientific production of the study of the impact of ECP and its main instruments, namely the ESIF, on the regional development of the EU.

Published articles were collected from the two most relevant databases, Scopus and Web of Science (WoS), between 1 and 4 February 2024. To ensure greater rigour and consistency, the search focused on scientific articles published up to 2024 and peer-reviewed,

omitting elements such as conference proceedings, technical reports, and book reviews. The language used was English, since the vast majority of papers have titles and abstracts in this language.

2.2. Research, Data Collection, and Treatment

Bearing in mind the need in this first stage to employ a holistic view that allows for a comprehensive characterization of the literature focused on ECP and capture its dynamics, it became necessary to use search criteria that were focused but, at the same time, broad enough to prevent the exclusion of relevant works.

Thus, the advanced search equation (Figure 1), favoured a wide search spectrum by including keywords associated with cohesion financing while refining the results to the European regional context using terms like “REGIONAL,” “EURO,” or “EU “. The search was limited to peer-reviewed articles in the social sciences and economics domains indexed in Scopus and Web of Science databases. The aim was to identify published studies focused on analyzing the impact of ECP, and particularly European Structural and Investment Funds (ESIFs), on the growth and convergence of the European regions, irrespective of the study’s methodology or geographical scope.

Nishimura, Au-Yong-Oliveira [6] employed a similar methodology but used tighter criteria, with search equations that are focused on structural funds and, simultaneously, on economic development, growth, or impact, which necessarily translates into a significantly smaller number of studies (170, after excluding duplicates). Foglia [5] performs a larger spectrum bibliometric analysis of the scientific literature of European cohesion, focusing on the topic of smart specialization and on the WoS database, obtaining a total of 1246 papers. Both studies use data collected in October 2020. The proposed approach in our work is more complex, involving different stages, analyzing a broad universe of scientific production to subsequently segment and characterize the specific sub-segment of quantitative studies, and, at a later stage, developing a specific analysis of econometric studies on the impact of the ESIF on a regional scale.

Figure 1 illustrates the systematic literature search process. The initial search yielded 1645 articles from Scopus and 1425 from Web of Science. In the second stage, the dataset obtained was cleaned, eliminating duplicates (878 articles) and non-relevant records such as editorials and book reviews (136 articles), totalling 2056 publications. The third stage consisted of screening by reviewing titles and abstracts, considering all publications that address the topic of ECP, and discarding off-topic articles. Studies that do not address any dimension of the cohesion policy, its instruments, or its impacts (1224) were not considered.

In a further effort to enhance the comprehensiveness of the search strategy, the fourth step employed “citation chaining,” also known as “snowballing”. This approach, following guidelines proposed by Wohlin [10], focuses on systematic rather than automatic searching, complementing the initial search with high-quality, relevant papers. This technique identified 25 additional studies that, while not indexed in the Scopus and WoS databases, were deemed highly relevant to the evaluation of the ECP’s impact, particularly the impact of ESIFs on regional development. These studies, primarily working papers and technical reports (grey literature), were widely recognized and cited within the field and demonstrably aligned with the thematic criteria established for the initial search equation. The inclusion of these relevant studies enriched the final database, bringing the total number of records to 857.

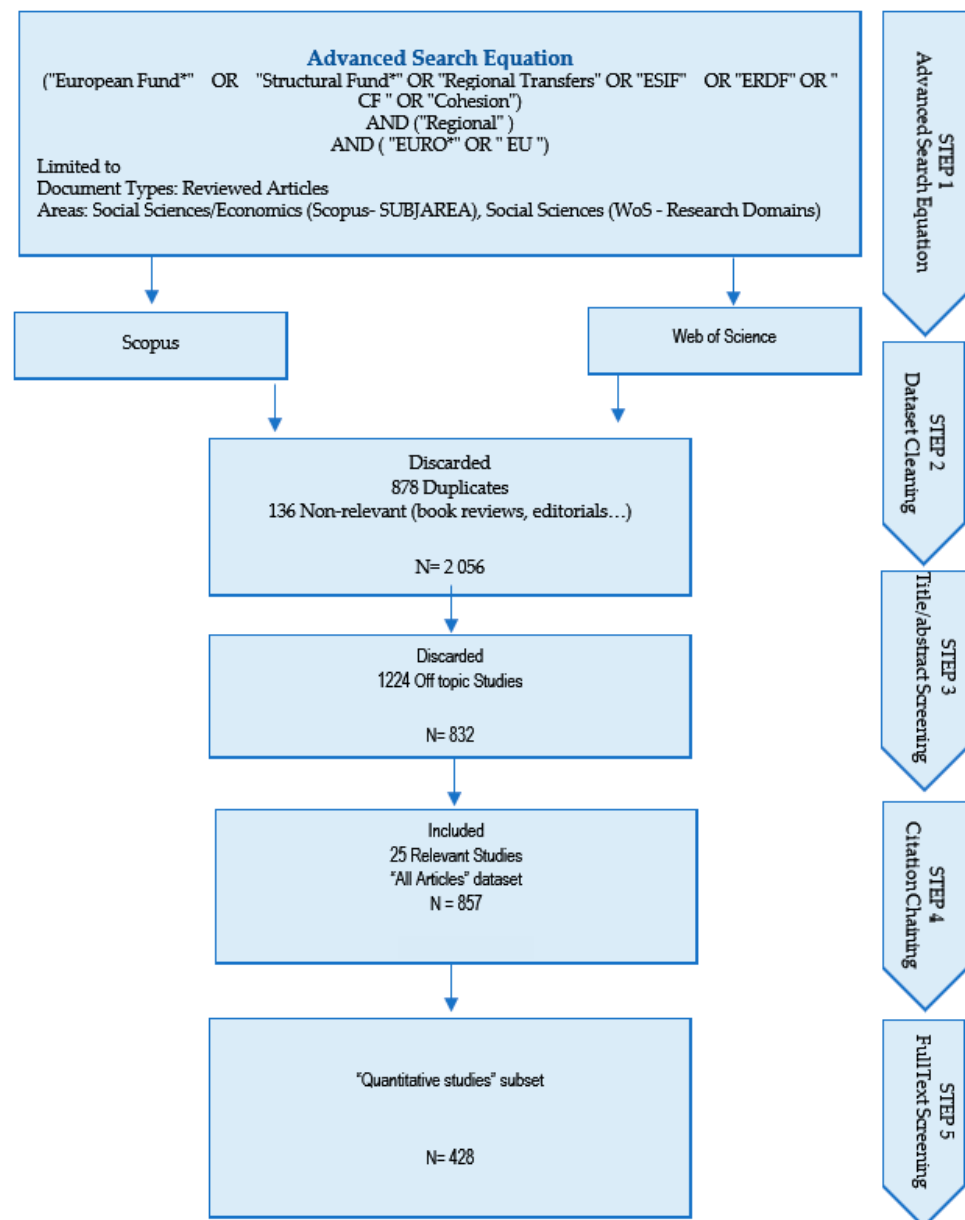


Figure 1. Flow diagram of the steps of the literature search process.

The final stage of the analysis involved classifying the selected articles as “quantitative studies”, defined as those that primarily employ quantitative empirical analysis methods. This encompasses a range of methodologies, including cluster analysis, construction of macroeconomic indices, statistical analysis, general equilibrium models, data envelopment, input-output, fund absorption analysis, and other econometric models. In total, 428 studies, representing 49.24% of the initial pool, were classified as “quantitative studies”.

It is acknowledged that some degree of subjectivity is inherent in classifying studies based on methodology. However, the classification process was guided by a pre-defined set of criteria established during the systematic literature review protocol. This systematic, transparent, and replicable approach minimizes the potential for bias and ensures a robust foundation for further analysis of the quantitative literature subset.

3. Descriptive Analysis

The descriptive analysis examines the evolution of research on ECP and ESIFs by mapping key trends in the scientific production of the field. It highlights the volume of

published studies over time and identifies the academic journals where these works are most frequently disseminated. Additionally, it provides an overview of authorship patterns, including the most prolific contributors and the extent of collaboration within the research community. By structuring these elements, this section contextualizes the bibliometric results and offers insights into the trajectory of academic discussions on cohesion policy.

3.1. Evolution of the Scientific Production on European Cohesion Policy

Research on the ECP emerged in the wake of the Single European Act (SEA) of 1986, which formally established regional policy as a competence of the European Community and inscribed social and economic cohesion as an objective. Since then, there has been a substantial increase in published articles, with 64 identified in 2023 and 2022 alone, representing an average of 5.5 articles per month.

The production of quantitative studies on the ECP's impact exhibits a similar pattern, with a delayed start. While the first quantitative studies appeared around 1995, their share of total ECP research has grown steadily. In the first decade of the 21st century, they constituted around 30.4% of identified research. This figure (Figure 2) has climbed to an average of 61.3% in the past ten years (2014–2023), even reaching 70.3% in 2023.

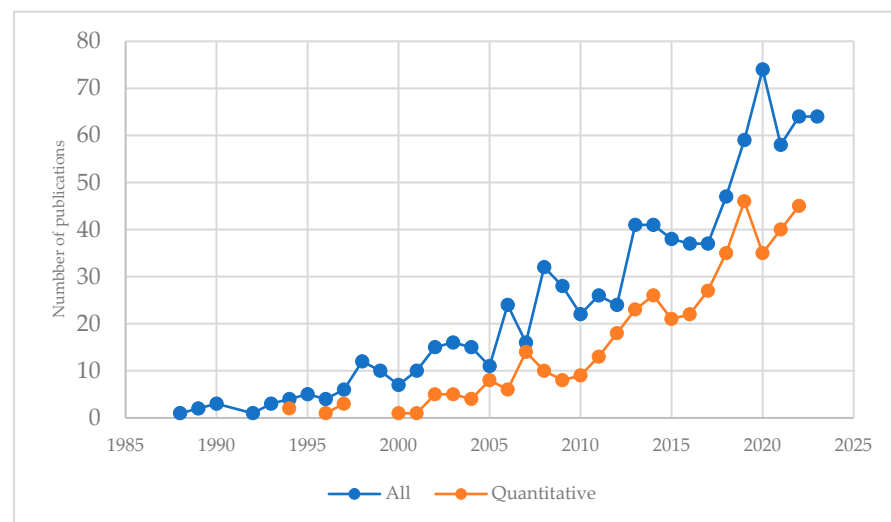


Figure 2. Evolution of published articles on European Cohesion Policy.

3.2. Journals with the Highest Scientific Production

Table 1 presents a summary of journals with the highest number of studies referenced. Among the 857 analyzed documents of the “All articles” dataset, 363 journals were used for dissemination. Regional Studies (Citescore 2022: 9) stands out with 88 publications, followed by European Planning Studies (Citescore 2022: 7) with 53 and Investigaciones Regionales (Citescore 2022: 1.8) with 24. This concentration, representing 18.9% of total publications, suggests a potential dominance of these journals within the field.

The analysis of the 428 “quantitative” studies, published in 206 different journals, reveals similar leadership by Regional Studies, European Planning Studies, and Investigaciones Regionales, with 55, 19, and 17 published articles, respectively. This consistency reinforces the dominance of these journals across different research approaches within ECP research. However, the share of the total articles published in these three journals, at 10.6%, is lower when compared with the complete dataset of articles.

Table 1. Journals with the highest scientific production.

No.	All Journal	Studies	Quantitative Journal	Studies
1	Regional Studies	85	Regional Studies	55
2	European Planning Studies	53	European Planning Studies	19
3	Investigaciones Regionales	24	Investigaciones Regionales	17
4	European Urban and Regional Studies	17	Papers in Regional Science	14
5	Sustainability (Switzerland)	16	Journal of Regional Science	10
6	Regional and Federal Studies	15	Sustainability (Switzerland)	10
7	Papers in Regional Science	15	Journal of Common Market Studies	8
8	Journal of Common Market Studies	13	Socio-Economic Planning Sciences	6
9	Journal of Regional Science	10	Regional Science and Urban Economics	5
10	European Environment	10	-	-

3.3. Authors with the Highest Scientific Production

The 857 studies were written by 1455 different authors (Table 2), with Andrés Rodríguez-Pose, Ricardo Crescenzi, and Mindaugas Butkus presenting the highest number of publications. In the subset of data related to the 428 quantitative studies, the panorama does not change substantially. The list of authors with the highest published scientific production is similar.

Table 2. Authors with the highest scientific production.

No.	All Author	Studies	Quantitative Author	Studies
1	Rodríguez-Pose, A.	12	Rodríguez-Pose, A.	11
2	Crescenzi, R.	10	Butkus, M.	9
3	Butkus, M.	9	Maciulyte-Sniukiene, A.	9
4	Fratesi, U.	9	Pellegrini, G.	9
5	Maciulyte-Sniukiene, A.	9	Crescenzi, R.	8
6	Pellegrini, G.	9	Fratesi, U.	8
7	Bachtler, J.	8	Matuzevičiute, K.	8
8	Dąbrowski, M.	8	Arbolino, R.	7
9	Dall'erba, S.	8	Cardenete, M. A.	7
10	Giua, M.	8	Dall'erba, S.	7
11	Matuzevičiute, K.	8	De Blasio, G.	7
12	Arbolino, R.	7	Di Caro, P.	7
13	Barbero, J.	7	Giua, M.	7
14	Cardenete, M. A.	7	Barbero, J.	6
15	De Blasio, G.	7	Cerqua, A.	6
16	Di Caro, P.	7	Gallo, J. L.	6

The analysis of authorship patterns in Table 3 reveals interesting trends: 32% of the articles are written by a single author, while 67.8% involve collaboration between two or more authors (30.7% with two authors and 24.5% with three authors). A comparison with the subset of data for quantitative studies (428 studies) reveals a potentially significant difference. The weight of single-authored articles drops to 20.6% in quantitative studies, suggesting a higher degree of collaboration within quantitative research in ECP.

Table 3. Number of authors per article.

Number of Authors	All		Quantitative	
	Number of Studies	%	Number of Studies	%
1	274	32.0%	88	20.6%
2	263	30.7%	127	29.7%
3	210	24.5%	143	33.4%
4	74	8.6%	47	11.0%
5 and above	36	4.2%	23	5.4%

4. Bibliometric Analysis

The articles database was processed in VosViewer version 1.6.18, an open-source tool for visualizing and analyzing scientific literature and producing bibliometric visualizations, developed by the Centre for Science and Technology Studies (CWTS) at Leiden University. The analysis focused both on all 857 articles identified and on the subset of 428 quantitative articles to build maps based on keywords and terms extracted from titles and abstracts, based on co-occurrence data. VosViewer clusters related topics and fields, assisting in discerning and analyzing intricate relationships among key concepts and research hotspots and identifying core issues and concepts. Items, like keywords or terms, are connected with links, and clusters are sets of grouped items where one item cannot belong to more than one cluster.

4.1. Keywords Co-Occurrence

A co-occurrence analysis was conducted in VosViewer using the keywords extracted from the published articles and generating co-occurrence maps. These maps helped us identify and characterize thematic clusters within the research. This analysis was performed for both the entire dataset of articles (all articles) and the subset focusing on quantitative research (quantitative articles).

4.1.1. All Articles

The co-occurrence map of keywords for all 857 identified ECP articles was generated in VosViewer, setting a minimum threshold of five occurrences per keyword. This resulted in 230 out of 2295 keywords meeting the criteria, and eight clusters being identified, as shown in Figure 3.

This co-occurrence map provides a comprehensive visual representation of the key topics and their relationships within the literature on the European Cohesion Policy and European Structural Funds, complementing the thematic organization of the keyword clusters. We can observe that the central and most prominent terms are, unsurprisingly, “European Union”, “regional policy”, “cohesion policy”, “Europe”, and “structural funds,” indicating that these are the core concepts discussed in the literature and closely related terms include “regional growth,” “economic growth,” “regional development,” and “convergence,” aligned with the objectives and instruments of the ECP. Terms such as “innovation,” “investment,” “employment,” “governance,” and “environment” are also clearly visible, suggesting that these themes are frequently explored in the context of the ECP’s impact on various aspects of regional development. The presence of terms like “Southern Europe,” “Eastern Europe,” “Western Europe,” and “the Czech Republic” indicates that a significant portion of the literature covers or emphasizes different geographical regions within Europe. Other terms like “evaluation,” “impact,” “assessment,” and “numerical model” reflect the literature’s focus on studies evaluating and modelling the impact of the ECP and its instruments.

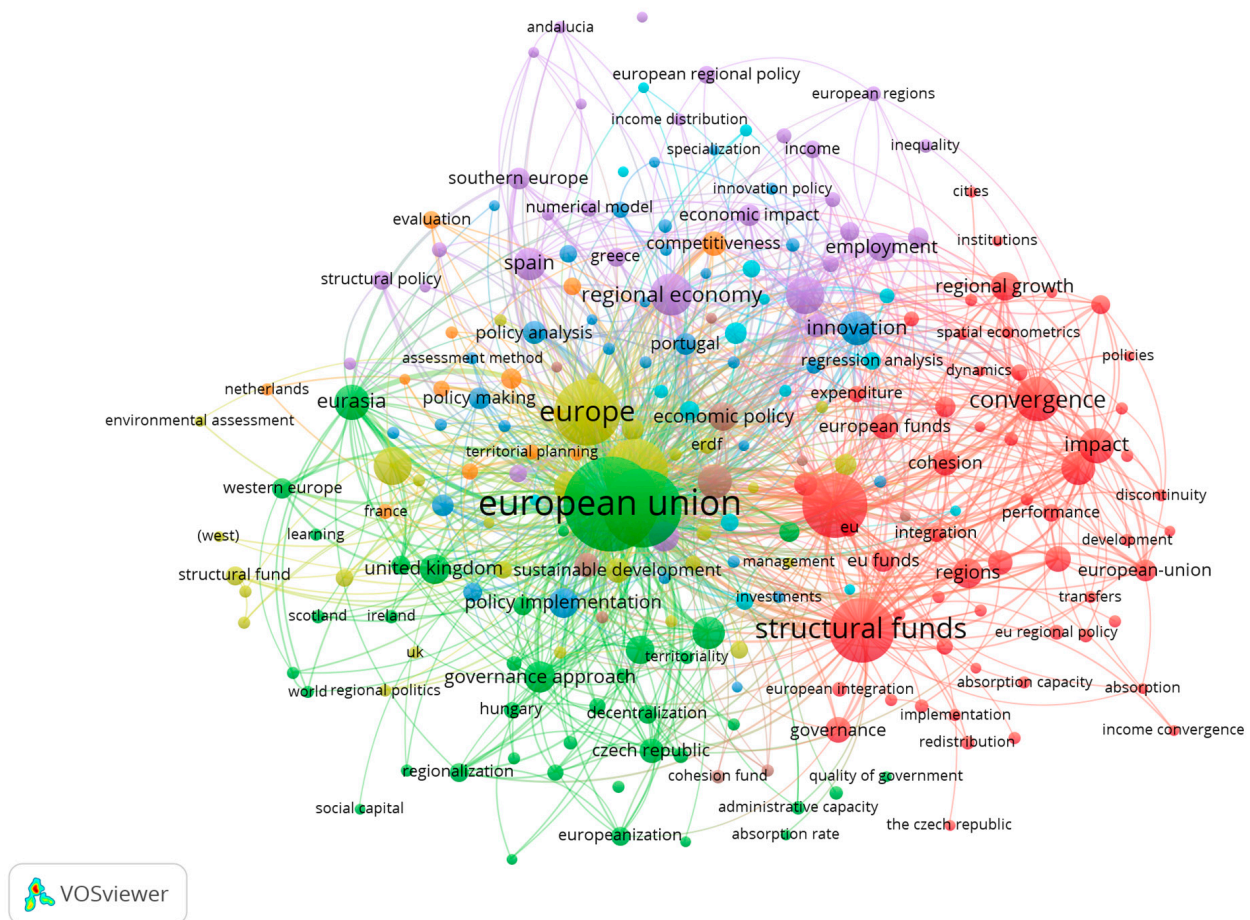


Figure 3. Co-occurrence map of keywords (Network Visualization): all articles. Note: Node colours represent keyword clusters identified by VosViewer’s clustering algorithm; the definition and composition of each cluster are reported in Table 4. Node size is proportional to keyword frequency, and links indicate co-occurrence relationships (with thicker links denoting stronger co-occurrence).

By comparing the co-occurrence map with the keyword clusters in Table 4, we can see that the clusters effectively capture the diverse themes and concepts present in the literature. Analyzing the keywords within each of the 8 clusters reveals the dominant thematic spectra of the published literature on ECP. This analysis provides a comprehensive overview of the research themes in cohesion policy, highlighting its multifaceted approach and its objectives in terms of territorial cohesion and reducing regional disparities. In Table 4, it is possible to find the list of keywords by cluster. Designations have been assigned to each of these clusters to capture their “thematic identity.” This comprehensive analysis of keyword clusters provides valuable insights into the diverse research themes and focus areas within the literature, reflecting its multidimensional nature.

Each cluster represents a distinct but interconnected aspect of ECP, reflecting the breadth of academic inquiry in this field. The first cluster, **Core Concepts of ECP**, encompasses the fundamental themes and terminologies central to understanding the policy. It covers aspects such as allocation, governance, economic growth, and regional development, with a strong focus on the impact and implementation of structural funds. It highlights discussions on how structural funds contribute to regional growth, convergence, and overall impact, with key terms suggesting an emphasis on measuring outcomes and the practical aspects of policy implementation.

Table 4. List of keywords per cluster: all articles.

Cluster	Keywords
1—Core Concepts of ECP	absorption; absorption capacity; agglomeration; allocation; cities; cohesion; cohesion policy; competition; convergence; development; discontinuity; disparities; dynamics; economic geography; economic-growth; efficiency; EU; EU funds; European integration; European structural funds; European union regional policy; European-union; euroscepticism; expenditure; funds; governance; government; growth; impact; implementation; income convergence; indicators; infrastructure; institutional quality; institutions; integration; model; panel data; performance; policy; politics; redistribution; region; regional disparities; regional economic growth; regional growth; regions; spatial econometrics; spillovers; structural and cohesion funds; structural funds; the Czech Republic; transfers; union; EU regional policy; European funds; policies; productivity.
2—Governance and Implementation of ECP	absorption rate; administrative capacity; administrative framework; brexit; Bulgaria; central Europe; Czech Republic; decentralization; Eastern hemisphere; EU cohesion policy; EU structural funds; Eurasia; European Union; European Union cohesion policy; europeanisation; europeanization; financial policy; governance approach; Hungary; institutional framework; Ireland; learning; multi-level governance; multilevel governance; partnership; partnership approach; Poland; political economy; quality of government; regional policies; regional policy; regionalism; regionalization; Scotland; social capital; structural change; territoriality; United Kingdom; Western Europe; world.
3—Economic Development Strategies in ECP	assessment method; cost–benefit analysis; decision making; development strategy; eastern Europe; economics; entrepreneurship; estimation method; financial crisis; industrial policy; innovation; innovation policy; investment; modelling; peripheral region; policy analysis; policy implementation; policy making; policy strategy; Portugal; public policy; public sector; research and development; resilience; smart specialization; smart specialization; specialization; stakeholder; strategic approach; technological development; technology policy; tourism; transport infrastructure.
4—Funding instruments and sustainability	cluster analysis; data envelopment analysis; economic development; environmental assessment; ERDF; Europe; Europe, (west); European cohesion policy; European Community; European regional dev. fund; European social fund; European structural and inv.funds; financial provision; management; policy approach; regional development; regional planning; regional politics; renewable energy; resource allocation; Romania; small and medium-sized enterprise; SMES; structural adjustment; structural fund; sustainability; sustainable development; UK; urban development; west.
5—Economic Impact of ECP	Andalucia; econometrics; economic growth; economic impact; economic planning; empirical analysis; employment; European commission; European regional policy; European regions; finance; general equilibrium analysis; Greece; gross domestic product; heterogeneity; human capital; income; income distribution; inequality; Italy; numerical model; policy development; regional convergence; regional economy; social accounting matrix; Southern Europe; Spain; spillover effect; structural policy; unemployment.
6—Rural Transformation, Labour Markets, and ECP	capital; common agricultural policy; comparative study; labour market; local government; migration; policy impact; policy reform; public spending; regression analysis; regression discontinuity design; rural area; rural development; rural policy; Slovakia; spatial analysis.
7—Cross-Border Cooperation and Territorial Development	border region; competitiveness; cross-border cooperation; evaluation; France; Germany; Interreg; Netherlands; Poland [central Europe]; socioeconomic conditions; territorial cohesion; territorial management; territorial planning.
8—Infrastructure Investment and Economic Growth in ECP	cohesion fund; economic activity; economic integration; economic policy; European regional dev. fund (ERDF); investments; spatial distribution; subsidies; total factor productivity; transportation infrastructure.

Closely linked to these foundational concepts is the second cluster, **Governance and Implementation of ECP**, which examines the governance structures and implementation

processes of ECP. It highlights administrative capacities, decentralization, partnership approaches, and institutional frameworks, reflecting discussions on the effectiveness and efficiency of policy implementation.

The third thematic area, **Economic Development Strategies in ECP**, focuses on various strategies and approaches to economic development within the framework of ECP, involving themes such as innovation policy, economic resilience, and regional development strategies. It focuses on economic growth, convergence processes, and strategies for promoting balanced regional development, including the reduction in regional disparities.

A crucial dimension of ECP research is addressed in the fourth cluster, **Funding Instruments and Sustainability**, which examines the evaluation of funding instruments and sustainability measures within ECP. This includes the allocation of funds and their impact on various socio-economic indicators, such as structural funds, impact evaluation, and regional performance indicators. A strong emphasis is placed on methodologies aimed at assessing policy effectiveness.

Complementing this financial perspective, the fifth cluster, **Economic Impact of ECP**, analyses the economic outcomes and impacts of ECP in relation to its core objectives. It includes topics such as economic growth, labour market effects, income distribution, and regional development, with a particular focus on the reduction in disparities among regions, a fundamental goal of the policy.

Rural Transformation, Labour Markets, and ECP constitute the core of the sixth cluster, focusing on rural transformation, labour market policies, and the related impacts of ECP. This cluster covers policy instruments, rural development, labour market dynamics, and human capital formation, which are essential components of regional development strategies. It also highlights the use of regression discontinuity design and spatial analysis, suggesting that empirical studies in this area frequently employ these techniques to assess policy impact.

Beyond national borders, the seventh cluster, **Cross-Border Cooperation and Territorial Development**, focuses on cross-border cooperation and territorial development within the ECP framework. It emphasizes themes such as regional cohesion, border regions, and territorial governance, reflecting their importance in the programmatic objectives of ECP.

Finally, the eighth cluster, **Infrastructure Investment and Economic Growth in ECP**, examines the impact of investments in transportation and economic infrastructure on regional development, including the contributions of funding mechanisms such as the Cohesion Fund and the ERDF. It also focuses on their role in fostering economic growth within ECP and includes aspects related to economic policy, infrastructure development, and spatial distribution.

4.1.2. Quantitative Articles

Examining the 428 articles classified as “Quantitative”, we observe a distinct thematic specialization profile, as expected. 133 keywords out of 1376 met the 5-occurrence threshold. Figure 3 visualizes the 6 identified clusters and their relationships. As expected, this sub-dataset map is more focused on econometric analysis, governance effectiveness, and spatial econometrics, indicating a more targeted investigation into policy impacts.

In Figure 4, the central and most prominent terms are “European Union”, “regional policy”, “cohesion policy”, “Europe”, and “structural funds”, indicating that these are the core concepts extensively discussed in quantitative studies and closely align with the major keywords of the “all articles” dataset.

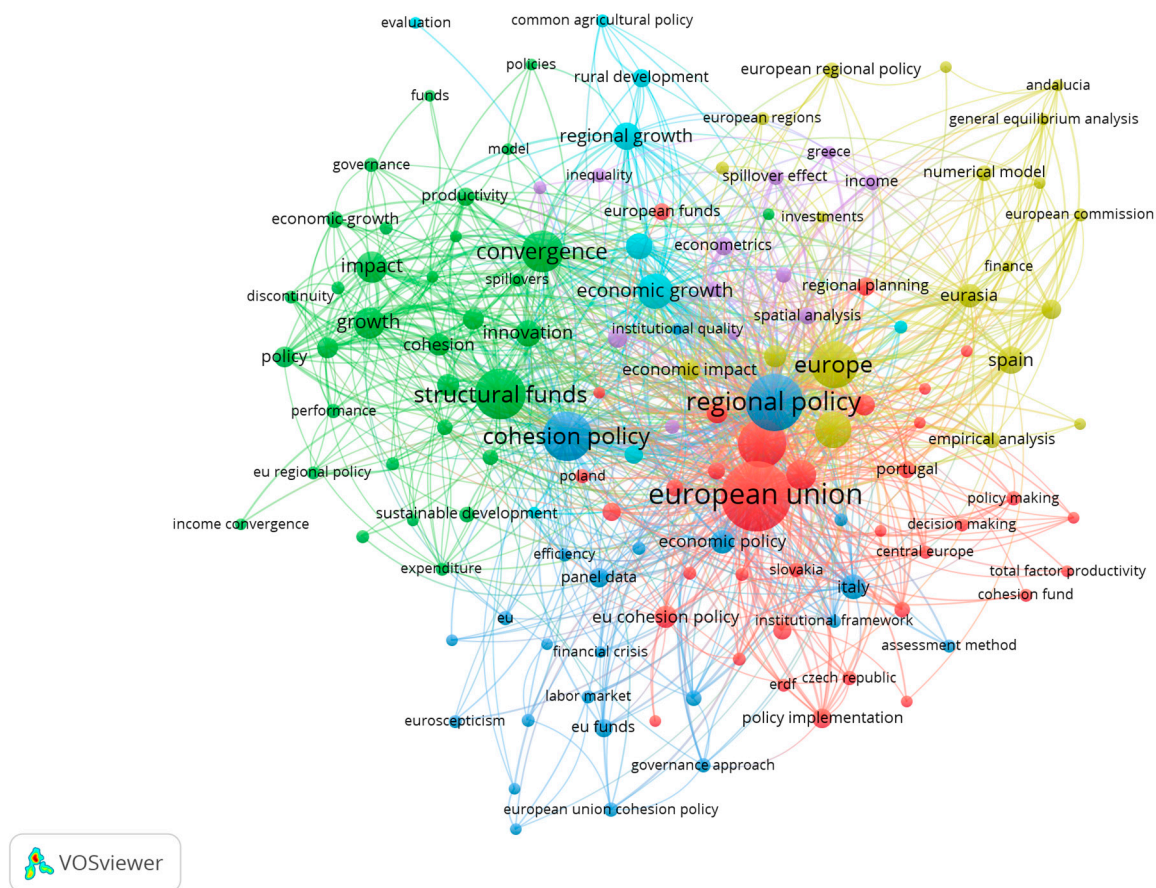


Figure 4. Co-occurrence map of keywords (Network Visualization): quantitative articles. Note: node colours represent keyword clusters identified by VosViewer’s clustering algorithm; the definition and composition of each cluster are reported in Table 5. Node size is proportional to keyword frequency, and links indicate co-occurrence relationships (with thicker links denoting stronger co-occurrence).

Additional terms like “innovation,” “productivity,” “employment,” “economic impact,” “labour market,” and “governance” are also highly emphasized, suggesting that these themes are frequently analyzed in the context of the ECP’s impact on various aspects of regional development.

Other terms such as “evaluation,” “impact,” “assessment”, “efficiency”, “performance”, and “numerical model” reflect the quantitative nature of these studies, emphasizing the evaluation and modelling of the ECP’s impacts. The presence of “panel data”, “regression analysis”, “econometrics,” “spatial analysis”, and “empirical analysis” further underscores the methodological approaches prevalent in quantitative research on this topic.

The map also highlights specific geographical regions, with terms like “Southern Europe,” “Central Europe,” “Eastern Europe,” “Spain,” and “Poland” indicating a focus on different areas within Europe.

Table 5 identifies the keywords that comprise each of the 6 clusters, along with the designation that seeks to identify the thematic identity of each cluster. The clusters in the subset of quantitative studies prioritize specific thematic areas within cohesion policy, particularly related to econometric, statistical, and spatial methodologies, potentially reflecting a greater concentration of research in these specific areas compared to the broader themes of the entire dataset. By focusing on specific aspects, this subset does not directly address themes such as regionalization, European integration, territorial cooperation, and cities, which are covered in the broader dataset.

Table 5. List of keywords per cluster: quantitative articles.

Cluster	Keywords
1—Economic Convergence and Cohesion Policy	Central Europe; cohesion fund; competitiveness; Czech Republic; data envelopment analysis; decision making; economic activity; economic development; economic integration; ERDF; EU cohesion policy; European cohesion policy; European funds; European regional dev. fund (ERDF); European struct. and inv. funds; European Union; Hungary; investment; Poland; Poland [Central Europe]; policy analysis; policy implementation; policy making; Portugal; regional convergence; regional development; regional planning; Romania; Slovakia; spatial distribution; structural change; sustainability; territorial cohesion; total factor productivity; transport infrastructure.
2—Impact of Cohesion Funds on Regional Growth	agglomeration; allocation; cohesion; convergence; discontinuity; economic geography; economic-growth; EU regional policy; EU structural funds; European-Union; expenditure; funds; governance; government; growth; impact; income convergence; infrastructure; innovation; integration; model; performance; policies; policy; productivity; regional disparities; regional economic growth; regions; spillovers; structural and cohesion funds; structural funds; sustainable development; union.
3—Governance, Institutions, and Cohesion Policy Effectiveness	absorption capacity; administrative capacity; assessment method; brexit; cohesion policy; decentralization; economic policy; efficiency; EU; EU funds; European Union cohesion policy; euroscepticism; financial crisis; governance approach; institutional framework; institutional quality; Italy; labour market; modelling panel data; public spending; quality of government; regional policy; United Kingdom.
4—Econometric Analysis of Cohesion Policy Impacts	Andalucía; economic impact; empirical analysis; Eurasia; Europe; European Commission; European regional policy; European regions; finance; general equilibrium analysis; gross domestic product; investments; numerical model; regional economy; smart specialization; social accounting matrix; southern Europe; Spain; structural policy; transportation infrastructure.
5—Spatial Econometrics and Cohesion Policy	econometrics; estimation method; European structural funds; Greece; heterogeneity; human capital; income; income distribution; inequality; spatial analysis; spatial econometrics; spillover effect.
6—Rural Transformation, Labour Markets, and ECP	common agricultural policy; economic growth; employment; evaluation; policy impact; regional growth; regression analysis; regression discontinuity design; rural development.

The first cluster, **Economic Convergence and Cohesion Policy**, addresses the fundamental aspects and outcomes of economic convergence within the framework of ECP. It focuses on how ECP contributes to economic activity, regional development, and overall cohesion. Prominent within this cluster are studies examining regions and countries that are significant recipients of cohesion funds, emphasizing their role and experiences in the implementation of ECP. Key themes include the impact of ECP on economic growth, regional convergence, and the effectiveness of structural funds.

Closely related to this is the second cluster, **Impact of Cohesion Funds on Regional Growth**, which explores the specific effects of cohesion funds on regional economic growth. Research in this area highlights questions of fund allocation, expenditure efficiency, and their overall effectiveness in fostering regional development. Keywords such as “model,” “convergence,” “performance,” “spillovers,” and “discontinuity” suggest a strong presence of econometric impact analyses aimed at quantifying the effects of ECP interventions.

The third cluster, **Governance, Institutions, and Cohesion Policy Effectiveness**, shifts focus to the governance mechanisms, institutional quality, and overall effectiveness of cohesion policies. It highlights the role of administrative capacity, policy implementation, and institutional frameworks in determining policy outcomes. Modelling, panel data, and

assessment method keywords reinforce the quantitative nature of the literature present in this cluster.

A more technical dimension of ECP research is found in the fourth cluster, **Econometric Analysis of Cohesion Policy Impacts**, which delves into the econometric and empirical analyses of the impacts of cohesion policies. It addresses various quantitative methods to assess the economic outcomes, policy effectiveness, and regional impacts of the ECP.

The fifth cluster, **Spatial Econometrics and Cohesion Policy**, concentrates on the role of spatial econometric methods in analyzing the impact of cohesion policy. Contains keywords related to spatial econometric methods and the analysis of the impacts of cohesion policy. It points to quantitative studies focused on how spatial factors, spillover effects, and others influence policy outcomes and regional development.

Finally, the sixth cluster, **Cohesion Policy and Rural Development**: Impact on employment and growth, focuses on the specific role of cohesion policy in rural development, employment, and economic growth, as well as econometric studies based on regression discontinuity models. It emphasizes the role of policy in promoting rural development and promoting inclusive economic development.

4.2. Title and Abstract Terms Co-Occurrence

Given the complexity of ECP research, a multi-dimensional approach is crucial. Keywords reflect, necessarily, a narrower analysis and depend on a more subjective classification process. Therefore, a co-occurrence analysis of terms taken from the titles and the abstracts of the selected articles allows for a more comprehensive capture of the key thematic areas within the research. The VosViewer map chosen was Overlay Visualization, similar to the Network Visualization used in Figures 2 and 3, but colouring the items differently, using the variable year of publication. This is particularly helpful, considering the large volume of terms extracted.

4.2.1. All Articles

For the 857 identified ECP studies, VosViewer was used to create co-occurrence maps of terms taken from the titles and abstracts of the publications. The minimum threshold for a term's occurrence was set to 10, which determined the eligibility of 535 out of 12,805 terms. For each of these terms, a relevance score was determined, and 60% of the most relevant terms were selected, resulting in 321 terms. Figure 4 depicts the Overlay Visualization, which highlights the time dimension alongside thematic clusters. This can be particularly useful in revealing how research focus has evolved over time within the field of ECP. Terms are coloured based on their publication year, providing a visual indicator that mimics a temporal lens, providing insights into the evolving research focus and how thematic prominence has shifted over time.

The analysis of this map reveals an interesting evolution in research focus. Older publications' terms (dark blue) like "Programme," "Europeanization," "Partnership," and "Brussels" focus on the frameworks and governance structures for cohesion policy, involving foundational principles and early implementation challenges.

Intermediate publications (light blue to green) reveal a shift towards evaluating the economic impacts of cohesion policies. These studies increasingly focus on terms related to the measurement of the effectiveness in promoting economic growth and regional development, such as "economic growth", "regional convergence", "disparity", "expenditure", or "productivity".

More recent publications (yellow) depict the emergence of terms focused on new and more complex challenges for ECP, like R&D, "innovation policy", "quality", "health",

and, inevitably, “crisis” and “resilience”, reflecting a growing emphasis on quantifying the impact of ECP on more dimensions beyond the traditional growth and convergence themes.

It is observable an increased emphasis on empirical analysis, econometric methods, and spatial analysis, reflecting a trend towards rigorous quantitative research. Recent publications highlight specific terms like “absorption”, “NUTS”, “policy efficiency”, “index”, and “data envelopment analysis”, indicating some predominance of analytical studies using more sophisticated quantitative methods to evaluate specific policy outcomes.

4.2.2. Quantitative Articles

Mirroring the analysis conducted for all articles, we employed the same methodology to explore the thematic landscape of the 428 quantitative studies. A minimum threshold of 10 occurrences per keyword in titles and abstracts was also applied, resulting in the identification of 264 terms out of 6789. After filtering for the top 60% most relevant, 158 terms were selected. Figure 5 shows the corresponding Overlay Visualization map, and as expected, a stronger emphasis on terminology related to empirical methodologies is exhibited, revealing a clear evolution in the focus of quantitative ECP research.

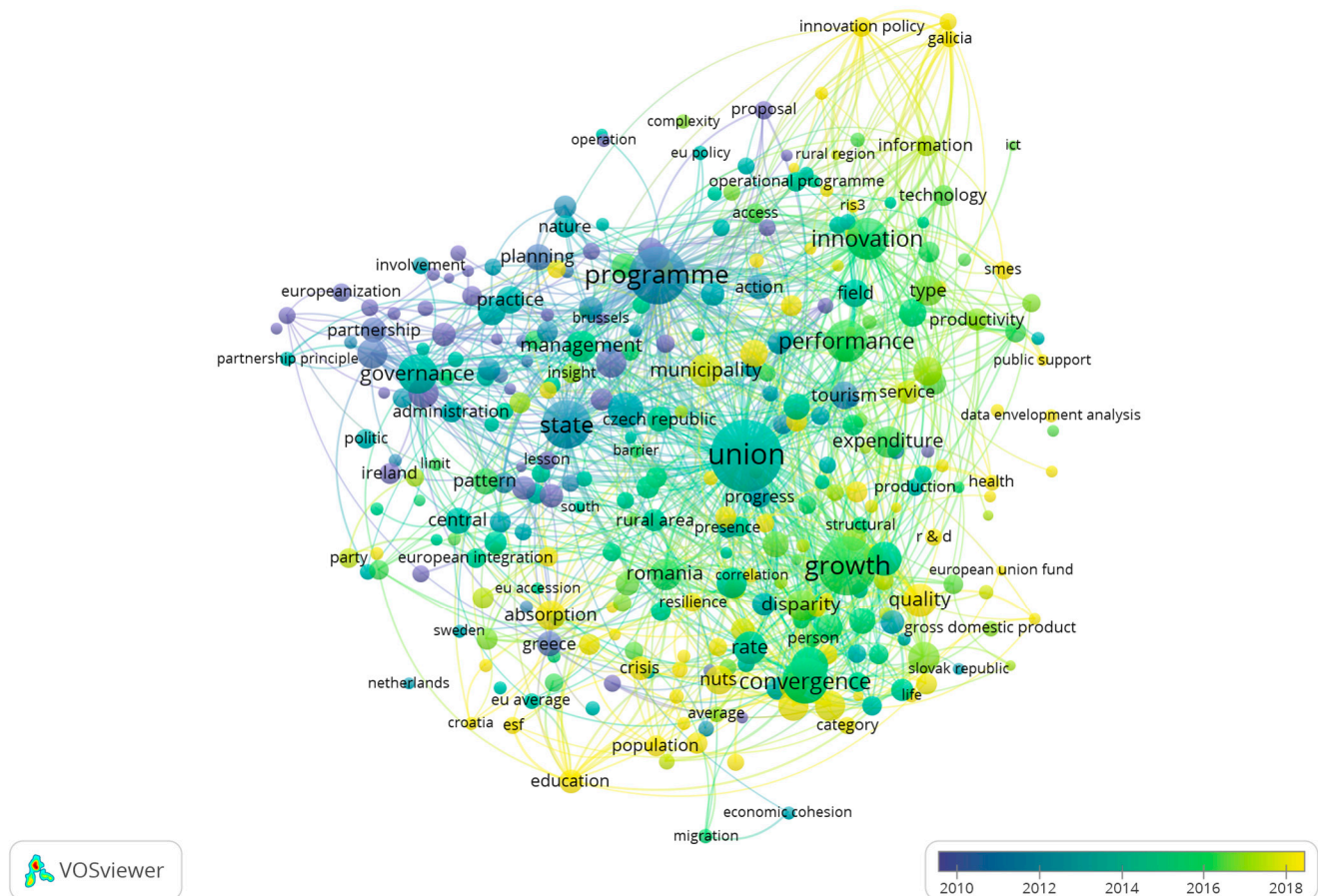


Figure 5. Co-occurrence map (Overlay Visualization) of terms (title and abstract): all articles.

Earlier terms (dark blue), such as “Europe”, “State”, “estimation”, “regional development”, “production”, and “regional inequality” were more prominent, pointing towards a foundational emphasis on the quantitative approaches, reflecting the data limitations of the time and initial research focused on establishing frameworks and theoretical models.

Intermediate publications (light blue to green) comprise terms like “empirical evidence”, “programme”, “indicator”, “intensity”, “productivity”, “institutional quality”,

governance, “performance”, “cluster”, indicating a shift towards a growing sophistication in the quantitative methods used to assess the impact of ECP.

Recent research trends (yellow) include “quality”, “absorption”, “firm”, “population”, “R&D”, “developed region”, “crisis”, “resilience”, “payment”, and “data envelopment analysis”, reflecting a growing interest in the qualitative aspects of regional development and policy impact and, at the same time, a focus on resilience against economic shocks.

4.3. Title and Abstract Terms Word Cloud

A simple word cloud technique using the terms extracted from the titles and abstracts of the selected literature, without clustering and networking techniques applied, can also be helpful in providing a bird's-eye view of the emphasis present in both datasets, all articles and quantitative articles. By comparing these word clouds (Figure 6), it is possible to discern some basic differences and similarities in the themes covered in the overall literature selected versus those specifically addressed by quantitative studies. Overall, both word clouds prominently feature terms such as “regional”, “policy”, “cohesion”, “funds”, “development”, “impact”, “growth”, “economic”, “structural”, “support”, and “regions”.

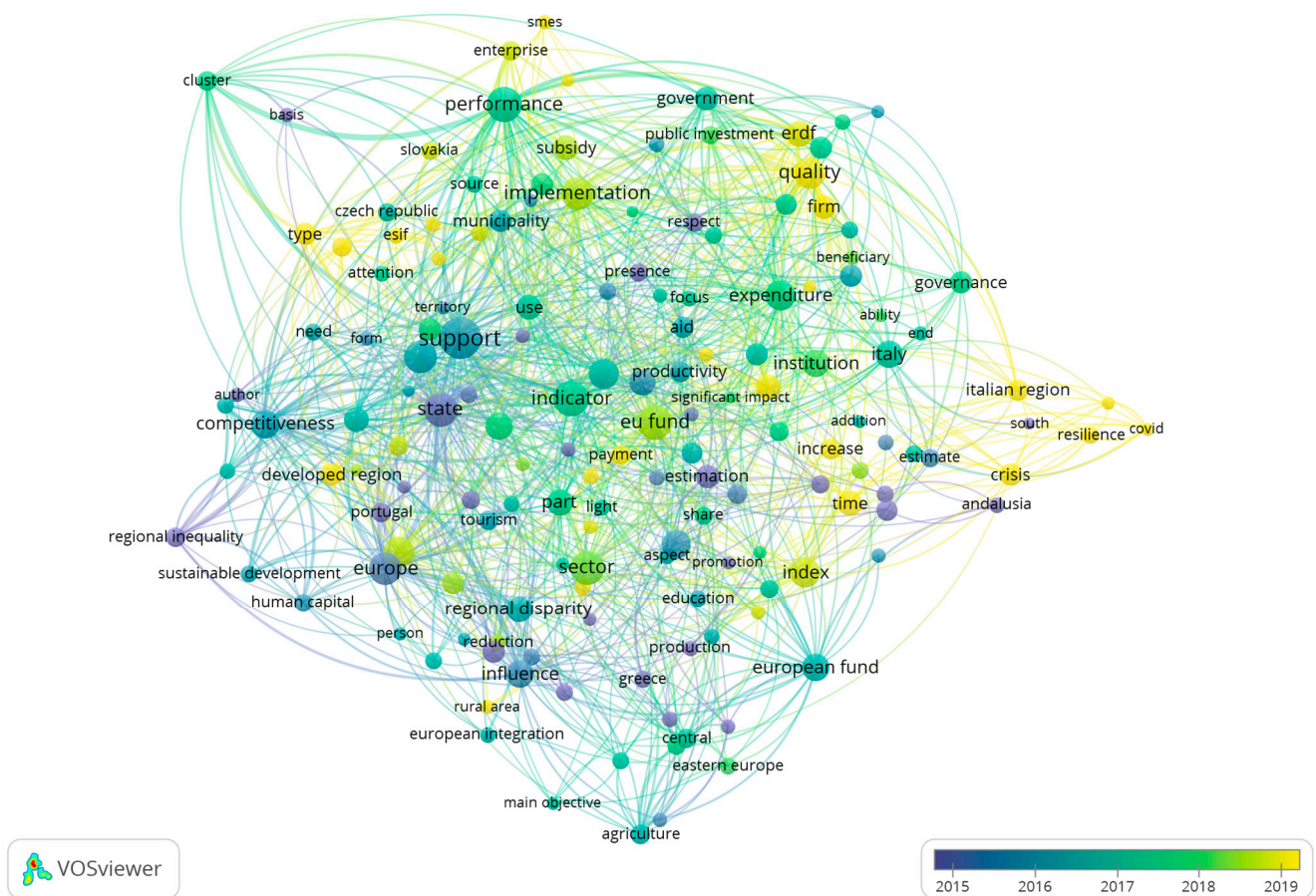


Figure 6. Co-occurrence map (Overlay Visualization) of terms (title and abstract): quantitative articles.

The green word cloud (Figure 7a), representing the terms for all articles, shows a broader range of terms. Key terms include “governance”, “national”, “funding”, “local”, “social”, “territorial”, “union”, “objective”, “policies”, and “evaluation.” This suggests a comprehensive exploration of ECP, covering various dimensions such as governance structures, social impact, territorial cohesion, and policy evaluation.



Figure 7. (a) Word cloud of terms—all articles; (b) word cloud of terms—quantitative articles.

The blue word cloud represents the terms contained in quantitative articles (Figure 7b) and, when compared with the green cloud (all articles), emphasizes terms like “data”, “spatial”, “effect”, “effectiveness”, “results”, “performance”, “model”, and “evaluation”. This indicates a concentration on empirical data analysis and modelling to assess the economic impacts of cohesion policies. Terms such as “panel”, “effect”, “spatial”, and “evaluation” highlight the methodological rigour and focus on quantitative assessments.

4.4. Brief Conclusions

Summing up, broader literature includes a diverse range of topics, reflecting a holistic approach to understanding ECP. In contrast, the quantitative subset is more focused on specific empirical and econometric analyses, suggesting a more detailed investigation into the effectiveness and impact of cohesion policies using statistical and modelling techniques.

All in all, these systematic analyses of co-occurrence maps have revealed a multifaceted landscape of research on the impact of the ESIFs. While all four maps (covering keywords and titles/abstracts for both all articles and quantitative studies) identified core themes like regional development, convergence, programme design, and evaluation, some key distinctions emerged.

Maps focusing on all studies (Figures 3 and 5) highlighted a broader range of thematic areas, including disparities, sustainability, territoriality, and European integration, among others. The analyses of quantitative studies (Figures 4 and 6) revealed a more concentrated focus on methodological aspects and a more detailed analysis. Here, clusters emerged around programme design and expenditure, firm-level performance evaluation, and the quantitative assessment of regional development impacts. These findings suggest that quantitative research delves deeper into the technical aspects of ESIF implementation and intervention effectiveness.

The word cloud (Figure 7) depicts an overview of an exploration of thematic across different analysis types aligned with the cluster techniques, painting a comprehensive picture of ESIF research. Overall, we believe this work highlights the multifaceted nature of the field, encompassing diverse research questions and methodologies, and helps understand the evolution from foundational research to more sophisticated, empirical

evaluations, reflecting the maturation of the literature studying European Cohesion Policy and the impact of structural funds.

5. Econometric Studies on ESIF Impact

Section 5 reviews econometric evidence on the impact of European Structural and Investment Funds on regional development. The central message emerging from this literature is not merely that findings are mixed, but that estimated effects vary systematically with context and research design. Divergence across studies is commonly linked to differences in institutional quality and administrative capacity, regional economic structure and initial conditions, spatial scale and data aggregation, and identification strategies used to address policy endogeneity. These dimensions provide a coherent lens through which the heterogeneity documented in Table 6 can be interpreted rather than treated as a set of disconnected results.

Table 6. Econometric studies on ESIF impact.

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Cappelen, A., et al. [11]	2003	Positive effect on growth, but stronger in more developed regions	Economic Growth	OLS	1980–1997	105 NUTS-1/2 EU-15
Ederveen, S., H.L.F. de Groot, and R. Nahuiz [12]	2003	On average, ineffective. Positive and significant impact, but only in countries with good institutional quality	Economic Growth	OLS	7 periods of 5 years, 1960–1995	EU-13 Countries
Ederveen, S., et al. [13]	2003	Positive and significant impact, only in a model with specific regional effects	Economic Growth	OLS	1981–1996	183 NUTS-2 EU-15
Rodríguez-Pose, A. and U. Fratesi [14]	2004	Very weak but positive and significant impact. Support for agriculture has short-term positive effects on growth, but wanes quickly. Only investment in education and human capital has medium-term positive and significant returns	Economic Growth	OLS, LSDV, GLS	1989–1999	152 NUTS-2 EU-15
Beugelsdijk, M. and S.C.W. Eijffinger [15]	2005	Positive impact on growth and convergence	Economic Growth/Convergence	GMM	1984–2002	EU-15 Countries
Puigcerver-Peñalver, M. [16]	2007	Positive and significant impact, but stronger in the first programming period	Economic Growth	OLS; FE	1989–1993 1994–1999	41 Regions Obj. 1 EU-15
Bähr, C. [17]	2008	Positive and significant impact when decentralization is accounted	Economic Growth	OLS	1960–1995 (7 periods)	EU-13 Countries

Table 6. Cont.

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Dall’erba, S. and J. Le Gallo [18]	2008	Positive benefit on growth, but in least developed regions that growth suffers from the small extent of regional spillover effects	Economic Growth	ML, GMM, SEM	1989–1999	145 NUTS-2 EU-12
Esposti, R. and S. Bussoletti [19]	2008	Positive impact on growth, but modest	Economic Growth	GMM-SYS; GMM-DIFF	1989–1999	206 NUTS-2 EU-15
Ramajo, J., et al. [20]	2008	faster conditional convergence in regions belonging to Cohesion Countries (Ireland, Greece, Portugal and Spain)	Convergence	OLS, ML-SAR	1981–1996	163 NUTS-2 EU-12
Dall’Erba, S., R. Guillin, and J. Le Gallo [21]	2009	Significant impact, but negative	Productivity	OLS, SAR	1989–1999 1989–2004	145 NUTS-2 EU-12
Becker, S.O., P.H. Egger, and M. von Ehrlich [22]	2010	Positive and cost effective impact on growth in Obj. 1 regions, but not significant on employment	Economic Growth/ Employment	DiD-RDD	1989–1993 1994–1999 2000–2006	NUTS-2/3 EU-25
Mohl, P. and T. Hagen [23]	2010	Positive and significant impact in Obj. 1 regions	Economic Growth	LSDV, GMM, SYS-GMM, FE-SAR	1995–2006	124 NUTS-1/2
Fiaschi, D., A. Lavezzi, and A. Parenti [24]	2011	Positive effect on productivity growth, but larger impact of Obj.1 funds	Productivity	OLS, SDM	1980–2002	173 NUTS-2 EU-12
Aiello, F. and V. Pupo [25]	2012	Positive impact on convergence, but low and no impact in terms of productivity	Economic Growth/ Productivity	GMM-SYS, LSDV	1996–2007	Italian Macro-regions
Kyriacou, A.P. and O. Roca-Sagalés [26]	2012	Positive and significant impact in regional disparities reduction	Convergence	FGLS	1994–1999 2000–2006	EU-14 Countries
Pellegrini, G., et al. [27]	2012	Positive and significant impact	Economic Growth	RDD	1994–1999 2000–2006	NUTS-2 EU-15
Becker, S.O., P.H. Egger, and M. von Ehrlich [28]	2013	Positive impact in 30% of regions	Economic Growth	RDD, HLATE	1989–1993 1994–1999 2000–2006	186 to 251 NUTS-2 EU-25
Bouayad-Agha, S., N. Turpin, and L. Védrine [29]	2013	Positive and significant impact	Economic Growth	GMM, SDPD	1980–2005	143 NUTS-1/2 UE-14

Table 6. Cont.

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Rodríguez-Pose, A. and K. Novak [30]	2013	Positive, mostly insignificant impact but marked improvement between the second and third programming periods	Economic Growth	FE	1994–1999 2000–2006	133 NUTS-1/2 EU-15
Crescenzi, R. and M. Giua [31]	2014	Positive and significant impact, but more positive in regions with most favourable socio-economic environment	Economic Growth	FE, SAR	1994–1999 2000–2006 2007–2013	139 NUTS-1 and NUTS-2 EU-12
Fratesi, U. and G. Perucca [32]	2014	Positive and significant impact, more effective when there is territorial capital	Economic Growth	OLS	2006–2010	108 NUTS-3 EU-14
Pinho, C., C. Varum, and M. Antunes [33]	2015	Positive and significant impact, especially in richer regions, with higher levels of education. Cohesion regions do not convert more transfers into more growth	Economic Growth	FE	1995–1999 2000–2006 2007–2013	92 NUTS-1/2 EU-12
Pinho, C., C. Varum, and M. Antunes [2]	2015	Positive and significant impact, but in regions with low levels of human capital and innovation	Economic Growth	FE	1995–2009	137 NUTS-1/2
Rodríguez-Pose, A. and E. Garcilazo [34]	2015	Positive and significant impact but above a threshold government quality improvements are more important	Economic Growth	FE	1996–2007	169 NUTS-1/2 in 18 EU Countries
Coppola, G. and Destefanis, S. [35]	2015	Weak, but significant, impact on total factor productivity change but virtually no effect on capital accumulation or employment	Productivity, Employment, TPF	FE	1989–2006	20 Italian NUTS-2
Pellegrini, G., EC: DG REGIO and Università di Roma Sapienza [36]	2016	Positive and significant impact	Economic Growth	RDD	1994–1999 2000–2006	202 NUTS-2 EU-27
Bondonio, D., et al. [37]	2016	Positive impact, more intense in Obj. 1 regions	Economic Growth	RDD, PSM, GPS	1994–1999 2000–2006 2007–2013	259 NUTS-2 EU-15

Table 6. Cont.

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Crescenzi, R. and M. Giua [38]	2016	ESIFs associated with stronger regional growth rates in all regions; however, stronger in the regions with the most favourable socio-economic environment	Economic Growth	FE, SAR, SDM, SEM	1994–1999 2000–2006 2007–2013	139 NUTS-1/2 EU-15
Gagliardi, L. and M. Percoco [39]	2016	Positive and significant impact, particularly evident for rural areas close to the city	Economic Growth	RDD, OLS	2000–2006	1233 NUTS-3
Pontarollo, N. [40]	2016	Positive impact for both the growth of productivity and GDP per capita is not always the case	Economic Growth/ Productivity	GAM	2000–2006	202 NUTS-2 EU-15
Arbolino, R. and R. Boffardi [41]	2017	Positive and significant impact, but the magnitude depends on institutional quality	Economic Growth	FE	2007–2015	20 NUTS-2 Italy
Crescenzi, R., U. Fratesi, and V. Monastiriotis [42]	2017	Positive impact, however, the magnitude is conditioned on the structure of the expenditure, more than on individual regional characteristics	Economic Growth	FE	1989–2013	15 NUTS-2
Di Cataldo, M. [43]	2017	Positive impact on growth and employment, but the effect may not be long-lasting	Economic Growth/ Employment	SCM, DiD	1994–1999 2000–2006 2007–2013	134 wards from Cornwall and 94 from South Yorkshire, UK
Host, A., V. Zaninović, and P. Krešimir [44]	2017	Positive impact is significant only in those countries where the institutional quality is at a high level	Economic Growth	FE, RE, OLS	2000–2013	EU-27 Countries
Cerqua, A. and G. Pellegrini [45]	2017	Average positive effect on regional growth, but the estimated function is concave and presents a maximum value	Economic Growth	RDD	1994–2006	208 NUTS-2 EU-15
Fiaschi, D., A.M. Lavezzi, and A. Parenti [46]	2017	Positive impact on labour productivity, only from Obj. 1 funds and other funds different from Obj. 2	Productivity	OLS, SDM	1991–2008	175 NUTS-2 EU-28
Becker, S.O., P.H. Egger, and M. von Ehrlich [47]	2018	Positive and significant impact (short-lived)	Economic Growth, Employment, Investment	RDD	1989–1993 1994–1999 2000–2006 2007–2013	187 to 253 NUTS-2 EU-25

Table 6. *Cont.*

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Bourdin, S. [48]	2018	Differentiated effects of the cohesion policy according to EU regions and their institutional quality	Economic Growth	GWR	2000–2014	248 EU NUTS-2
Crescenzi, R. and M. Giua [49]	2018	Positive and significant effect on both growth and employment in the EU. However, the regional impacts are not uniform across the Member States	Economic Growth	RDD	2000–2010 2010–2014	NUTS-3 AT, BE, FI, DE, IT, ES, UK
Piętak, Ł [50]	2018	Positive and significant impact in Spanish regions. The impact on the convergence process was insignificant	Economic Growth/ Convergence	GMM, GMM-SYS, OLS, FE	1989–2016	17 NUTS-2 Spain
Šlander, S. and P. Wostner [51]	2018	CP increases public development investments in target areas, which should lead to stronger growth performance	Structural Public Expense	FE	1990–1993 1994–1999 2000–2006	EU-15 Countries
Bourdin, S. [52]	2018	Significant positive influence of the cohesion policy on growth, higher for core regions	Economic Growth	SDM; GWR	2000–2016	147 Central and Eastern NUTS-3
Breidenbach, P., T. Mitze, and C.M. Schmidt [53]	2018	Contribution is insignificant or even negative for several peripheral EU regions, due to spatial spillovers and lower levels of institutional quality	Economic Growth	FE, GMM-SYS, Spatial GMM-SYS	1997–2007	127 NUTS-2 EU-15
Coppola, G., et al. [54]	2018	EU funds have a significant effect on GDP per capita, both with and without national co-financing	Economic Growth	FE	1994–2013	20 Italian NUTS-2
Di Cataldo, M. and V. Monastiriotis [55]	2018	ECP interventions are highly productive in the UK, irrespective of place and local conditions	Economic Growth	FE	1994–2013	37 UK NUTS-2
Butkus, M., et al. [3]	2019	No positive or negative return on investing SF if all expenditures and funds are considered together. Positive return on ERDF. CF has a negative return in terms of regional disparities	Convergence	DiD	1995–1999 2000–2006 2007–2012	1251 NUTS-3 EU-25

Table 6. Cont.

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Fidrmuc, J., M. Hulényi, and O. Zajkowska [56]	2019	Significant and positive effect on growth. Inter-regional spillovers are important. Positive impact of institutional quality	Economic Growth	OLS, IV, SDM	1994–2014	272 NUTS-2 EU-28
Arbolino, R., P. Di Caro, and U. Marani [57]	2019	Positive contribution to the resilience of Italian regional labour markets, but significant only when institutional quality is accounted for	Labour Markets	GLS, GMM	2007–2013	20 NUTS-2 Italy
Butkus, M., A. Mačiulytė-Šniukienė, and K. Matuzevičiūtė [58]	2019	Positive effect on growth, but strong conditioning by the institutional quality of the regions	Economic Growth	FE	1995–1999 2000–2006	1247 NUTS-3 UE-25
Antunes, M., et al. [59]	2020	No positive impact is detected	Economic Growth	OLS, FE, SDM	1995–2009	96 NUTS-2 EU-28
Butkus, M., A. Mačiulytė-Šniukienė, and K. Matuzevičiūtė [60]	2020	Direction, size, and significance of the effect of the CP commitment intensity on growth and productivity are conditional on institutional quality	Economic Growth/Productivity	FE	2000–2006 2007–2013	270 NUTS-2 and 1326 NUTS-3 EU-25
Butkus, M., et al. [61]	2020	2000–2006 had an overall negative effect on convergence dynamics. Only ERDF Obj. 2 contributed positively to convergence	Convergence	DiD	2000–2006	NUTS-3 EU-25
Butkus, M., et al. [62]	2020	Impact of regional support on convergence is positive with the diminishing marginal effect as the intensity of payments increases	Convergence	FE, DiD	2000–2006 2007–2011 2009–2013	1251 NUTS-3 EU-25
Cerqua, A. and G. Pellegrini [63]	2020	Results are consistent with the hypothesis that the EU regional policy is effective not only in the short term but also in the long term	Economic Growth	MBA	1991–2015	37 NUTS-2 EU-15

Table 6. *Cont.*

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Jestl, S., A. Maucorps, and R. Römisch [64]	2020	Negative effect of structural laggardness growth and a statistically significant, positive effect of funding. Also, an inadequate allocation of CP funding	Economic Growth	StrEqM	2008–2016	276 EU25 NUTS-2
Albanese, G., G. de Blasio, and A. Locatelli [65]	2020	Positive effect only for the part of the ERDF expenditure devoted to infrastructure. Characteristics of local context do matter	TFP Growth	Several Methods	2007–2015	Southern Italy LLMs
Canova, F. and E. Pappa [66]	2021	ERDF has a positive short-term impact but gains typically dissipate within 3 years. ESF has a negative or insignificant impact, but exercises positive average effects after 2–3 years	Output, employment, productivity, investment, and labour part.	IV, BA	1980–2017	279 NUTS-2 EU-28
Piętak, Ł. [67]	2021	The influence of structural funds on convergence was positive but very weak in Poland	Economic Growth/Convergence	FE, GMM	2004–2016	16 NUTS-2 Poland
Koudoumakis, P., G. Botzoris, and A. Protopapas [68]	2021	Positive and significant impact on the development and convergence of regions with a GDP p.c. PPS lower than 90% of the EU average	Economic Growth	FE	1986–2016	237 EU Regions
Védrine, L. and J. Le Gallo [69]	2021	Positive influence on growth. Trade-off between within and between regional disparities over the 2000–2014	Economic Growth	FE, SAR	2000–2014	205 NUTS-2 EU-25
Fernández, M., R. Bande, and R. Pereira [70]	2021	Funds' impact on the positive public stock cap in Galicia. In Portugal, the possible crowding-out of public investment	Production, Investment, Labour Demand	OLS	1980–2001	23 NUTS-2 ES and PT

Table 6. Cont.

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Di Caro, P. and U. Fratesi [71]	2021	Positive and significant effects were registered in about 40% of regions. Effectiveness does not necessarily depend on the level of assistance, but can be related to the presence of a selected number of national and regional contextual factors	Economic Growth	DMG, LOGIT	1989–2015	250 NUTS-2 EU-25
Destefanis, S., M. Di Serio, and M. Fragetta [72]	2022	ESIF provides the largest and most pervasively significant GDP multipliers. Nationally funded government investment and government consumption shocks are more limited	Economic Growth	BA PVAR	1994–2016	20 NUTS-2 Italy
Di Caro, P. and U. Fratesi [73]	2022	Positive and significant effects during all the recessionary events, although with regional variation regarding regional labour market resilience. Region and crisis-specific patterns during different shocks	Employment	MGE	1980–2015	255 NUTS-2 EU-28
Scotti, F., A. Flori, and F. Pammolli [74]	2022	Different Impacts depending on Sector. Larger spillovers in Belgium, the Netherlands, and Slovakia	Economic Growth/spillovers	OLS, FE, GMM, SDM, GPS	2007–2014	258 NUTS-2 EU-27
Staehr, K. and K. Urke [75]	2022	ERDF may have had some effect, but it cannot be estimated precisely. Other ESIF does not seem to have been related to public investment in the EU countries	Public Investment	FE	2000–2018	EU-28 Countries
Coppola, G. et al. [76]	2023	Significant impact on sectoral products, in particular the ERDF as well as on aggregate GDP per capita	Multi-input, multi-output transf. function	FE	1994–2016	20 Italian NUTS-2

Table 6. *Cont.*

Author(s)	Year	Main Results (Impact of ESIFs)	Analysis	Econometric Methodology	Period	Units
Fusaro, S. and R. Scandurra [77]	2023	Positive impact on population with lower-secondary and tertiary education, negative impact on those with upper-secondary education. In employment, positive response for youth of all ed. levels	Youth education and employment	FE, IV	2007–2018	NUTS-2 EU-27
Veneri, P., M. Diaz Ramirez, and L. Kleine-Rueschkamp [78]	2023	Regional transfers induce positive business dynamics' outcomes. Foster the net rate of firm creation and the jobs associated, raising regional labour productivity	Business Dynamics	RDD	2007–2013	159 NUTS-2 in 18 EU Countries

Against this background, the analysis of ESIF impact has increasingly relied on econometric methods to assess the effectiveness of cohesion policy in promoting regional development. This section reviews studies that apply quantitative techniques to measure the relationship between ESIF and key economic indicators, such as growth, employment, and convergence. By examining the methodologies, geographic scope, and main findings of these works, this section provides a structured synthesis of the empirical evidence on the causal effects of cohesion policy.

5.1. Quantifying the Impact: Econometric Analyses of ESIF Impact on Regional Growth in Europe

Building on the findings from the systematic literature review (SLR) analysis above, a selection of key studies has been drawn from the identified subset of 428 quantitative studies. These studies were chosen based on two primary criteria:

1. **Econometric Methodology:** The study employs an econometric approach to assess the impact of ESIF on regional growth.
2. **Research Question Relevance:** The study directly addresses the research question: What is the impact of ESIF on regional growth in Europe?

While sample size (number of regions or time period) was considered during selection, priority was given to studies that demonstrably address the research question through a robust econometric methodology. This focus on methodological rigour and thematic relevance departs from an initial SLR process, which helped mitigate selection bias by establishing clear selection criteria, but it is important to acknowledge that the final selection process inherently involves a degree of subjectivity. However, the aim is not to present an exhaustive list of econometric studies on ESIF impact. Rather, the goal is to curate a representative dataset that reflects the current state of the art of the knowledge and the evolution of research on this topic.

The studies have been categorized based on relevant characteristics such as methodology, timeframe (period) of the study, regions investigated, and the primary results obtained. Table 6 presents the 70 studies included in this analysis, providing a comprehensive overview of the authors, years, titles, main results, econometric methodologies, analysis focus, periods, and units of study. The information from column 5 of Table 6, which lists

the abbreviations of the econometric methodologies used in each study, has been included in Appendix A, where a short description of these methodologies is provided.

5.2. Characterization of the Econometric Results

Hagen and Mohl [79] succinctly formulate one of the most common conclusions regarding the scientific production of econometric studies on ESIF impact: “the empirical evidence has provided mixed, if not contradictory, results”. Fourteen years later, the dataset analyzed in this study, covering a period of 21 years (2003–2023) and comprising 70 different econometric studies employing multiple methodologies, does not alter this observation.

In a nutshell, we can say there is a significantly larger number of studies pointing to a positive effect on growth, employment, or convergence, particularly when conditionalities are considered. However, a substantial body of research finds no significant impact, while some studies even suggest an absence of tangible effects. We might argue that ESIF represents more than one-third of the EU’s budget and continues to expand in both financial scope and policy instruments, so this evidence appears limited, but we must recognize the complexity of the task of identifying a clear causal effect in such a complex economic, social, and political environment.

The econometric studies analyzed can be categorized according to several key dimensions, beginning with the estimation methodologies employed. Ordinary Least Squares (OLSs) is a commonly used approach, identified in 18 studies, including those by [11,12,14]. While its simplicity makes it a preferred method for establishing baseline estimates of ESIF impacts, it is often used in conjunction with more advanced techniques. The Generalized Method of Moments (GMMs), identified in 11 studies, including [15,19], is frequently employed to address potential endogeneity issues. The Fixed Effects (FEs) model is the most frequently applied methodology, appearing in 28 studies such as those by [2,34], largely due to its ability to control for time-invariant characteristics. In addition to these conventional approaches, there is a clear trend toward more sophisticated econometric techniques. Examples include Difference-in-Differences (DiDs), as employed by [22]; Spatial Durbin Models (SDMs), used in studies such as [46]; and Regression Discontinuity Design (RDD), applied by [45]. The increasing use of these methodologies reflects an effort to better isolate the causal impact of ESIFs.

The temporal coverage of the studies spans from the early 1980s to recent years, capturing the evolution of EU funding cycles. Some studies, such as [23], focus on earlier periods and Multiannual Financial Frameworks (MFFs), specifically analyzing data from 1995 to 2006, while others, including Staehr and Urke (2018) [75], extend the analysis to more recent funding cycles. Many studies are structured around specific MFF programming periods, such as 1989–1999, 1994–2006, and 2007–2013, allowing for comparative assessments of the evolving impact of ESIF over time.

The geographical coverage of these studies predominantly aligns with the regional scale used in ECP. The most common sample unit is a combination of NUTS-2 regions, sometimes complemented by selected NUTS-1 regions with similar characteristics. A smaller number of studies, particularly those with a more granular approach, analyze NUTS-3 regions across the EU, offering a more localized perspective. Specific regional case studies include [54], which focuses on Italian NUTS-2 regions, and [55], which examines UK regions. Meanwhile, other studies adopt a broader, country-level perspective, particularly relevant due to the novelty of the methodological approaches employed.

Across the reviewed studies, empirical findings also display systematic variation according to the econometric strategy employed. Contributions based on cross-sectional regressions and standard panel models more frequently report positive and statistically significant average effects of ESIFs on regional growth or convergence, although these

estimates are often sensitive to specification choices and the inclusion of conditioning variables. Studies adopting quasi-experimental approaches, such as difference-in-differences or regression discontinuity designs, tend to identify more moderate, conditional, or locally confined effects, reflecting stricter identification and a narrower population of inference. Spatial econometric models frequently alter both the magnitude and distribution of estimated impacts by explicitly accounting for interregional spillovers, in some cases attenuating direct effects while revealing indirect or redistributive dynamics. These patterns suggest that part of the heterogeneity observed in the literature reflects not only contextual differences across regions but also the distinct causal objects identified by alternative econometric approaches.

The main results of the econometric studies analyzed can be categorized into three broad trends. A substantial number of studies report positive impacts of ESIF, particularly on economic growth, as evidenced in works such as [11,31]. Other studies highlight benefits in employment and productivity, particularly when conditional factors such as institutional quality are accounted for. However, other studies report mixed or insignificant impacts, as observed in [14,59]. These findings frequently highlight the variability of results based on regional characteristics and the efficiency of fund allocation. In contrast, a smaller subset of studies identifies negative impacts, such as those reported by [21], where regions characterized by low institutional quality or ineffective fund utilization experience adverse effects.

6. Concluding Thoughts

This systematic review and bibliometric analysis of studies on the ECP and the ESIFs demonstrate the multidimensional nature of this research field. It highlights the evolution of scholarly interest, moving from foundational studies focused on policy design and early implementation to more sophisticated evaluations employing advanced econometric and spatial methodologies. Over time, research has shifted toward a more rigorous, evidence-based approach, seeking to better quantify the economic, institutional, and regional effects of ESIFs.

The analysis reveals that regional development, convergence, and program evaluation emerge as core themes across the literature, reflecting the overarching objectives of ECP. These themes underscore the sustained academic interest in understanding how ESIFs contribute to reducing regional disparities and fostering balanced economic growth across Europe. The strong emphasis on measuring policy impacts suggests a continuous effort to refine evaluation methodologies and provide empirical evidence for policy adjustments.

Methodological advances are particularly evident in quantitative studies. Econometric analyses have increasingly focused on the technical aspects of policy evaluation, addressing complex questions about efficiency, regional disparities, and the influence of institutional quality. These studies reflect a growing trend toward employing more sophisticated methodologies—such as spatial econometrics, DiD, and RDD—to provide more robust assessments of policy outcomes. While the broader literature on ESIFs covers a wide range of topics, quantitative research tends to focus on specific outcomes such as economic growth, employment, and governance. These studies frequently analyse how regional and institutional contexts condition the impacts of cohesion policy interventions, highlighting the role of administrative capacity, absorptive efficiency, and governance quality in determining the effectiveness of ESIF-funded projects.

From a methodological perspective, the increasing adoption of more advanced econometric techniques in this literature reflects an explicit response to the limitations of earlier approaches. Initial cross-sectional regressions and standard panel models, while informative, are particularly exposed to policy endogeneity, reverse causality, and omitted-variable

bias, given that ESIF allocations are explicitly targeted toward structurally weaker regions. Subsequent use of difference-in-differences, regression discontinuity designs, and spatial econometric models aimed to strengthen causal identification by exploiting temporal variation, eligibility thresholds, or spatial dependence. However, these approaches rely on strong identifying assumptions, such as parallel trends, local continuity around cut-offs, or correctly specified spatial interaction structures, and often entail trade-offs between internal and external validity. As a result, methodological sophistication does not mechanically translate into convergent estimates, and differences in empirical findings partly reflect the sensitivity of impact estimates to identification strategies and their underlying assumptions.

Against this methodological background, and despite methodological improvements, the findings from econometric studies remain mixed. The majority of studies indicate positive impacts on regional growth, employment, and convergence, but these effects are often conditional on factors such as institutional quality, socio-economic environment, and targeted investments in education and infrastructure. In other words, most studies indicate that while ESIF can be an effective tool for promoting regional development, its success depends on the broader institutional and policy framework within which it operates. However, a significant number of studies report no significant impact or even negative effects, underscoring the importance of efficient fund allocation and strong institutional frameworks. In regions where governance is weak or where funds are not strategically allocated, the intended benefits of ESIF may not materialize, leading to inefficiencies or even counterproductive outcomes.

The mixed results also highlight the complexity of assessing ESIF impacts and suggest that policy effectiveness is highly context-dependent. Factors such as regional economic structures, governance quality, and specific socio-economic conditions all play a crucial role in shaping the outcomes of ESIF interventions. As such, the variation in results observed across studies is not necessarily contradictory but rather reflective of the heterogeneous nature of policy implementation across diverse regional contexts. This reinforces the need for more targeted, region-specific policy approaches rather than broad, uniform funding mechanisms.

Given these findings, the policy implications are significant. The heterogeneous impacts of ESIFs highlight the importance of tailoring strategies to regional specificities, enhancing institutional capacities, and ensuring efficient resource allocation. As studies increasingly point to the role of governance in moderating policy outcomes, it becomes evident that a one-size-fits-all approach to ESIF allocation may be insufficient. Instead, targeted interventions and region-specific adjustments could enhance policy effectiveness. Furthermore, the continuous refinement of evaluation methodologies is critical to maximizing policy impact and informing future iterations of ECP.

As the field matures, there is a growing need to integrate richer datasets, adopt innovative methodologies, and explore emerging themes such as resilience, sustainability, and long-term structural transformations. Future research could benefit from further disaggregation of impacts by regional and temporal dimensions, which would contribute to a more nuanced understanding of the ESIF's effectiveness.

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Abbreviations

The following abbreviations are used in this manuscript:

DiD	Differences in Differences
ECP	European Cohesion Policy
ESIFs	European Structural and Investment Funds
FES	Fixed Effects
GMMs	Generalized Method of Moments
OLSs	Ordinary Least Squares
MFF	Multiannual Financial Framework
SDM	Spatial Durbin Model

Appendix A

Table A1 provides a concise description of the econometric methodologies referenced in Table 6.

Table A1. Econometric methodologies.

<i>BA</i>	Bayesian Approach: Uses Bayes' theorem to update the probability of a hypothesis as more evidence becomes available.
<i>BA PVAR</i>	Bayesian Panel Vector Autoregressive Model: A Bayesian method that accounts for dynamic interdependencies across multiple time series and panel data.
<i>DiD</i>	Difference-in-Differences: Compares the changes in outcomes over time between a treatment group and a control group to estimate causal effects.
<i>DMG</i>	Dynamic Mean Group: Estimates long-run relationships in dynamic panel data models, allowing for heterogeneous slopes across groups.
<i>FE</i>	Fixed Effects: Controls for time-invariant characteristics in panel data by allowing individual-specific intercepts.
<i>FLGS</i>	Feasible Generalized Least Squares: An extension of GLS that estimates the covariance structure of the error terms.
<i>GLS</i>	Generalized Least Squares: Accounts for heteroskedasticity or autocorrelation in regression models.
<i>GMM</i>	Generalized Method of Moments: Uses moment conditions derived from the data to estimate parameters efficiently.
<i>GMM-DIFF</i>	Difference GMM: Applies GMM to first-differenced equations to control for unobserved fixed effects.
<i>GMM-SYS</i>	System GMM: Uses a system of equations in levels and first differences to improve efficiency in GMM estimation.
<i>GWR</i>	Geographically Weighted Regression: A local regression technique that accounts for spatial variability in the data.
<i>HLATE</i>	Heterogeneous Local Average Treatment Effect: Estimates treatment effects that vary across subpopulations.
<i>IV</i>	Instrumental Variables: Addresses endogeneity by using instruments—variables correlated with the endogenous explanatory variables but uncorrelated with the error term.
<i>LSDV</i>	Least Squares Dummy Variable: Fixed effects model with dummy variables.
<i>MBA</i>	Mean Balancing Approach: Balances treatment and control groups on observable covariates to estimate causal effects.

Table A1. *Cont.*

<i>ML</i>	Maximum Likelihood: Estimates parameters by maximizing the likelihood function, assuming a specific distribution for the error terms.
<i>OLS</i>	Ordinary Least Squares: Estimates regression parameters by minimizing the sum of squared residuals.
<i>ML-SAR</i>	Maximum Likelihood Spatial Autoregressive Model: Combines the spatial autoregressive framework with maximum likelihood estimation to determine the model parameters.
<i>SEM</i>	Spatial Error Model: Models spatial dependence in the error terms.
<i>SAR</i>	Spatial Autoregressive model: Accounts for spatial dependence by including a spatially lagged dependent variable.
<i>DiD-RDD</i>	Difference-in-Differences with Regression Discontinuity Design: Combines time-based comparisons and cutoff-based causal inference.
<i>RDD</i>	Regression Discontinuity Design: Combines time-based comparisons and cutoff-based causal inference.
<i>SDPD</i>	Spatial Dynamic Panel Data: Incorporates both spatial dependence and temporal dynamics including lagged dependent variables over time and space.
<i>PSM</i>	Propensity Score Matching: Estimates the causal effect of a treatment by matching treated and untreated units with similar propensity scores.
<i>GPS</i>	Generalized Propensity Score Matching: Extension of propensity score matching used for estimating causal effects in scenarios with multiple treatment levels or continuous treatments.
<i>SDM</i>	Spatial Durbin Model: Includes both spatially lagged dependent and independent variables to account for spatial spillover effects in the relationships between variables.
<i>GAM</i>	General Additive Mode: Allows for non-linear relationships between the dependent variable and independent variables.
<i>SCM</i>	Synthetic Control Method: Estimates causal effects by comparing the treated unit to a weighted synthetic version of untreated units.
<i>RE</i>	Random Effects Estimator: Assumes that individual-specific effects are uncorrelated with the independent variables.
<i>StrEqM</i>	Structural Equation Model: Used to test hypotheses about relationships among observed and latent variables.
<i>LOGIT</i>	LOGIT: Predicts the probability of a binary outcome.
<i>MGE</i>	Mean Group Estimator: Estimates the long-run relationships by averaging the individual coefficients obtained from time series regressions for each cross-sectional unit.

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