

Article

Decoupling Knowledge from Reality: Climate Risks, Fiscal Capacity and Institutional Asymmetries in The EU

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Abstract: This study examines the relationship between academic research and economic and institutional conditions in EU27 countries, in the context of climate change risks, fiscal capacity and economic stability. Although the literature on these topics has expanded significantly, limited attention has been paid to reflecting the structural realities implicit in research findings. To address this gap, the paper combines bibliometric analysis with an overlay analysis of institutional indicators and a gap mapping analysis, applied to EU27 countries over the period 2010–2024. The bibliometric dataset is based on a sample of articles extracted from the Web of Science and complemented by a Composite Socio-Economic and Institutional Index ($CSEI_i$), constructed using GDP per capita, government effectiveness and tax revenues, to capture the institutional and economic capacity of countries. Integrating these approaches allows us to assess whether scientific output reflects national socio-economic conditions, going beyond the limitations of separate analyses. The relationship between socio-economic and institutional capacity and research intensity is analysed both visually, through a scatter plot, and statistically, using the Spearman correlation coefficient. The results confirm the expansion of the field, but the study's central contribution indicates an insignificant correlation between institutional capacity and scientific production, not supporting the hypothesis of a direct alignment between development level and research intensity. These results suggest the need to reorient the research agenda and allocate academic resources to underrepresented countries and regions to ensure better alignment between scientific priorities and real public policy needs in the field under analysis.

Keywords: climate change risks; fiscal capacity; economic stability; institutional capacity; bibliometric analysis; research intensity; knowledge–reality gap; European Union

1. Introduction

The relationship between structural risks and the capacity of states to manage them has become increasingly relevant in both the academic literature and public policy debates. In particular, climate change risks are distinguished by their multidimensional nature, affecting not only environmental systems, but also economic stability, the sustainability of public finances and the functioning of institutions [1]. Thus, we can no longer view climate change in isolation but as a systemic factor that affects economies. This is because it amplifies existing vulnerabilities and puts pressure on the capacity of states to respond effectively.



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Fiscal capacity and institutional quality play a key role in how these risks are managed. States characterised by strong financial resources and efficient institutions tend to be better prepared to implement adaptation and mitigation policies [2], while more fragile economies face significant constraints [3]. Also, economic stability acts as a buffer mechanism [4], influencing both risk exposure and resilience to climate shocks. Therefore, the three dimensions presented are deeply interconnected [5], forming a complex framework that requires an integrated approach.

Although scholarly attention to these dimensions has grown in recent years, they are still predominantly examined in isolation, with limited focus on their interconnections. This fragmentation raises a key issue: to what extent does the geographical distribution of research on climate risks, fiscal capacity, and economic stability mirror the actual institutional strength and economic conditions of EU27 member states? In response to this gap in the literature, the present study advances the following hypothesis:

H1: *countries characterised by stronger socio-economic performance and more developed institutional frameworks are more likely to display higher levels of research activity in the areas of climate risk, fiscal capacity, and economic stability.*

From this perspective, the discrepancy between existing research priorities and areas that warrant further investigation highlights important limitations in the current body of literature.

Previous studies have examined climate risks, fiscal capacity, and economic stability either independently or in relation to bilateral relationships. However, little attention has been paid to whether the geographical distribution of academic research corresponds to the socio-economic and institutional realities of the countries analysed. In short, the literature has not addressed the alignment between scientific production and institutional capacity. However, this aspect may be relevant in the context of the European Union, where there are differences among Member States in economic development, governance quality, and fiscal capacity.

Based on these considerations, our study proposes an integrated analysis that combines bibliometric tools with an empirical approach. Through this integration, we aim to overcome the classical separation between the analysis of specialised literature and the assessment of economic reality. We also aim to examine the relationships between research volume and the three analysed dimensions. Thus, our study makes three main contributions. First, we have undertaken a bibliometric analysis of EU27 research to map the intellectual structure of the literature on climate change risks, fiscal capacity, and economic stability. This allows us to identify the main thematic clusters, collaborative networks and temporal developments. Second, we have constructed a Composite Socio-Economic and Institutional Index ($CSEI_i$) by combining GDP per capita with government effectiveness and tax revenues. This approach aims to assess the socio-economic and institutional capacity of EU27 Member States in a unified framework. Finally, the third contribution is the integration of an original gap-mapping framework, complemented by robustness analyses using alternative institutional-capacity and research-intensity specifications to assess the stability of the empirical findings. This approach compares research intensity with institutional capacity, allowing countries to be grouped into four categories: Over-Researched Low-Capacity, Structural Alignment, Under-Researched High-Capacity and Dual Underperformance. Thus, we can observe new insights into the alignment between academic knowledge production and policy-relevant realities.

The rest of the paper follows this structure: Section II reviews the relevant literature on climate change risks, fiscal capacity, and economic stability. Section III presents the data used and the methodology applied in our study. Section IV discusses the bibliometric, the empirical analysis and the robustness checks. The final section concludes by summarising the main findings, discussing policy implications, and outlining some limitations of the study and directions for future research.

2. Literature Review

The literature examines three central dimensions that form the basis of this study: climate change risks, fiscal capacity, and economic stability. The integration between these three dimensions is still in its infancy and is not as mature as the analyses conducted individually on each theme. However, there is a growing interest in studying the interdependencies between them in a unified framework.

Over time, climate-related risks have increasingly been framed as systemic threats with significant fiscal and macroeconomic consequences, rather than being confined to environmental concerns [6]. Such risks encompass both physical impacts, including extreme weather events, rising sea levels, and temperature fluctuations, and transition-related risks linked to policy shifts, technological transformation, and market restructuring [7]. Research shows that the degree of exposure to these risks varies considerably across countries, depending on geographical location as well as structural and institutional characteristics [8]. Nevertheless, much of the existing literature concentrates primarily on exposure levels, while comparatively less attention is given to differences in institutional

capacity to respond. Accordingly, vulnerability should be understood not only in terms of exposure but also in relation to states' ability to anticipate, withstand, and adapt to such shocks. The second dimension, fiscal capacity, refers to the ability of governments to generate revenues, manage public finances effectively, and respond to economic and social pressures [9]. In the context of climate change, fiscal capacity plays a crucial role in shaping resilience, as both mitigation and adaptation policies require substantial, sustained financial resources. Existing studies suggest that countries with stronger fiscal positions are better equipped to implement climate-related policies, absorb external shocks, and maintain macroeconomic stability [10]. Conversely, limited fiscal space constrains policy responses and may intensify the long-term economic consequences of climate-related risks. Finally, the third dimension concerns economic stability. This captures the overall resilience of an economy to internal and external shocks, including inflation volatility, unemployment fluctuations, and vulnerabilities in the financial system [11]. The literature highlights that climate risks can undermine economic stability by disrupting production, disrupting supply chains, and increasing uncertainty in financial markets [12]. Economic stability also influences how climate risks translate into broader systemic impacts [13]. Thus, more stable economies tend to have stronger buffers and more diversified structures, which reduces their sensitivity to shocks.

The literature review found that, although these three dimensions are intensively studied, their analysis remains predominantly sectoral. That is, a coherent integration of their interdependencies is lacking. This integration is necessary because climate change risks can erode economic stability, which in turn can weaken fiscal capacity. Similarly, limited fiscal capacity constrains the capacity to address climate risks, creating feedback loops that can exacerbate vulnerabilities over time. However, the current literature does not sufficiently examine how these interdependencies are reflected in the international distribution of academic research.

Furthermore, scientific production is concentrated in developed economies, while states with lower institutional capacity are underrepresented. This asymmetry raises questions about the extent to which academic research reflects the economic and institutional realities of the countries studied.

Thus, we can conceptualise this problem as a gap between knowledge and reality, between what is studied in academia and the socio-economic reality of the countries analysed. Although there is discussion about geographical bias in research, this perspective has not yet been applied to the link between climate change, fiscal capacity and economic stability. Therefore, we can ask whether the scientific literature truly reflects the real challenges and capacities of the most vulnerable states.

To address these gaps, our study combines bibliometric analysis with an approach grounded in institutional overlap and gap mapping. Unlike previous studies that only analysed thematic links among climate change, economic stability, and fiscal capacity, we aim to assess in this study whether scientific studies accurately reflect institutional and socio-economic realities in the EU27. By combining bibliometric data with a Composite Socio-Economic and Institutional Index ($CSEI_i$), we bring an innovative view on how knowledge production relates to structural capacity, contributing to current debates about the disconnect between theory and practice in the field of sustainability.

3. Analytical Methods

3.1. Data

To conduct the case study, we used two main types of data: bibliometric and institutional data. The bibliometric dataset was extracted from the Web of Science Core Collection database using keywords relevant to the research objective: “climate change risks”, “fiscal capacity”, and “economic stability”. Initially, the query returned 4832 articles globally, but this set was subsequently refined using filtering criteria to ensure relevance to the proposed analysis. The inclusion of the Web of Science database was determined by its strict indexing requirements, its vast portfolio of high-visibility journals, and its frequency of use in bibliometric analyses. This choice ensures greater coherence and credibility of the data.

As mentioned, the search strategy used the Boolean expression ((“climate change risks”) AND ((“fiscal capacity”) OR (“economic stability”))), ensuring that all retrieved records explicitly addressed climate change risks together with either fiscal capacity or economic stability. All inclusion and exclusion criteria were applied directly within the Web of Science search interface, resulting in the final dataset used in the analysis. In a first stage, the time interval was restricted to the period 2000–2026, with an emphasis on the temporal correlation between the analyses, for the period 2010–2024, and the typology of the documents was limited to scientific articles and book chapters, published exclusively in English. Subsequently, only those works that included the analysis of one or more Member States of the European Union were selected, this choice being justified by the objective of the study to assess the correlation between scientific production and the specific institutional context of the EU27, considered a relatively homogeneous space in terms of political and economic architecture. Following

the application of these inclusion and exclusion criteria, a final set of 742 articles resulted, which constituted the database used to carry out the bibliometric analysis. The overall search strategy, including the filtering sequence and the final number of records obtained after these steps is summarized in Figure 1.

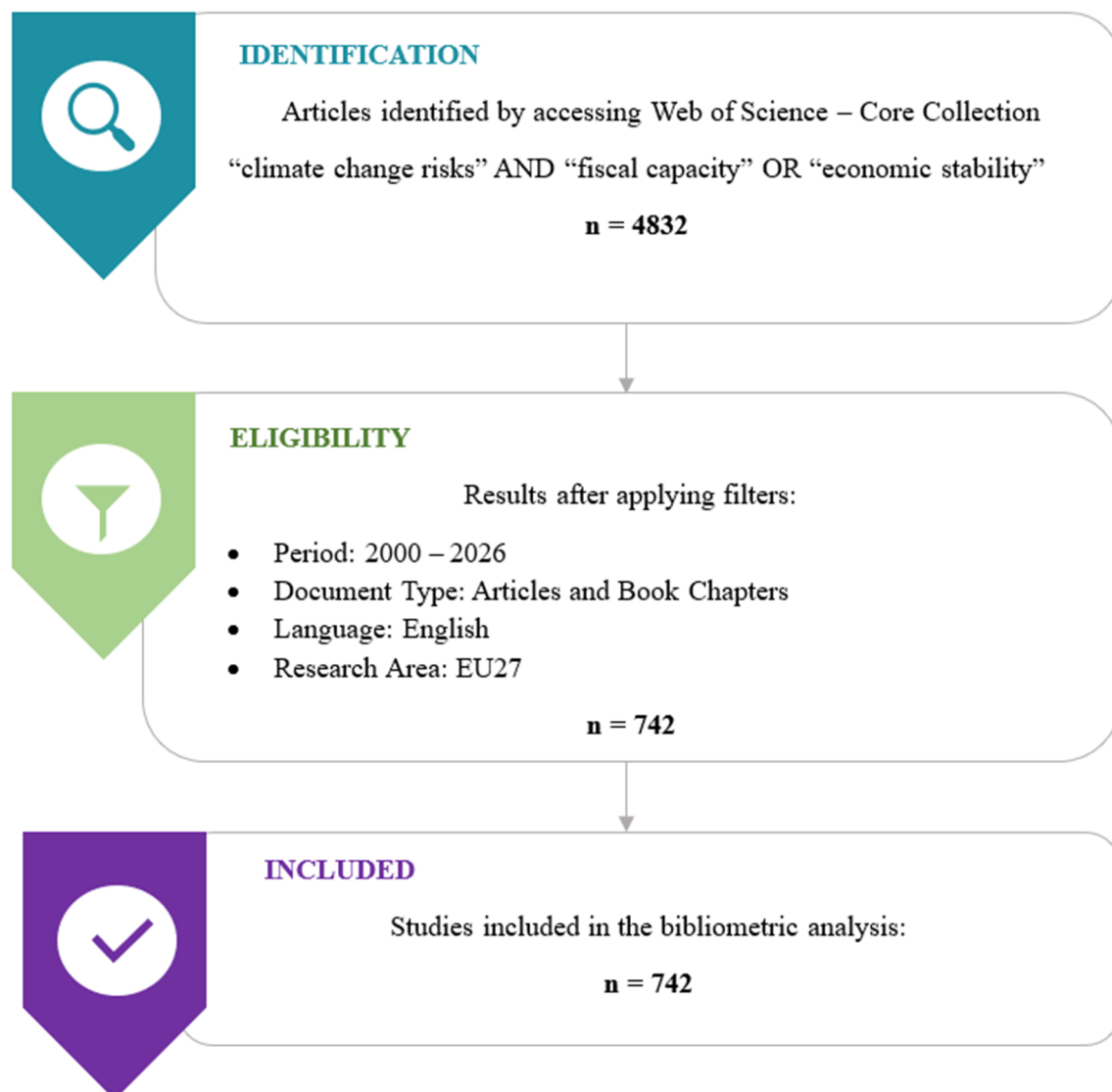


Figure 1. Collection of studies on the impact of climate change on fiscal capacity and economic stability in Europe (EU27). Source: Data processed by the author.

In parallel, within an integrated analytical framework (bibliometric–institutional) and not as a separate analysis, we used institutional data from the World Bank database for each EU27 member state. Specifically, we included three main indicators: GDP per capita, Government Effectiveness (an indicator from the Worldwide Governance Indicators set), and Tax Revenues as a percentage of GDP.

The analyzed period was 2010–2024, because, on the one hand, 2024 represents the last year for which the data are complete, and on the other hand, 2010 marks the beginning of a more visible stage of development of the field, analyzed in the literature, thus ensuring coherence between the evolution of scientific production and the availability of empirical data, presented in the Temporal Evolution Analysis. Based on these variables, which can be seen in Table 1, we built a composite socio-economic and institutional index ($CSEI_i$), which represents one of the central methodological contributions of our study.

Table 1. Description of indicators taken from the World Bank database.

No.	Variable Name	Description	Unit of Measure
1.	Composite Socio-Economic and Institutional Index ($CSEI_i$)	Synthetic indicator that reflects the socio-economic and institutional capacity of states, constructed as the arithmetic mean of the normalised values of GDP per capita, Government Effectiveness and Tax Revenue (% of GDP).	Index (standardised score between 0–1)
2.	GDP per capita	It reflects the level of economic development of a country, expressing the average value of economic production relative to the population.	\$ (dollars)/capita
3.	Government Effectiveness	It reflects perceptions of the quality of public services, the efficiency of the civil service and the degree of autonomy from political influences, the effectiveness of policy formulation and implementation, and the credibility of the government's commitment to these policies.	Index (standardised score, approximately between –2.5 and +2.5)
4.	Tax Revenue	It indicates the state's ability to generate tax revenue, relative to the size of the economy.	% of GDP

Source: Own processing.

The choice of the three indicators is justified by the fact that they complementarily capture three fundamental dimensions of state capacity: (i) economic development (GDP per capita), (ii) institutional quality (government effectiveness) and (iii) fiscal capacity (tax revenues), these being frequently used in the specialised literature to approximate economic-institutional resilience in the face of systemic shocks [14]. The integration of the two data sets (bibliometric and institutional) enables a transition from a descriptive analysis of the literature to a relational assessment of the relationship between knowledge production and the structural conditions of the analysed states, thereby providing a unified empirical framework. Our study uses a mixed sequential design. In the first stage, bibliometric tools were used to map the field's conceptual architecture and trajectory. Second, we constructed a Composite Socio-Economic and Institutional Index ($CSEI_i$) to capture countries' structural capacities. Third, the correlation between scientific outputs and institutional resources is assessed through linkage analysis and gap mapping, thus facilitating the identification of potential dissonances between research directions and the actual institutional context.

3.2. Methods

The study combines three major research directions. The first approach consists of a bibliometric analysis, used to explore the structure and main directions of the literature on the relationship between climate change risks, fiscal capacity and economic stability. In this sense, we used scientific mapping in VOSviewer (version 1.6.20) [15], building two types of maps: keyword co-occurrence and country-level co-authorship. The aim is to identify scientific structures in the field and highlight thematic and geographical patterns of scientific production [16].

In addition to the bibliometric analysis, we examined the overlap among institutional indices and correlated scientific production with indicators of socio-economic and institutional capacity. This integration aims to go beyond a purely descriptive approach to the literature and introduce an explanatory dimension to the relationship between the institutional context and the distribution of scientific knowledge. The approach is not limited to trends, but aims to reflect the real context of EU economies. The bibliometric data used are those collected from the Web of Science for the period 2010–2024, using the “full counting” method. In parallel, with the help of the World Bank database, we built a set of relevant empirical indicators. The choice of variables aims to capture, in a synthetic way, the level of economic development, the quality of institutions, and fiscal capacity.

To reduce the influence of cyclical fluctuations generated by events such as economic crises or the COVID-19 pandemic, we used the average values of the indicators for the period 2010–2024, thereby obtaining a representative value for each country. Missing values were treated based on the available years, and the absence of publications was coded with zero (to avoid selection bias in the bibliometric analysis).

The next stage involved normalising the data to enable comparability across indicators with different units of measurement [17]. In this sense, we applied a min-max procedure, in which each variable was transformed to a standardised scale ranging from 0 to 1. This transformation was performed using the following Formula (1) applied for each indicator separately at the level of all analysed countries:

$$X_{norm,i} = \frac{X_i - X_{min}}{X_{max} - X_{min}} \quad (1)$$

where $X_{norm,i}$ is the normalised value of the indicator for observation i ; X_i represents the initial value of the indicator; X_{min} is the minimum value of the indicator in the sample; X_{max} is the maximum value of the indicator in the sample.

Through this approach, we eliminated scale differences and ensured a common basis for comparison. Based on the normalised values, we subsequently constructed a composite socio-economic and institutional index ($CSEI_i$) [18], calculated as the simple arithmetic mean of the three normalised indicators for each country (2).

$$CSEI_i = \frac{GDP_{norm,i} + GE_{norm,i} + TR_{norm,i}}{3} \quad (2)$$

Where $CSEI_i$ represents the composite index for country i ; $GDP_{norm,i}$ is the normalized value of GDP per capita; $GE_{norm,i}$ is the normalised value of government efficiency; $TR_{norm,i}$ is the normalised value of tax revenues.

We chose equal weighting because we wanted to avoid making subjective assumptions about the relative importance of each dimension. Thus, each component, namely economic development, government efficiency, and fiscal capacity, contributes equally to the final score.

To assess the robustness of the Composite Socio-Economic and Institutional Index ($CSEI_i$), an alternative specification was additionally constructed using an alternative two-indicator specification based on GDP per capita and Government Effectiveness (3). The purpose of this supplementary analysis was to examine whether the gap-mapping classification was substantially influenced by the inclusion of the fiscal indicator or whether the overall country groupings remained stable under an alternative aggregation scheme.

$$CSEI_i^R = \frac{GDP_{norm,i} + GE_{norm,i}}{2} \quad (3)$$

where $CSEI_i^R$ represents the robustness version of the Composite Socio-Economic and Institutional Index for country i ; $GDP_{norm,i}$ is the normalized value of GDP per capita; $GE_{norm,i}$ is the normalised value of government efficiency.

To test H1, we examined the association between the Composite Socio-Economic and Institutional Index ($CSEI_i$) and research intensity using both graphical and statistical techniques. H1 would be supported by a positive and statistically significant Spearman correlation coefficient.

In the final stage of the analysis, the relationship between the composite institutional index and the intensity of scientific production was assessed both visually, by means of a scatter plot with a coefficient of determination (R^2), and statistically, using the Spearman correlation coefficient. While the graphical representation and R^2 give us insight into the linear relationship between the variables, the Spearman coefficient completes the analysis by assessing the association based on ranks. This approach is suitable for data that do not follow a perfectly linear relationship and for asymmetric or non-parametric distributions.

The Spearman correlation coefficient (ρ) is formally defined as follows (4):

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)} \quad (4)$$

where d_i represents the difference between the ranks of each observation for the two variables, and n is the number of observations (EU27 countries). The coefficient ranges between -1 and $+1$, where values close to $+1$ indicate a strong positive association, values close to -1 indicate a strong negative association, and values around zero suggest the absence of a monotonic relationship.

This approach is preferred in the context of the present analysis, because the relationship between institutional capacity and scientific output is not assumed to be strictly linear, and the distribution of the variables is potentially non-parametric at the cross-country level.

Gap mapping is becoming an increasingly common method for detecting discrepancies between the situation on the ground and how resources are distributed. In this paper, the approach was adjusted to measure the extent to which institutional resources align with the interests expressed by the scientific community. To go beyond a strictly correlational analysis, we have integrated the gap mapping method [19] into the analysis of the overlap among institutional indices (scatter plot). Its purpose is to identify structural patterns in the distribution of research in relation to the socio-economic and institutional capacities of the EU27 states. Unlike correlation coefficients, which test the existence of a global statistical relationship between variables, gap mapping analysis highlights structural discrepancies between institutional reality and academic production.

The approach involves comparing the two constructed dimensions:

- (a) The Composite Socio-Economic and Institutional Index ($CSEI_i$), used as a proxy for the structural capacity of states;
- (b) The intensity of scientific production, measured by the total number of publications associated with each state.

In this study, research intensity refers to the relative visibility of countries in the analysed scientific field, measured through publication output. It does not represent research efficiency or scientific productivity per researcher.

In the case of the composite socio-economic and institutional index ($CSEI_i$), standardisation is implicit, as it was constructed exclusively from the normalised values of the three component indicators. Regarding the intensity of scientific production, the number of publications was standardised to the range 0–1, according to the Formula

(1) presented above, to ensure comparability between the two dimensions. Subsequently, the EU27 member states were classified in a 2×2 matrix. To carry out the gap-mapping analysis, a two-dimensional scatter plot was constructed using the Composite Socio-Economic and Institutional Index ($CSEI_i$) on the X-axis and the standardized research intensity indicator on the Y-axis. The plot was divided into four quadrants using the mean values of both variables as reference lines, allowing countries to be classified according to their relative institutional capacity and research intensity. The plot was divided into four quadrants by introducing horizontal and vertical reference lines corresponding to the mean values of each variable. The EU27 mean served as a baseline to clearly separate nations performing above and below the European average. This method is standard practice in quadrant-based comparative studies. Thus, this procedure allowed us to classify countries according to their relative position in relation to the overall EU27 average. In this way, we wanted to construct four structural categories:

- States with high capacity and high scientific production (structural alignment);
- States with high capacity but low scientific production;
- States with low capacity but high research intensity;
- States with low values for both dimensions (dual underperformance).

Because absolute publication counts may favour countries with larger populations, an additional robustness analysis was conducted using a population-adjusted research intensity indicator. Specifically, scientific output was recalculated as the number of publications per million inhabitants using population data from the World Bank database. The population-adjusted research intensity indicator (PRI) was calculated as follows (5):

$$PRI_i = \frac{P_i}{Pop_i} \times 1.000.000 \quad (5)$$

where PRI_i represents the population-adjusted research intensity for country i ; P_i denotes the total number of publications associated with country i and Pop_i represents the average population of country i over the analysed period (2010–2024). The baseline analysis based on absolute publication counts was retained because the objective of the study is to evaluate the visibility of EU27 countries in the scientific literature, while the supplementary indicator assesses whether the main findings remain valid after controlling for differences in country size. Therefore, the Spearman correlation analysis was repeated using the population-adjusted research intensity indicator. This additional test was conducted to verify whether the relationship between institutional capacity and research output was sensitive to the measurement of scientific production. It has to be mentioned that population data from the World Bank database were used exclusively to adjust the research intensity indicator in the robustness analysis and were not included in the construction of the Composite Socio-Economic and Institutional Index ($CSEI_i$).

4. Results

4.1. Thematic Structure of Literature–Bibliometric Analysis

The beginning of this analysis is marked by the keyword map, presented in Figure 2, which highlights, through the identification of four clusters, a relatively clear structuring of research directions. Thus, the red cluster concentrates terms mainly associated with the macroeconomic dimension and public policy responses. Words such as “impact”, “economic stability”, “politics”, “inflation” or “financial crisis” suggest that a significant part of the literature analyses the effects of climate risks through the lens of economic shocks and adjustment mechanisms. Also, the inclusion of terms such as “COVID-19” or “volatility” indicates a recent trend toward integrating overlapping crises, suggesting that researchers no longer treat climate change in isolation but in interdependence with other sources of instability.

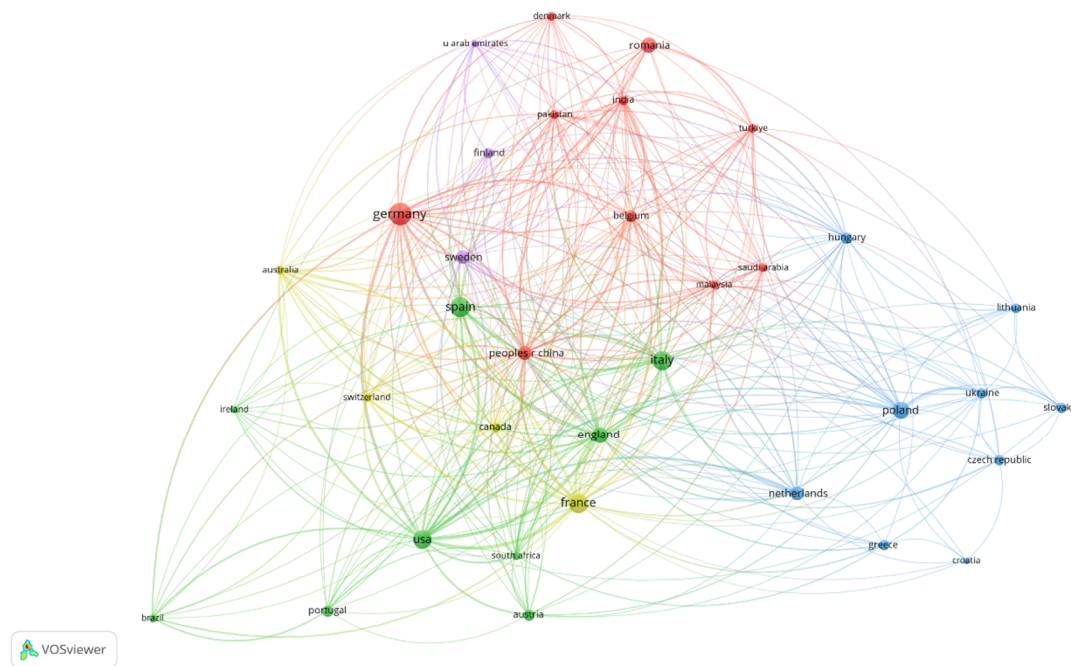


Figure 3. Scientific co-authorship network, based on the countries where the documents were published. Source: data processing by the author in VOSviewer. (version 1.6.20).

Taken together, the results of the bibliometric analysis highlight that the relationship among climate risks, fiscal capacity, and economic stability has become increasingly interdisciplinary. It is structured around well-defined thematic cores and collaboration networks. The two maps suggest not only the diversity of research directions but also the existence of geographical and institutional poles that influence scientific production.

The thematic structure shows that research in this field is increasingly focused on integrated solutions that link climate risks to economic stability and fiscal capacity. This evolution clearly shows a maturation of the field: we are moving from isolated analyses to a systemic approach, in which climate, economic and institutional policies cannot be treated separately.

Although these conclusions confirm the field's maturity and interdisciplinary nature, they also reveal a concentration of research within certain institutions and regions. This does not prevent us from questioning whether the information obtained is truly representative.

4.2. Temporal Evolution Analysis

To complement the bibliometric analysis, we investigated how the field has evolved over time in relation to key indicators of scientific performance. This analysis tracks how the field of research has evolved over time, using two main indicators: the number of publications and the number of citations, to understand both academic interest and scientific impact.

The data, taken from the Web of Science Core Collection, shows that between 2002 and 2010, interest in this topic was low, with few papers and citations. After 2010, however, a gradual increase is observed, and after 2015–2016 the field begins to develop much more rapidly, amid increasing global concerns about climate change. After 2020, this evolution becomes even more evident, with a strong increase in both publications and citations, which shows that the field has consolidated and become increasingly relevant in the specialised literature. At the same time, the COVID-19 pandemic has increased interest in systemic risks and in the links between the economy and the climate. Overall, a clear evolution can be observed: from an incipient phase of research to a stage of maturation and consolidation of the field. This analysis is important because it provides a clear understanding of research dynamics and helps identify key moments that have influenced the field's development. (Figure 4).

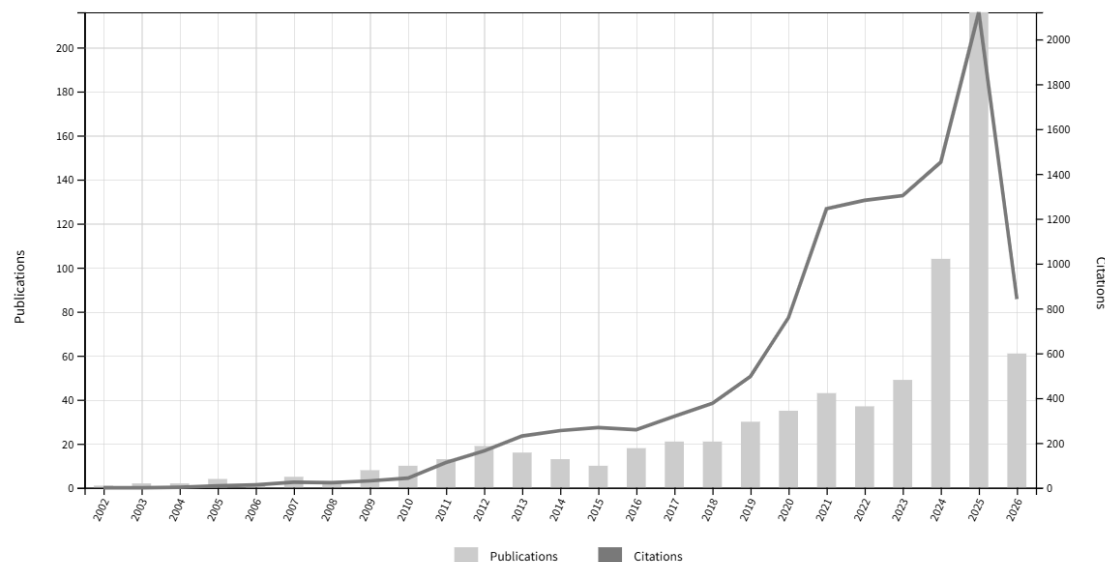


Figure 4. Publications and citation numbers distributed by year. Source: author's data processing in Web of Science.

Another relevant aspect is that this dynamic overlaps with periods of global crisis, such as the COVID-19 pandemic, which brought to the fore the idea of systemic risk and interdependence among different types of shocks. As a result, research has evolved from simpler approaches that focused on costs and vulnerabilities to more complex perspectives that include concepts such as resilience, sustainability, and the role of public policy. The evolution of citations confirms this change. If at the beginning of the period the impact was low, after 2018–2019 a rapid increase is observed, a sign of the consolidation of the field. The high level reached around 2025 indicates that recent works have become important landmarks. As for the decrease in 2026, it is explained by the natural delay between publication and citation accumulation. Overall, we observe a clear trajectory over time. Thus, from an incipient phase of limited interest, there follows a period of rapid expansion and, subsequently, a maturation stage in which research becomes more coherent and relevant. Thus, studies in this field have not only increased in volume but have also diversified and deepened, adapting to the complexity of current challenges.

4.3. Assessing the Relationship between Socio-Economic and Institutional Capacity and Scientific Production

The result is a synthetic indicator that enables the classification of countries by their socio-economic and institutional capacity. In the final stage, we analysed the relationship between this composite index and research intensity, measured by the total number of publications. For this, we used a scatter plot (Figure 5), which allowed us to identify general patterns and potential discrepancies between levels of institutional development and academic visibility. It is worth noting that the Composite Socio-Economic and Institutional Index ($CSEI_i$) is represented on the X-axis, while the standardized intensity indicator is represented on the Y-axis.

The scatter plot does not indicate a clear systematic relationship between socio-economic and institutional capacity and scientific output. Although some countries with higher institutional capacity display greater research visibility, the overall distribution suggests substantial heterogeneity among EU27 states. However, this pattern is not consistent across the EU27 and does not translate into a meaningful overall association. Differences in research visibility may reflect variations in academic resources, research infrastructure or participation in international research networks rather than institutional capacity alone. The heterogeneous pattern is further illustrated by several exceptions. Some developed countries are less represented in the literature, indicating certain gaps in research. At the same time, some less developed countries attract more attention, perhaps due to their vulnerability or higher climate risks. In general, countries in Western Europe tend to exhibit higher levels of socio-economic and institutional capacity and a more visible presence in the specialised literature, but the relationship is not uniform. There are also countries with high institutional scores but a relatively low contribution to scientific output in the analysed field. Overall, the results indicate a regional imbalance in socio-economic and institutional capacity, as well as in research contributions, with the literature not uniformly reflecting the realities of EU states.

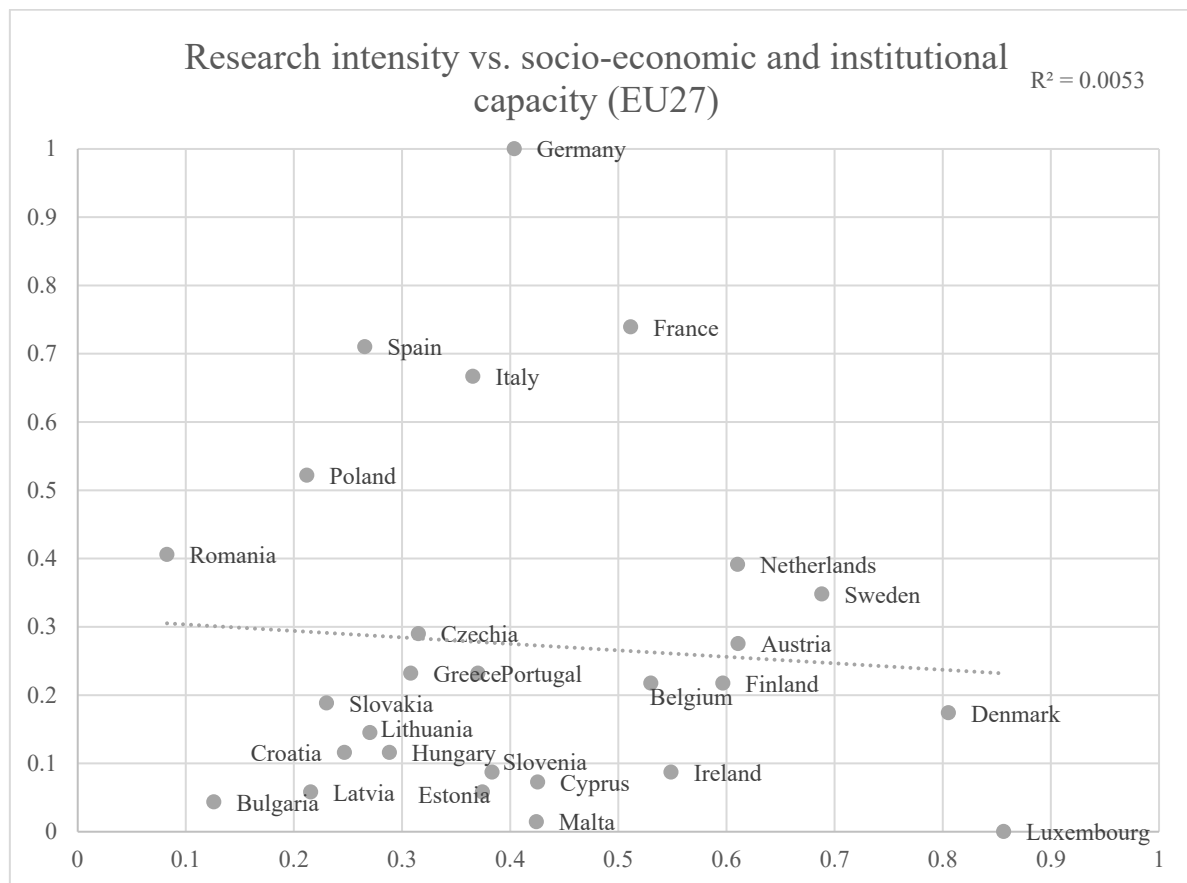


Figure 5. Distribution of EU27 states by composite index of socio-economic capacity and scientific output (2010–2024). Source: data processing by the author in Microsoft Excel 2019 (version 2607). Note: The grey dotted line represents the linear trendline and the R^2 value indicates the goodness of fit of the linear relationship.

To statistically validate the relationship observed graphically, we calculated the Spearman correlation coefficient, which is appropriate for nonlinear relationships. The result obtained ($\rho = -0.04032$) indicates a negligible negative association that is statistically insignificant between the composite index of socio-economic and institutional capacity and the intensity of scientific production. Therefore, the empirical data do not confirm hypothesis H1, which predicted a direct proportional relationship between the levels of socio-economic and institutional development and the intensity of research activities. At the same time, the low coefficient of determination ($R^2 = 0.0053$) in the scatter plot suggests that the variation in the level of research is explained to a very small extent by differences between the states. The results demonstrate that the interaction between institutional development and research intensity is much more nuanced than a simple proportionality would suggest. To fully understand this phenomenon, future studies focused on a detailed analysis of each national context are essential.

Following the application of the gap mapping method, the scatter plot was divided into four quadrants (Figure 6), according to the mean values of the Composite Socio-Economic and Institutional Index (X-axis) and standardized research intensity (Y-axis). Accordingly, the upper-left quadrant includes “Over-Researched Low Capacity” countries, the upper-right quadrant represents “Structural Alignment”, the lower-right quadrant contains “Under-Researched High-Capacity” countries, whereas the lower-left quadrant corresponds to “Dual Underperformance”.

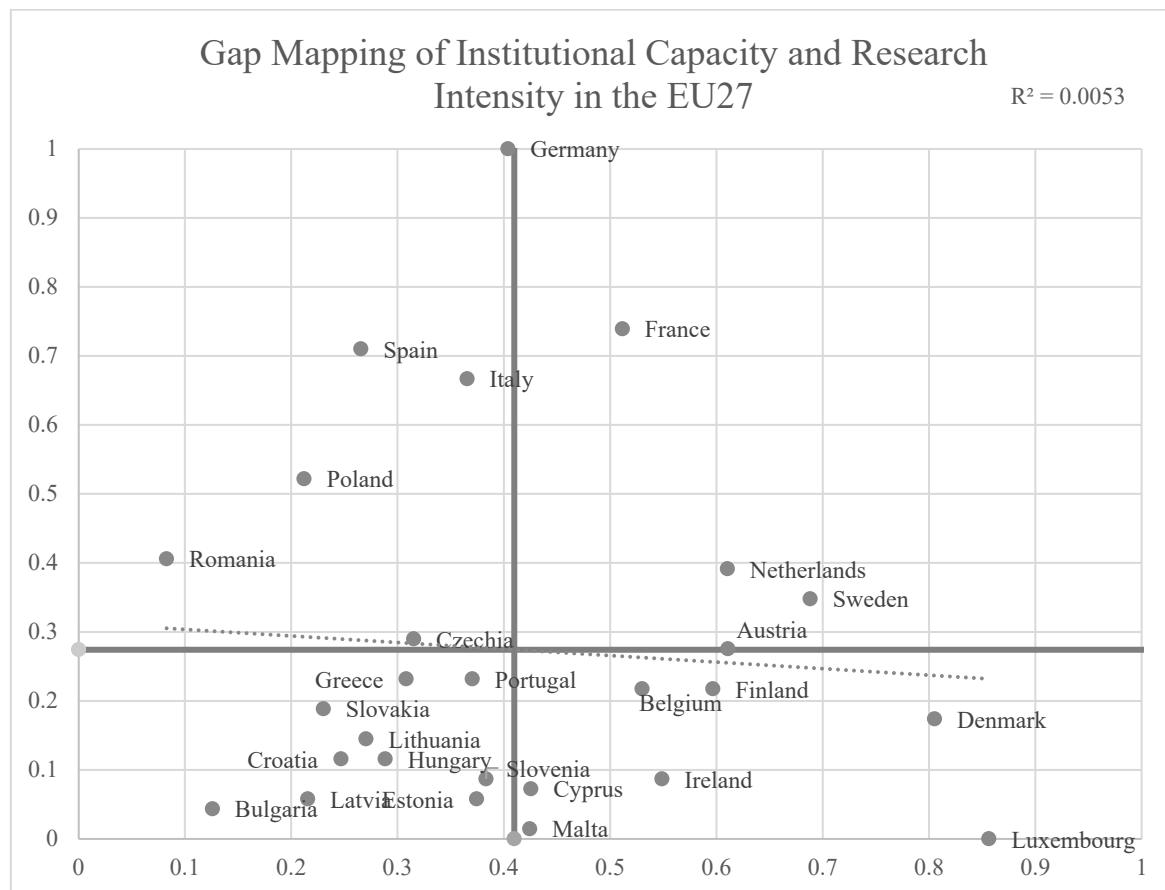


Figure 6. Gap Mapping of Institutional Capacity and Research Intensity in the EU27. Source: data processing by the author in Microsoft Excel 2019 (version 2607). Note: The grey dotted line represents the linear trendline and the R^2 value indicates the goodness of fit of the linear relationship.

Table 2 presents data on the countries analysed and the groups they belong to, providing a clearer picture of this distribution. It is worth mentioning that the classification of states into the four categories must be interpreted in relation to the structure of the composite index ($CSEI_i$) used. Occupying these places in the ranking does not indicate reduced institutional capacity per se; rather, it reflects the relative positioning resulting from applying an equal-weighting method to calculate the Composite Socio-Economic and Institutional Index ($CSEI_i$). Thus, the classification does not exclusively reflect the general level of economic development but rather the relative positioning resulting from the aggregation of the three dimensions used: GDP per capita, government effectiveness, and tax revenues. Consequently, certain developed states may appear, for example, in the “over-researched low-capacity” category, not as a result of a reduced institutional capacity in an absolute sense, but because of the lower values recorded for one of the components of the composite index. One such example is Germany, which was distributed in the “over-researched low-capacity” category. Germany records high levels of GDP per capita and government effectiveness, but relatively low values of tax revenues as a percentage of GDP. Thus, when using a simple arithmetic average to calculate the $CSEI_i$, this tax component lowers the final score, resulting in a relatively low position relative to the general perception of this state’s institutional capacity.

Of the 27 EU Member States, 10 belong to the insufficient double performance category, 7 to the under-researched high capacity category, 6 to the over-researched low capacity category and 4 to the structural alignment category. This distribution further highlights the uneven relationship between institutional capacity and scientific visibility across the European Union. The majority of countries fall into the category of “Dual Underperformance”, indicating an uneven distribution of institutional capacity and scientific visibility in the EU. However, the fact that some countries have strong infrastructure yet low visibility shows that institutional resources do not automatically guarantee major scientific impact. These results indicate a discrepancy between existing knowledge and the factual situation, highlighting that the scientific community’s concerns are not always aligned with the economic and institutional structural resources of EU member countries.

Table 2. Classification of EU27 states based on gap mapping analysis.

No.	Country	Gap Mapping Category
1.	Czechia	Over-Researched Low-Capacity
2.	Germany	
3.	Italy	
4.	Poland	
5.	Romania	
6.	Spain	
7.	Austria	Structural Alignment
8.	France	
9.	Netherlands	
10.	Sweden	
11.	Belgium	Under-researched High Capacity
12.	Cyprus	
13.	Denmark	
14.	Finland	
15.	Ireland	
16.	Luxembourg	
17.	Malta	
18.	Bulgaria	Dual Underperformance
19.	Croatia	
20.	Estonia	
21.	Greece	
22.	Hungary	
23.	Latvia	
24.	Lithuania	
25.	Portugal	
26.	Slovakia	
27.	Slovenia	

Source: data processing by the author.

To assess whether the inclusion of Tax Revenue influenced the gap-mapping results, an additional robustness analysis (Figure 7) was conducted. For this purpose, an alternative two-indicator Composite Socio-Economic and Institutional Index was constructed, based exclusively on GDP per capita and Government Effectiveness. This supplementary specification evaluates whether the exclusion of Tax Revenue materially affects the classification of EU27 Member States and the overall structural patterns identified in the baseline analysis.

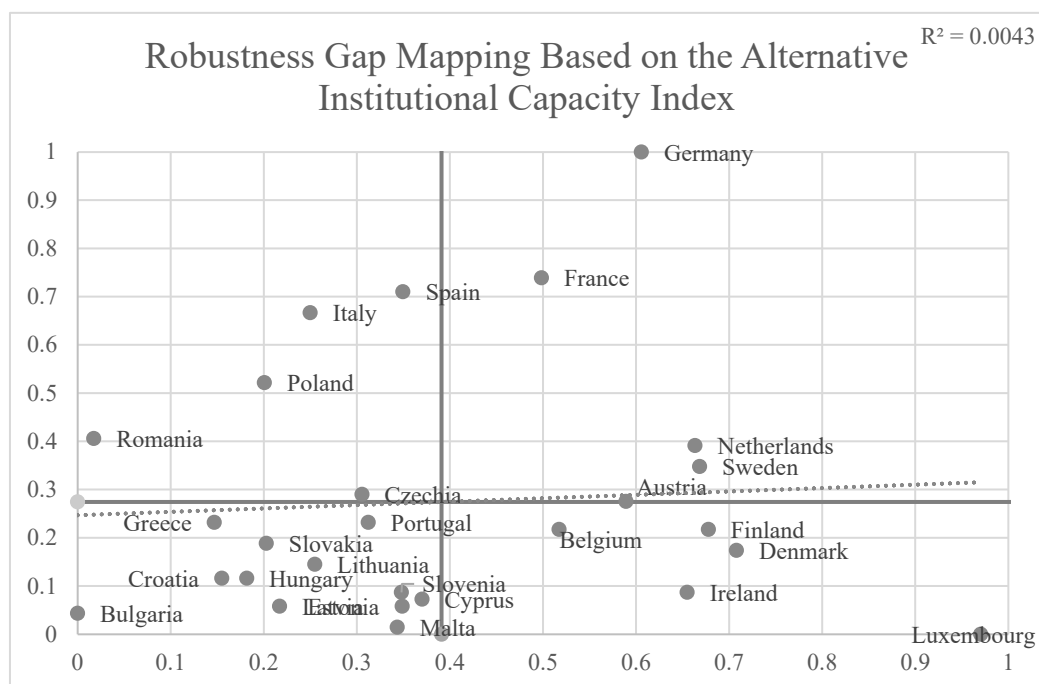


Figure 7. Robustness Gap Mapping Based on The Alternative Institutional Capacity Index. Source: data processing by the author in Microsoft Excel. Note: The grey dotted line represents the linear trendline and the R^2 value indicates the goodness of fit of the linear relationship.

Figure 7 presents the robustness version of the gap-mapping analysis based on the alternative institutional capacity index. The overall distribution of countries remains broadly comparable with the baseline specification. This suggests that the main relationship between institutional capacity and research intensity is not substantially affected by the inclusion of the fiscal component. Although, some countries experience changes in their relative position due to the modified index composition, the four-quadrant structure is largely preserved. Moreover, the coefficient of determination changes only marginally, from $R^2 = 0.0053$ in the baseline specification to $R^2 = 0.0043$ in the robustness analysis. This indicates that institutional capacity explains only a negligible share of the variation in research intensity regardless of the index specification. The resulting country-level classification is presented in Table 3.

Table 3. Robustness Gap Mapping Classification of EU27 States Based on the Alternative $CSEI_t$ Specification.

No.	Country	Gap Mapping Category
1.	Czechia	Over-Researched Low-Capacity
2.	Italy	
3.	Poland	
4.	Romania	
5.	Spain	
6.	Austria	Structural Alignment
7.	France	
8.	Germany	
9.	Netherlands	
10.	Sweden	
11.	Belgium	Under-researched High Capacity
12.	Denmark	
13.	Finland	
14.	Ireland	
15.	Luxembourg	
16.	Bulgaria	Dual Underperformance
17.	Croatia	
18.	Cyprus	
19.	Estonia	
20.	Greece	
21.	Hungary	
22.	Latvia	
23.	Lithuania	
24.	Malta	
25.	Portugal	
26.	Slovakia	
27.	Slovenia	

Source: data processing by the author.

The robustness classification indicates that the exclusion of Tax Revenue does not alter the main interpretation of the gap-mapping analysis. However, some country-level changes occur, reflecting the sensitivity of individual classifications to the composition of the composite index. In particular, the reclassification of the countries such as Germany highlights that the use of alternative aggregation schemes may influence specific positions, while the broader pattern of incomplete alignment between institutional capacity and research intensity remains unchanged.

Through Spearman correlation, gap mapping analyses and robustness checks based on alternative specifications of both institutional capacity and research intensity, we observe that aggregate statistical indicators mask substantial structural heterogeneity among countries. Thus, although institutional capacity does not explain scientific output at the macro level, the mapping highlights imbalances (over- and underrepresentation) in the academic environment of the EU. Furthermore, when research intensity is adjusted for population size, the Spearman coefficient changes from $\rho = -0.04032$ to $\rho = 0.1416$, remaining weak and statistically non-significant. This indicates that the absence of a meaningful relationship is not driven exclusively by differences in country size.

5. Conclusions

Through our analyses, we identified a significant increase in interest in the relationship among climate risks, fiscal capacity, and economic stability over the last two decades. The field under study has become more clearly defined, shifting from general descriptions to models that capture complex interactions. This confirms an increasingly interdisciplinary approach. The bibliometric analysis highlights the structuring of the literature around major directions, ranging from macroeconomics and public policy to sustainability and advanced methods. The evolution has not been uniform, as the number of publications increased sharply after 2015 and accelerated

significantly after 2020. This indicates that climate change has moved to the center of economic and political debates. In parallel, the impact of the works is increasing, suggesting the field's maturation and better integration of theoretical and empirical dimensions. The expansion of scientific collaboration networks supports this dynamic. But these remain concentrated around the dominant geographic poles, especially in Western Europe.

An important result comes from the analysis of the correlation between institutional indicators and scientific production. At a descriptive level, some highly developed countries with strong institutions display relatively greater scientific visibility, although this pattern is not consistent across the EU27 and is not supported by the correlation analysis. However, the overall distribution does not indicate a consistent positive relationship between institutional capacity and research intensity. The empirical findings do not support H1. Despite some descriptive differences among countries, Spearman's rank correlation indicates no statistically significant association between institutional/socioeconomic capacity and research intensity in the EU27. However, by integrating gap mapping analysis, it was possible to overcome the limitations of a strictly correlational approach and highlight structural patterns in the distribution of research within the EU27. On the contrary, Member States can be grouped into distinct categories of academic alignment, under-representation and over-representation. This perspective suggests the existence of a structural geography of research, in which academic visibility does not always reflect the real level of socio-economic and institutional capacity. The gap analysis grouped EU member states into four distinct categories, including under-researched high-capacity countries and over-researched low-capacity countries. This demonstrates that aggregated statistical data actually hide major structural asymmetries.

Overall, the results suggest that the literature does not reflect the economic and institutional realities in the European Union in a balanced way, which may influence both research directions and public policies. This suggests a discrepancy between the “geography of research” and the “geography of institutional capacity”, which may lead to a partial understanding of climate risks at the European level. These findings indicate an observed mismatch between research intensity and institutional capacity. However, because the analysis is correlational rather than causal, the results should not be interpreted as evidence that institutional capacity directly determines research intensity. Instead, they highlight patterns that may inform future investigations and policy discussions. More importantly, the study reveals an empirical pattern suggesting that scientific production and institutional capacity follow partially distinct spatial logics, although no causal relationship can be inferred from the present analysis.

The robustness analyses further confirmed that the main findings remain stable under alternative specifications of both the composite institutional index and the research-intensity indicator, reinforcing the conclusion that the absence of a statistically meaningful association is not driven by the specific measurement approach adopted in this study.

However, some reservations regarding the limited studies are warranted. First, the bibliometric analysis relies exclusively on the Web of Science Core Collection. Although this database is widely recognized for its high-quality indexing and is frequently used in bibliometric studies, its exclusive use may introduce selection bias by excluding relevant publications indexed in databases such as Scopus or Dimensions. Consequently, the findings should be interpreted with caution, as the observed publication patterns may not be fully generalizable to the entire body of international scientific literature. Second, the Composite Socio-Economic and Institutional Index only partially reflects institutional capacity. In addition, the predominantly descriptive and correlational nature of the analysis limits the ability to establish causal relationships.

On the other hand, the paper suggests new directions for study, such as including governance quality and climate vulnerability, and expanding the analysis to the global level to test the generality of the conclusions. Studies could also adopt causal econometric models and dynamic panel techniques, thereby moving from simple correlational analysis to the precise determination of cause-and-effect relationships and of how variables interact.

In terms of methods, our research suggests that by combining bibliometric data, institutional indicators, and gap maps, we can better understand inconsistencies in research systems. This combination is more effective than classical techniques that measure correlation alone.

Finally, the findings suggest that the development of scientific knowledge at the European Union level is not systematically aligned with the socio-economic potential of all regions. Identifying and correcting this imbalance is vital for a more inclusive and applicable scientific direction in public policies targeting climate change, taxation and economic stability.

Author Contributions

O.-R.L.: conceptualisation, methodology, writing—original draft preparation, investigation, supervision, writing—reviewing and editing; A.-D.M.: methodology, software, data curation, writing—original draft preparation, visualisation, investigation, validation, writing—reviewing and editing; N.C.M.: writing—original

draft preparation, investigation, writing—reviewing and editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Publicly available datasets were analysed in this study. The data were obtained from the Web of Science Core Collection database and the World Bank Open Data database.

Conflicts of Interest

Given the role as editorial board member, Oana-Ramona Lobonț had no involvement in the peer review of this paper and had no access to information regarding its peer-review process. Full responsibility for the editorial process of this paper was delegated to another editor of the journal. All authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

During the preparation of this manuscript, the authors used large language models (such as Grammarly, OpenAI ChatGPT and Google Gemini) for structural refinement, academic English text editing, and formatting alignment with the journal template. The authors have thoroughly reviewed and edited the output and take full responsibility for the content and integrity of this publication.

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