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Climate Risk in Banking and Financial Stability: A Bibliometric Review of Emerging Research Frontiers (2014-2025)

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Abstract:
This study investigates the evolution of research on climate risk in banking and financial stability over the period 2014–2025 through a bibliometric analysis of the Web of Science database. After applying the selection criteria, a final sample of 189 documents was retained. The analysis was conducted in RStudio using the Bibliometrix package and its Biblioshiny interface. The results show a marked expansion of the field, particularly after 2021, with an annual growth rate of 21.15%. The literature is dispersed across 108 sources, but a clear publication core is led by Journal of Financial Stability, International Review of Financial Analysis, and Finance Research Letters. The authorship structure remains distributed, with 499 authors, while 89.2% of them contributed only one publication, broadly consistent with Lotka's Law. Conceptually, the field is organised around a central core formed by financial stability, climate risk, and climate change. Thematic analysis further shows that carbon tax, climate transition risk, and climate policy uncertainty function as motor themes, whereas central banking and stress testing appear as niche themes.

Keywords: climate risk; banking; financial stability; bibliometric analysis; sustainable finance
Jel Classification Codes : G21; G28; Q54; Q56; E58

الملخص:
تبحث هذه الدراسة في تطور البحوث المتعلقة بالمخاطر المناخية في القطاع المصرفي والاستقرار المالي خلال الفترة الممتدة من 2014 إلى 2025، وذلك من خلال إجراء تحليل ببليومتري لقاعدة بيانات شبكة العلوم. وبعد تطبيق معايير الاختيار، تم الاحتفاظ بعينة نهائية مكونة من 189 وثيقة. وقد أُجري التحليل باستخدام برنامج آر ستوديو، بالاعتماد على حزمة بيبليومتريكس وواجهتها التفاعلية بيبليوشايني. وتُظهر النتائج توسعًا ملحوظًا في هذا المجال البحثي، لا سيما بعد عام 2021، بمعدل نمو سنوي بلغ 21.15%. وتتوزع الأدبيات العلمية على 108 مصادر، مع وجود نواة واضحة للنشر تتصدرها مجلات مجلة الاستقرار المالي، والمجلة الدولية للتحليل المالي، ورسائل البحث في التمويل. كما يظل هيكل التأليف موزعًا، إذ بلغ عدد المؤلفين 499 مؤلفًا، بينما ساهم 89.2% منهم بمنشور واحد فقط، وهو ما يتوافق بصورة عامة مع قانون لوتكا. ومن الناحية المفاهيمية، ينتظم هذا المجال حول نواة مركزية تتشكل من الاستقرار المالي، والمخاطر المناخية، والتغير المناخي. كما يُظهر التحليل الموضوعي أن ضريبة الكربون، ومخاطر التحول المناخي، وعدم اليقين بشأن السياسات المناخية تمثل موضوعات محركة، في حين يظهر كل من البنوك المركزية واختبارات الضغط كموضوعات متخصصة.

الكلمات المفتاحية: مخاطر المناخية؛ قطاع المصرفي؛ استقرار المالي؛ تحليل ببليومتري؛ تمويل مستدام.
تصنيف جال: G21؛ G28؛ Q54؛ Q56؛ E58.

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I- Introduction :

Climate change has progressively moved from being treated as a purely environmental issue to being recognised as a major source of economic and financial vulnerability. In recent years, its implications have extended beyond ecological damage to affect asset valuation, credit quality, investment behaviour, and the resilience of financial institutions. Within this broader context, the banking sector has attracted increasing attention because of its central role in financial intermediation, credit allocation, and systemic stability. A growing body of literature now examines how climate-related shocks are transmitted through banking systems and financial markets, confirming that climate risk has become an increasingly important issue in debates on prudential supervision, financial regulation, and systemic resilience (Monasterolo, 2020; Carè, 2023; Carè et al., 2024; Pacelli et al., 2025).

The importance of the variables addressed in this study lies in the fact that each of them captures a key dimension of a rapidly evolving research and policy agenda. Climate risk has emerged as a multidimensional source of uncertainty that affects financial systems through both physical and transition channels. Banking provides a particularly relevant institutional setting, since banks transmit climate-related pressures into lending, pricing, risk assessment, and balance-sheet adjustments. Financial stability, in turn, represents the broader systemic outcome through which climate-related vulnerabilities become relevant not only for individual institutions but also for the resilience of the financial system as a whole. Recent studies have shown that climate-related financial risks are increasingly integrated into central banking, prudential regulation, and macroprudential policy discussions, while empirical work has also begun to document their effects on loan quality, bank stability, and credit-risk assessment (Feridun and Güngör, 2020; Nehrebecka, 2021; Zhang et al., 2024; Redondo and Aracil, 2024; Luangaram et al., 2026).

Despite this rapid expansion, the literature remains fragmented across several overlapping strands, including climate finance, sustainable banking, systemic risk, prudential regulation, central banking, and transition-risk modelling. Existing studies have made valuable contributions to understanding specific parts of the relationship between climate-related shocks and banking stability; however, the intellectual structure of this body of knowledge remains insufficiently synthesised. Recent bibliometric and review-based studies indicate that research on climate-related financial risks is expanding quickly, but also remains fragmented, hybrid, and unevenly structured across topics and disciplines (Jena, 2026; Bringas-Fernández et al., 2025; Suciati, 2025; Vogl et al., 2025). In particular, there is still limited bibliometric evidence focused specifically on how research on climate risk in banking and financial stability has evolved over time, which themes dominate the field, which journals and authors have shaped its development, and which research fronts are currently emerging as key drivers of future inquiry. This gap justifies the need for a dedicated bibliometric investigation capable of mapping the field's conceptual, intellectual, and thematic architecture in a systematic way.

Against this background, the main research problem of the present study can be formulated as follows: **How has the literature on climate risk in banking and financial stability evolved, and what does its bibliometric structure reveal about the dominant themes, influential contributors, and emerging research directions within the field?**

To address this problem, the study is guided by the following sub-questions:

1. How has scientific production on climate risk in banking and financial stability evolved over time?
2. Which journals, authors, and documents have been the most productive and influential in shaping the field?
3. What are the main conceptual clusters and keyword relationships structuring the literature?
4. Which themes appear as basic, motor, niche, or emerging themes in the thematic evolution of the field?
5. To what extent does the field reflect interdisciplinary expansion across banking, climate policy, regulation, and sustainable finance?
6. What research fronts remain underdeveloped and may constitute promising avenues for future investigation?

In response to these questions, this study conducts a bibliometric analysis of the literature indexed in the Web of Science database in order to identify publication trends, source

concentration, authorship patterns, citation structures, conceptual clusters, and thematic evolution. By doing so, the article seeks to provide a structured overview of the field and to clarify how research on climate risk in banking and financial stability has developed into an increasingly visible and policy-relevant domain.

II– Methods and Materials:

II.1 Data Source and Search Strategy

This study adopts a bibliometric approach to examine the development of research on climate risk in banking and financial stability. The analysis seeks to identify the main publication trends, influential sources, conceptual foundations, collaboration patterns, and emerging thematic directions within this research field.

The bibliographic data were retrieved exclusively from the Web of Science Core Collection (WoSCC). This database was selected because it provides high-quality and standardised bibliographic records, including information on authors, institutional affiliations, keywords, cited references, and citation indicators, all of which are essential for reliable bibliometric analysis. It is also widely used in citation-based research and offers an export format that is fully compatible with the Bibliometrix package and its Biblioshiny interface.

The decision to use a single database was also based on methodological considerations. Combining records from several databases may generate duplicate documents, inconsistencies in author names and source titles, and differences in citation counts and indexing practices. These issues require extensive harmonisation and may affect the internal consistency of the bibliometric dataset. The exclusive use of WoSCC therefore enabled the construction of a coherent and standardised database for analysis.

Nevertheless, this choice may limit the comprehensiveness of the study. Although Web of Science applies rigorous indexing standards, it does not cover all publications available in other major databases, such as Scopus, Google Scholar, or specialised regional databases. As a result, some relevant studies, particularly those published in regional journals, recently indexed sources, or conference proceedings, may not have been included. The findings should therefore be interpreted as representing the literature indexed in WoSCC rather than the entire body of research on climate risk in banking and financial stability. Future studies may combine Web of Science and Scopus, provided that appropriate deduplication and metadata-harmonisation procedures are applied.

The search strategy was structured around three main thematic dimensions: climate-related risk, banking, and financial stability. These concepts were combined using Boolean operators and truncation symbols in order to maximise the retrieval of relevant publications while maintaining thematic precision. The search was conducted using the Topic Search field (TS) and covered the period from 2014 to 2025. The year 2014 was selected as the starting point because a preliminary search showed that publications explicitly addressing the intersection of climate-related risk, banking, and financial stability became sufficiently consistent and thematically coherent from that year onwards.

The initial search of the Web of Science Core Collection identified 216 records. A structured screening procedure was then conducted in accordance with the PRISMA 2020 guidelines to ensure the relevance and consistency of the dataset.

In the first stage, records published outside the study period (2014–2025) were excluded, reducing the dataset to 210 records. Subsequently, the eligibility criteria were applied by restricting the document types to research articles, review articles, and early access articles, while excluding editorials, conference papers, book chapters, letters, meeting abstracts, corrections, notes, and other non-peer-reviewed publications. Finally, only English-language publications were retained to ensure linguistic consistency throughout the bibliometric analysis.

Duplicate records were verified during the data preparation stage, and no duplicate publications requiring removal were identified within the Web of Science dataset. After applying all inclusion and exclusion criteria, the final bibliographic dataset consisted of 189 documents (N = 189), which formed the basis for all subsequent analyses.

The literature identification, screening, and selection procedure is summarised in the PRISMA flow diagram presented in Figure 1.

II.2 Data Processing and Analytical Tools

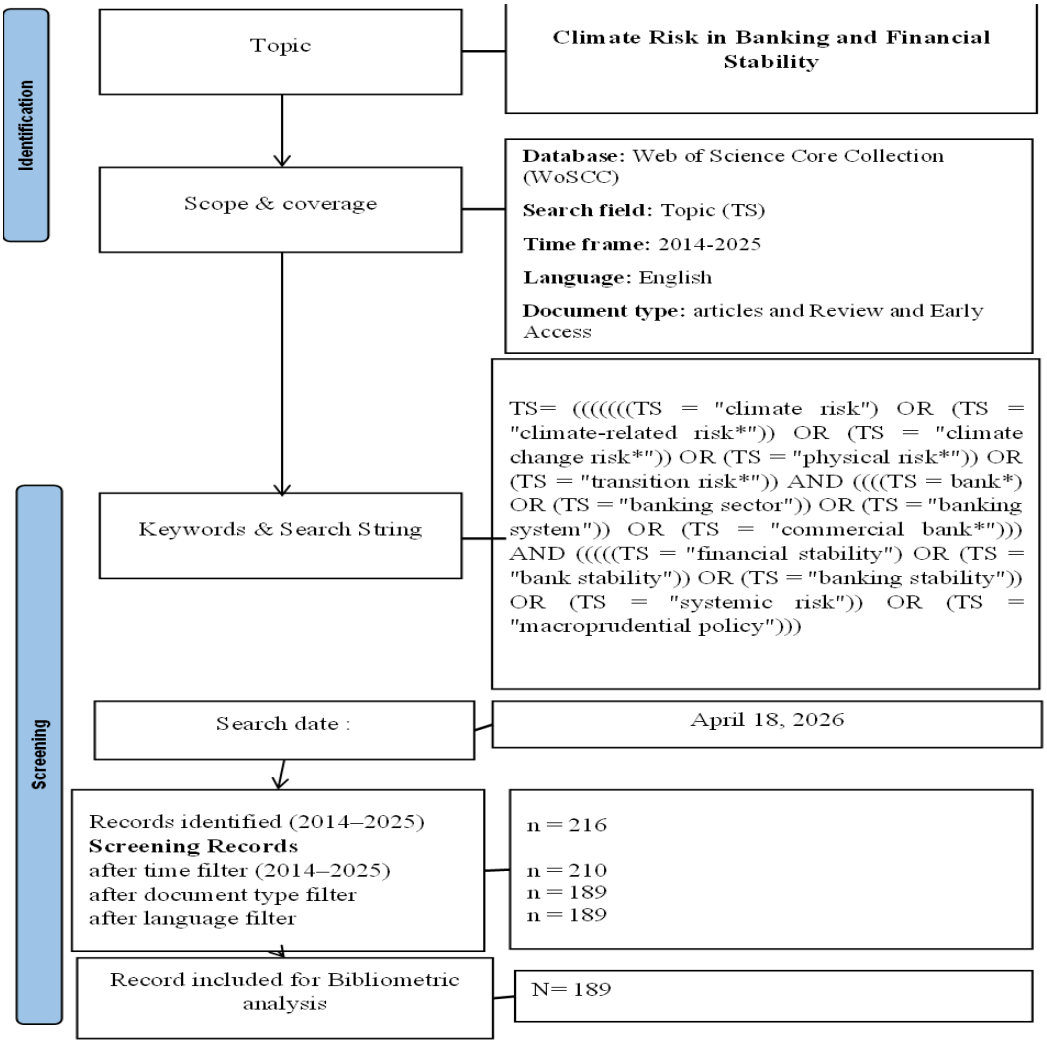
All bibliographic records retrieved from the Web of Science database were exported and analysed using the Bibliometrix package through the Biblioshiny interface in RStudio. Before conducting the analysis, the dataset underwent a systematic cleaning process to improve data quality and consistency. This process included identifying and removing duplicate records, harmonising variations in author names, and standardising keywords and related terms to reduce conceptual fragmentation.

The bibliometric analysis was conducted entirely within the RStudio and Biblioshiny environment. It included descriptive statistical analysis, examination of publication and citation trends, assessment of the productivity of journals and authors, analysis of scientific output by country, keyword co-occurrence analysis, thematic mapping, and thematic evolution analysis.

In addition, Bradford's Law was applied to identify the core journals publishing on the topic, while Lotka's Law was used to examine patterns of author productivity within the field. These methods provided further insight into the distribution of publications across sources and the contribution patterns of researchers.

The use of an integrated analytical environment supported a systematic and consistent examination of the literature on climate risk in banking and financial stability. It also enhanced the transparency and reproducibility of the analytical process.

Figure (1): PRISMA Flow Diagram of the Literature Search and Selection Process



Source: Elaborated by authors based on the PRISMA 2020 Statement

III- Results and discussion :

III. 1. Results

- Descriptive Bibliometric Characteristics

The descriptive bibliometric analysis provides an initial quantitative overview of the literature on climate risk in banking and financial stability. At this stage, the objective is to identify the principal structural features of the dataset, including the volume of scientific production, the diversity of publication sources, the composition of the authorship base, collaboration tendencies, and citation-related performance indicators. Together, these measures help to assess the maturity, visibility, and expansion dynamics of the field. They also establish the analytical foundation for the subsequent exploration of thematic evolution, conceptual relationships, and research frontiers. The main descriptive findings are reported in Table 1.

Table (1): Descriptive statistics

Description	**Results**
Timespan	2014:2025
Sources (Journals, Books, etc)	108
Documents	189
Annual Growth Rate %	21,15
Document Average Age	2,48
Average citations per doc	31,39
DOCUMENT CONTENTS	
Keywords Plus (ID)	309
Author's Keywords (DE)	531
AUTHORS	
Authors	499
Authors of single-authored docs	27
AUTHORS COLLABORATION	
Single-authored docs	29
Co-Authors per Doc	3,04
International co-authorships %	35,98
DOCUMENT TYPES	
article	167
article; early access	16
review	6

Source: Elaborated by authors based on R Studio using biblioshiny

Table 1 presents the main descriptive characteristics of the bibliometric dataset on climate risk in banking and financial stability covering the period 2014–2025. The final dataset comprises 189 documents published across 108 different sources, including journals, books, and other academic outlets. The relatively large number of publication sources compared with the total number of documents suggests that research on this topic remains dispersed across a wide range of disciplines. This pattern reflects the interdisciplinary nature of the field, which integrates perspectives from banking, finance, economics, environmental studies, climate policy, and sustainable finance.

The literature exhibits a strong annual growth rate of 21.15%, indicating a rapid expansion of scientific interest during the study period. This trend suggests that climate-related financial risk has evolved from a relatively specialised research topic into a central issue within both academic research and financial policy discussions. The average document age of 2.48 years further confirms the recent development of the field, with a considerable proportion of publications appearing in the

most recent years.

The dataset records an average of 31.39 citations per document, indicating substantial citation visibility within the analysed literature. This citation performance suggests that several publications have rapidly become influential references in the field. Nevertheless, this indicator should be interpreted with caution, as average citation values may be influenced by a limited number of highly cited seminal studies.

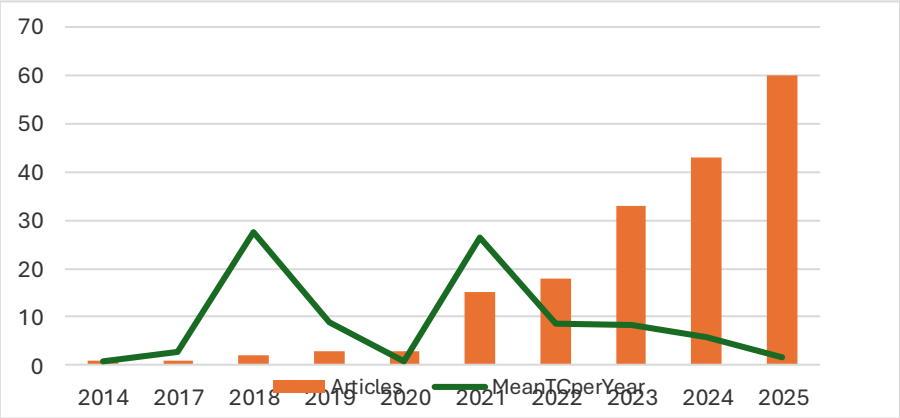
The conceptual structure of the field is characterised by considerable thematic diversity. The dataset contains 309 Keywords Plus and 531 authors' keywords. The higher number of authors' keywords indicates that researchers employ a broad range of concepts to describe climate-related financial risks, banking resilience, financial regulation, and sustainable finance. While this diversity reflects the dynamic evolution of the research field, it may also indicate that a fully standardised conceptual vocabulary has not yet emerged.

A total of 499 authors contributed to the 189 publications, demonstrating broad scholarly participation. Only 29 documents were written by a single author, whereas collaborative publications account for the overwhelming majority of the literature. This finding is reinforced by an average of 3.04 co-authors per document, suggesting that research in this area increasingly relies on multidisciplinary collaboration. Such collaboration is expected given the complexity of climate risk, which requires expertise from finance, economics, environmental science, and regulatory policy.

International collaboration is also well represented, with 35.98% of the publications involving co-authors from different countries. This level of international co-authorship reflects the global relevance of climate-related financial risks and the growing integration of researchers across national boundaries. However, it also indicates that most publications continue to be produced within domestic research networks, suggesting further opportunities for strengthening international scientific cooperation.

Regarding document types, original research articles dominate the literature, accounting for 167 publications, followed by 16 early access articles and only six review papers. The predominance of original research indicates that the field is primarily driven by empirical and methodological contributions. Conversely, the limited number of review studies suggests that there remains scope for more comprehensive evidence syntheses capable of consolidating the rapidly expanding body of knowledge.

Figure (2): Annual Trends in Scientific Production and Mean Citations per Year (2014–2025)



Source: Elaborated by authors based on Web of Science

As illustrated in Figure 2, research on climate risk in banking and financial stability remained limited and relatively fragmented during the period from 2014 to 2020, with only a small number of publications produced annually. A clear turning point emerged in 2021, when the annual scientific output increased to 15 articles, followed by sustained growth to 18 publications in 2022,

33 in 2023, 43 in 2024, and 60 publications in 2025. This remarkable increase indicates that climate-related financial risk has evolved from a relatively specialized research topic into a major area of interest within banking, financial stability, and macroprudential regulation.

Several global developments may explain this rapid expansion. First, the COVID-19 pandemic highlighted the vulnerability of financial systems to large-scale systemic shocks and reinforced interest in financial resilience, risk management, and crisis preparedness. The pandemic also stimulated broader discussions on non-traditional sources of financial risk, including climate-related risks, encouraging researchers to examine how environmental shocks may affect banking stability and financial markets. Second, international climate policy gained considerable momentum after the adoption of stronger global climate commitments, particularly following the 2021 United Nations Climate Change Conference (COP26), which intensified attention to climate-risk disclosure, sustainable finance, and the integration of climate considerations into financial regulation. In parallel, central banks and financial supervisory authorities increasingly incorporated climate stress testing, scenario analysis, and climate-related risk assessment into their supervisory frameworks, further stimulating academic research in this field.

Figure 2 also reveals substantial variation in the mean number of citations per year. Publications published in 2018 and 2021 achieved the highest average citation rates, suggesting that studies produced during these years attracted considerable scholarly attention and contributed significantly to the intellectual development of the field. In contrast, the mean citation rate shows a declining trend for publications after 2021 despite the sharp increase in publication output. This pattern should not be interpreted as evidence of declining scientific quality or relevance. Rather, it is primarily explained by the citation-window effect, whereby recently published articles have had less time to accumulate citations than earlier studies.

- Core Journals and Source Impact

Table (2): Most Relevant Sources

Sources	Articles
JOURNAL OF FINANCIAL STABILITY	14
INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS	12
FINANCE RESEARCH LETTERS	9
RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE	7
CLIMATE POLICY	6
INTERNATIONAL REVIEW OF ECONOMICS \& FINANCE	5
ASIA-PACIFIC JOURNAL OF FINANCIAL STUDIES	3
BUSINESS STRATEGY AND THE ENVIRONMENT	3
ECONOMIC CHANGE AND RESTRUCTURING	3
JOURNAL OF ENVIRONMENTAL MANAGEMENT	3

Source: Elaborated by authors based on Web of Science

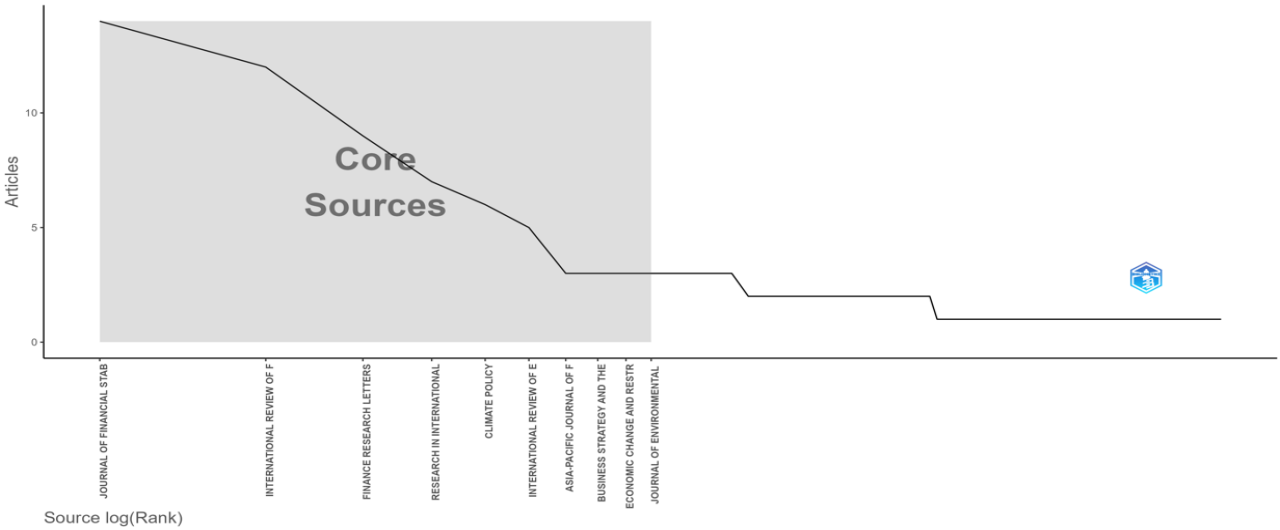
Table 2 shows that research on climate risk in banking and financial stability is mainly concentrated in finance-oriented journals. The Journal of Financial Stability ranks first with 14 articles, followed by the International Review of Financial Analysis with 12 articles and Finance Research Letters with 9. Together, these three journals account for 35 of the 65 publications listed in the table, or approximately 53.8%, indicating a clear concentration of research in a limited number of specialized financial outlets.

This pattern reflects the dominant treatment of climate risk as a financial and systemic issue related to banking stability, credit risk, asset valuation, lending decisions, and macrofinancial

resilience. The presence of journals such as Research in International Business and Finance and the International Review of Economics & Finance also highlights the importance of international and empirical financial perspectives.

At the same time, the inclusion of Climate Policy, Business Strategy and the Environment, and the Journal of Environmental Management demonstrates the growing interdisciplinary nature of the field. These journals connect financial risk with climate governance, environmental policy, and corporate sustainability. However, their lower publication counts show that the literature remains primarily rooted in finance and economics.

Figure (3): Core Journal Concentration According to Bradford's Law

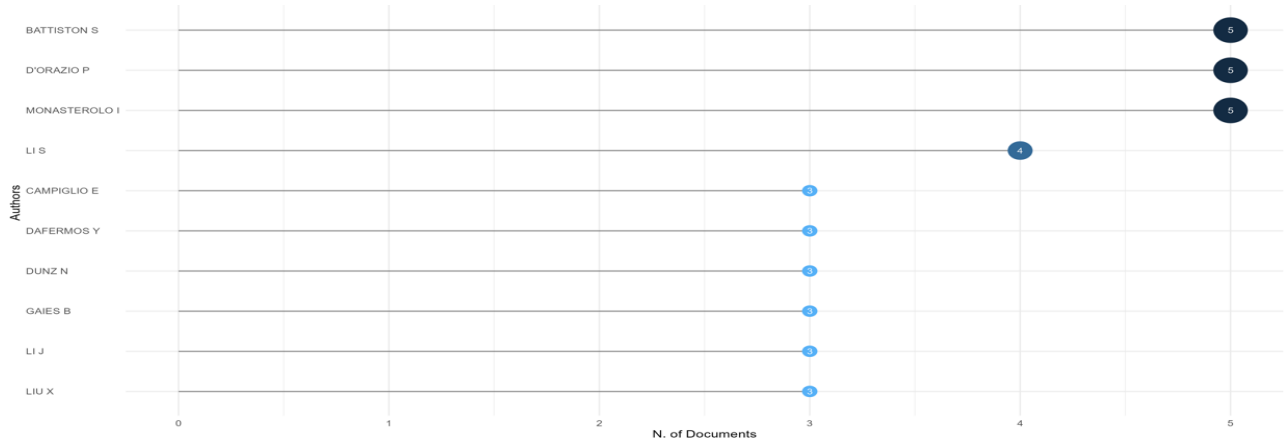


Source: Elaborated by authors based on Web of Scince data using Biblioshiny.

As shown in Figure 3, the Bradford distribution reveals a strong concentration of publications in a limited number of journals. Zone 1 includes only 10 sources but accounts for 65 articles, led by the Journal of Financial Stability, the International Review of Financial Analysis, and Finance Research Letters. This concentration reflects the central role of specialised finance journals in shaping research on climate risk and financial stability. The long tail, composed of journals publishing only a few articles, indicates the gradual expansion of the topic into sustainability, climate policy, environmental economics, and regulation. Overall, the pattern is consistent with Bradford's Law and highlights both the consolidation of the field and its growing interdisciplinary diffusion.

- Author Productivity Patterns

Figure (4): Most relevant Author's



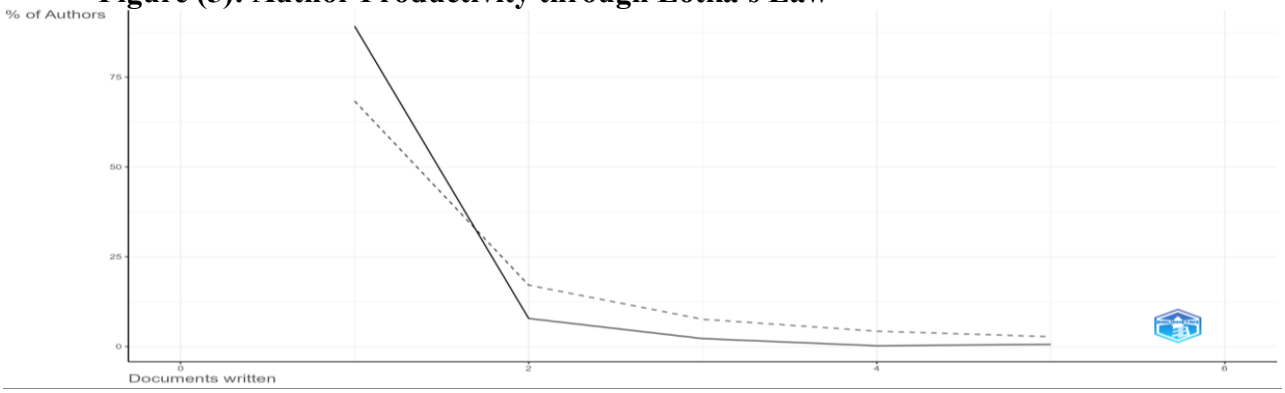
Source: Elaborated by authors based on Web of Science data using Biblioshiny

Figure 4 presents the most productive authors in the field of climate risk in banking and financial stability. As shown in the figure, Battiston, S., D'Orazio, P., and Monasterolo, I. lead the ranking with five publications each, while Li, S. follows with four documents. The remaining authors within the top group-Campiglio, E., Dafermos, Y., Dunz, N., Gaies, B., Li, J., and Liu, X.- each contributed three publications.

The relatively limited variation in publication counts among these leading contributors suggests a distributed authorship structure rather than one dominated by a single highly prolific scholar. This pattern indicates that research on climate risk in banking and financial stability is being shaped by several active and recurrent authors, reflecting the collaborative and evolving nature of the field. Moreover, the presence of different citation averages among these contributors suggests that scholarly influence is not determined solely by productivity, but also by the varying intellectual impact of their work.

Figure 5 demonstrates that author productivity in the field of climate risk in banking and financial stability broadly follows the inverse power-law pattern predicted by Lotka's Law. A large majority of authors (89.2%) produced only a single publication; a proportion notably higher than the 68.3% expected under the theoretical model. The share of authors declines sharply as productivity increases, with only 7.8% contributing two documents and progressively smaller proportions producing three or more.

Figure (5): Author Productivity through Lotka's Law



Source: Elaborated by authors based on Web of Science data using Biblioshiny.

The empirical distribution remains generally consistent with the theoretical curve in its overall structure, although some deviations appear in the upper productivity classes. A very limited group of recurring authors accounts for multiple publications, while the overwhelming majority

remain occasional contributors. This configuration reflects a typical bibliometric pattern characterised by a broad base of one-time authors and a small core of more sustained contributors supporting the cumulative development of the field.

- Most Influential Publications

Table (3): Most Globally Cited Documents

Paper	DOI	Total Citations	TC per Year
CAMPIGLIO E, 2018, NAT CLIM CHANG	Climate change challenges for central banks and financial regulators	452	50,22
BATTISTON S, 2021, J FINANC STAB	Climate risks and financial stability	374	62,33
JAVADI S, 2021, J CORP FINANC	The impact of climate change on the cost of bank loans	360	60,00
DIKAU S, 2021, ECOL ECON	Central bank mandates, sustainability objectives and the promotion of green finance	332	55,33
SEMIENIUK G, 2021, WILEY INTERDISCIP REV-CLIM CHANG	Low-carbon transition risks for finance	308	51,33
HUANG HH, 2022, STRATEG MANAGE J	Firm climate risk, risk management, and bank loan financing	226	45,20
RONCORONI A, 2021, J FINANC STAB	Climate risk and financial stability in the network of banks and investment funds	195	32,50
LAMPERTI F, 2021, J FINANC STAB	Three green financial policies to address climate risks	183	30,50
DAI Z, 2023, INT REV FINANC ANAL	Climate policy uncertainty and risks taken by the bank: Evidence from China	155	38,75
DUNZ N, 2021, J FINANC STAB	Climate sentiments, transition risk, and financial stability in a stock-flow consistent model	137	22,83

Source: Elaborated by authors based on Web of Science data using Biblioshiny.

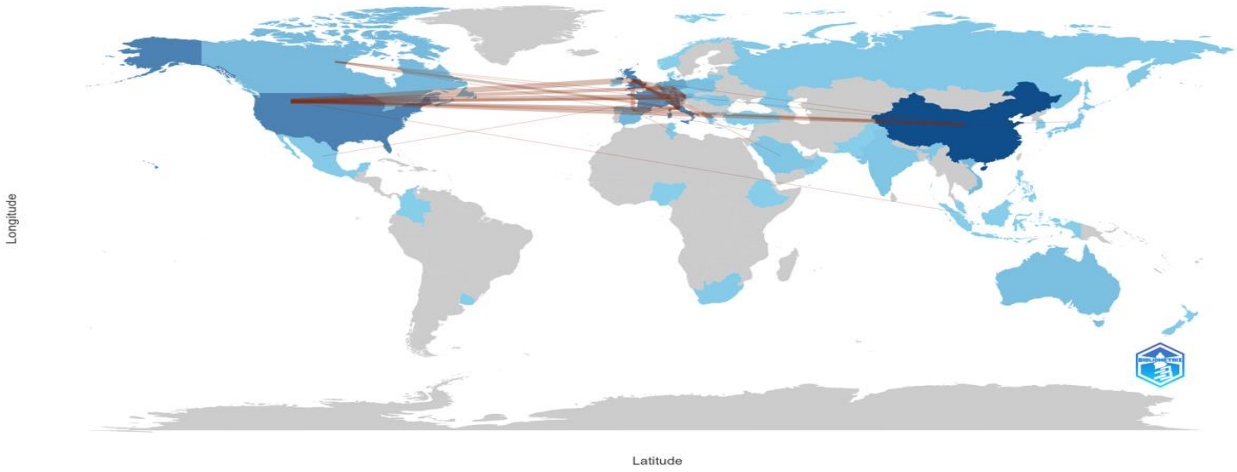
Table 3 reports the most highly cited documents in the dataset, highlighting the intellectual pillars shaping research on climate risk in banking and financial stability. The study by Campiglio (2018), published in *Nature Climate Change*, ranks first with 452 total citations and 50.22 citations per year, confirming its foundational influence on the role of climate change in central banking and financial regulation. Similarly, Battiston (2021) and Javadi (2021) display exceptionally strong citation performance, with 374 and 360 citations respectively, reflecting the centrality of financial stability, lending behaviour, and climate-related risk transmission in the development of the field.

Notably, the list reveals a strong concentration around issues such as central bank mandates, green finance, transition risk, and bank loan pricing. The presence of highly cited contributions by Dikau (2021) in *Ecological Economics* and Semieniuk (2021) in *Wiley Interdisciplinary Reviews: Climate Change* indicates that the field extends beyond mainstream finance journals into broader sustainability and policy-oriented debates. More recent contributions, particularly Dai (2023), exhibit high annual citation intensity, signalling rapid academic uptake and strong contemporary relevance. Overall, the dominance of journals such as *Nature Climate Change*, *Journal of*

Financial Stability, *Journal of Corporate Finance*, and *Ecological Economics* confirms that the intellectual core of the field is structured around the intersection of climate policy, financial regulation, and systemic stability.

- Geographical Distribution of Research Output and International Collaboration Network Analysis

Figure (6): Global geographical distribution of scientific publications and Collaboration Network



Source: Elaborated by authors based on Web of Science data using Biblioshiny.

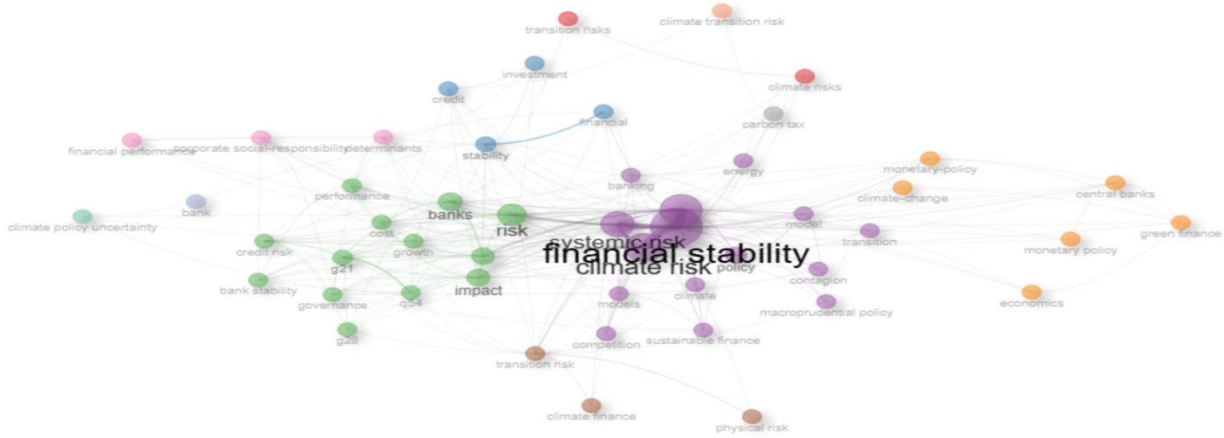
Figure 6 depicts the global distribution of publications in the field of climate risk in banking and financial stability, revealing a geographically broad yet clearly uneven pattern of scientific production. China leads by a wide margin with 161 occurrences, followed by Italy (82), the United Kingdom (65), the United States (61), and France (54), indicating particularly strong engagement from East Asia, Western Europe, and North America. Other notable contributors include Germany, the Netherlands, Austria, Spain, and Switzerland, while countries such as Vietnam, Poland, Canada, and Australia also show visible participation.

The spatial distribution points to a concentration of research output within financially advanced and institutionally strong economies, especially those actively involved in climate policy, banking regulation, and sustainable finance debates. By contrast, contributions from Africa, Latin America, and several developing regions remain comparatively limited, although they are not entirely absent. While the field has diffused across a wide range of countries, publication intensity varies substantially, suggesting disparities in research capacity, policy prioritisation, and integration into global academic networks.

Figure 6 further complements this geographical distribution by illustrating the international collaboration network in the field. The map shows that scientific cooperation is organised around a limited number of highly connected countries, particularly China, the United Kingdom, the United States, Italy, and France, which appear as the main hubs of cross-border collaboration. The density of links among these countries suggests that the development of the field is increasingly supported by international research partnerships, especially across Europe, North America, and East Asia. At the same time, the network reveals a more selective and peripheral integration of other countries, indicating that although the field has achieved broad global diffusion, the most influential collaborative ties remain concentrated within a relatively small core of scientifically and financially advanced economies.

- Thematic Evolution and Conceptual Structure

Figure (7): Keyword Co-occurrence Network in Climate Risk, Banking, and Financial Stability Research



Source: Elaborated by authors based on Web of Science data using Biblioshiny.

Figure 7 presents the keyword co-occurrence network in the field of climate risk in banking and financial stability, thereby revealing its conceptual structure and the principal relationships connecting the literature. In this network, node size reflects keyword frequency, whilst the links indicate the strength of co-occurrence between concepts. The figure clearly shows that financial stability occupies the most dominant and structurally central position in the network. This interpretation is supported by the network metrics, as financial stability records the highest values of betweenness centrality (281.895), closeness centrality (0.0169), and PageRank (0.0956), confirming its role as the principal organising concept of the field. The prominence of climate risk and climate change, which also display high betweenness and PageRank values, further indicates that the literature is fundamentally structured around the interaction between climate-related shocks and systemic financial resilience.

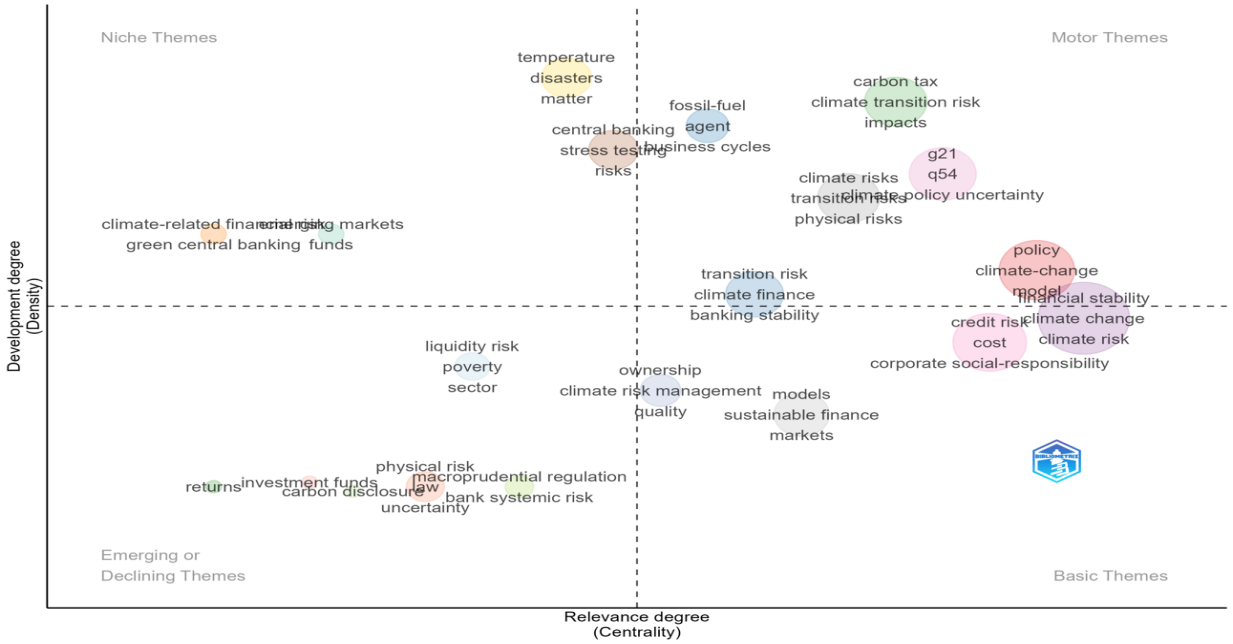
The network also highlights several conceptually important bridging terms linking the central core to more specialised areas of inquiry. In particular, systemic risk, risk, banks, and policy occupy strategically relevant positions, connecting the main financial stability cluster to research on banking vulnerability, regulatory responses, and risk transmission mechanisms. Although policy is less frequent than the principal core terms, its network position and centrality indicate that regulatory and policy-oriented debates constitute an important connecting dimension within the literature. Likewise, the visibility of credit, credit risk, bank stability, governance, and performance suggests that the field increasingly extends beyond macro-financial stability to encompass bank-level outcomes, institutional behaviour, and risk management concerns.

At the cluster level, the network reveals a differentiated but highly interconnected structure. The core cluster, centred on financial stability, climate risk, climate change, and systemic risk, forms the conceptual backbone of the field. Around this nucleus, several complementary clusters can be identified. One cluster links banks, risk, credit, governance, and performance, reflecting the strong presence of banking and financial intermediation perspectives. In this context, the appearance of G21 and Q54 is particularly meaningful. According to the JEL Classification System, G21 refers to banks, depository institutions, microfinance institutions, and mortgages, whereas Q54 refers to climate, natural disasters and their management, and global warming. Their presence in the network therefore signals that the literature is positioned at the intersection of banking and financial intermediation, on the one hand, and climate-related and environmental risks, on the other.

Another cluster revolves around policy, monetary policy, central banks, and green finance, highlighting the increasing relevance of central banking and regulatory frameworks in addressing

climate-related financial vulnerabilities. Additional clusters organised around transition risk, climate finance, physical risk, carbon tax, and climate policy uncertainty point to more specialised strands concerned with transition pathways, environmental regulation, and the financial consequences of climate-related uncertainty. Overall, the network depicts a conceptually structured and increasingly mature field organised around a strong financial stability core and connected to multiple specialised lines of research.

Figure (8): Thematic Map Based on climate risk in banking and financial stability



Source: Elaborated by authors based on Web of Science data using Biblioshiny

Figure 8 illustrates the thematic map of research on climate risk in banking and financial stability, showing how the field is structured according to centrality and density. In the upper-right quadrant, the motor themes are represented by clusters such as carbon tax, climate transition risk, climate risks, climate policy uncertainty, and the G21/Q54 grouping. These themes combine relatively high centrality with strong internal development, indicating that they are both well established and closely connected to the wider research field. Their position suggests that recent scholarship is increasingly driven by questions related to transition pathways, climate-related policy measures, and the financial implications of environmental regulation.

In the upper-left quadrant, the map identifies a set of niche themes, including temperature, disasters, central banking, and stress testing. These themes appear to be well developed internally but less strongly connected to the broader conceptual structure of the field. This suggests that they represent specialised lines of inquiry, particularly in relation to physical climate shocks, technical risk assessment tools, and the role of central banks in addressing climate-related financial vulnerabilities.

The lower-left quadrant contains emerging or declining themes, such as physical risk, macroprudential regulation, carbon disclosure, investment funds, and returns. Their relatively low density and centrality indicate that these topics remain weakly integrated into the core of the literature. This may suggest either that they are still in an early stage of development or that they currently occupy a more marginal position within the field.

Finally, the lower-right quadrant is dominated by the basic themes, most notably financial stability, climate change, climate risk, and policy, alongside related topics such as credit risk, cost, and corporate social responsibility. These themes display high centrality but more moderate

density, indicating that they form the conceptual foundation of the field while remaining broad and transversal rather than highly specialised.

III. 2. Discussion

The bibliometric findings indicate that research on climate risk in banking and financial stability has evolved into a rapidly expanding and increasingly structured field. The sharp rise in publication output, particularly after 2021, suggests that climate-related financial risk is no longer treated as a peripheral environmental concern, but rather as an increasingly important topic within banking regulation, macroprudential governance, central banking, and sustainable finance debates (Jena, 2026; Bringas-Fernández et al., 2025; Suciati, 2025; Carè, 2023). This interpretation is further supported by recent studies showing that the growing prominence of climate stress testing, NGFS scenarios, prudential tools, and climate-related financial policies has accelerated scholarly attention to the systemic implications of climate shocks for financial systems (Carè et al., 2024; Hidalgo-Oñate et al., 2023; D'Orazio, 2025; Chan et al., 2024).

Although the field remains relatively recent, its citation profile suggests that it has already achieved visible scientific influence. The notable average citation level observed in the present dataset is consistent with recent review-based studies which describe the field as young but already intellectually salient, partly because it is closely connected to major debates on systemic risk, central banking, and financial regulation (Suciati, 2025; Pacelli et al., 2025; Vogl et al., 2025). The continued prominence of earlier contributions is also unsurprising, since foundational studies on climate-related financial risk, network contagion, and climate stress testing have had more time to accumulate citations and have served as key reference points for subsequent work (Monasterolo, 2020; Roncoroni et al., 2021; Battiston et al., 2017; Chabot and Bertrand, 2023).

The source analysis further suggests that the field is consolidating around a relatively stable nucleus of journals, while simultaneously expanding across adjacent disciplines. The concentration of publications in a limited set of outlets is consistent with Bradford-type dynamics and indicates the emergence of a recognisable publication core. At the same time, the presence of journals related not only to finance but also to sustainability, environmental policy, and climate governance confirms that the field is increasingly interdisciplinary in orientation (Jena, 2026; Bringas-Fernández et al., 2025; Suciati, 2025). This dual pattern of intellectual concentration and disciplinary expansion suggests that climate risk in banking is becoming a distinct research domain, but one that continues to draw conceptual and methodological input from neighbouring fields.

The authorship structure reinforces this interpretation. The field appears to be shaped by a limited group of recurring contributors, while most authors publish only once, a pattern broadly consistent with Lotka's Law and characteristic of many developing bibliometric domains. This indicates that the literature is consolidating around a relatively small core of active scholars, even though participation remains relatively broad at the margins (Vogl et al., 2025). At the same time, the distribution of leading authors suggests that the field is not dominated by a single scholar, but rather by several active and partially interconnected research streams. This distributed authorship structure coexists with a more concentrated pattern of scientific influence, in which a small group of highly cited papers provides the main conceptual and methodological foundations of the field (Bringas-Fernández et al., 2025; Suciati, 2025; Carè et al., 2024; Pacelli et al., 2025).

This contrast between dispersed authorship and concentrated influence is particularly visible in the most highly cited papers. The citation leaders in the field revolve around themes such as central banking, climate stress testing, transition risk, climate policy, and bank lending behaviour, which together form the main intellectual pillars of the literature. Foundational contributions have examined the systemic transmission of climate shocks through financial networks, the implications of climate risk for bank stability, and the role of prudential and monetary authorities in addressing climate-related vulnerabilities (Battiston et al., 2017;

Monasterolo, 2020; Roncoroni et al., 2021; Le et al., 2023; Jung et al., 2025). This suggests that the field has developed around a relatively small set of seminal contributions that continue to shape subsequent empirical and conceptual work.

The annual evolution of publications confirms that the field has moved from a relatively limited niche into a rapidly expanding research area. This growth pattern is consistent with broader bibliometric evidence from climate finance and sustainable finance, which shows strong acceleration after the mid-2010s and especially after 2020, reflecting the growing integration of climate-related concerns into financial regulation, green transition debates, and systemic risk assessment (Mohamad, 2025; Khan et al., 2024; Luo et al., 2022; Kouwenberg and Zheng, 2023; Verma et al., 2025). At the same time, the higher citation intensity of earlier publications is consistent with their longer citation window and their foundational role in establishing the field's core analytical concerns.

In geographical terms, the field is clearly international, but unevenly so. Scientific production is led by China, followed by Italy, the United Kingdom, the United States, and France, indicating that the literature is concentrated in countries with stronger research systems, more developed financial sectors, and more active engagement in climate and sustainable finance agendas. Similar patterns have been identified in recent bibliometric analyses of climate finance and sustainable banking, which also highlight the leading role of a relatively small number of highly productive countries (Mohamad, 2025; Long et al., 2022; Bhatnagar and Sharma, 2022; Bringas-Fernández et al., 2025). The collaboration network further suggests that research is increasingly shaped by cross-border partnerships, although these remain concentrated around a limited number of highly connected countries. Thus, the field is becoming more globally interconnected, but the centre of gravity of collaboration remains geographically selective.

From a conceptual perspective, the keyword co-occurrence network confirms that financial stability, climate risk, and climate change form the core of the field. The prominence of these terms indicates that the literature is fundamentally organised around the ways in which climate-related shocks affect the resilience of financial systems. At the same time, the surrounding network reveals several specialised but connected strands related to banking, regulation, credit risk, governance, transition risk, and climate finance, suggesting that the field has expanded well beyond general discussions of climate-finance linkages towards more specific analyses of transmission mechanisms and institutional responses (Jena, 2026; Pacelli et al., 2025; Bringas-Fernández et al., 2025; Redondo and Aracil, 2024). The appearance of the JEL groupings G21 and Q54 further reinforces the interdisciplinary nature of the field, linking banking and financial intermediation to climate, natural disasters, and global warming.

The cluster structure also indicates that the field is both conceptually differentiated and strongly interconnected. Alongside the central cluster built around financial stability, other clusters emphasise the increasing relevance of policy, central banking, transition risk, climate finance, and bank-level performance. This pattern is consistent with recent bibliometric studies showing that climate-finance research is organised around multiple thematic groupings that remain connected through shared concerns with systemic vulnerability, regulation, and sustainable finance (Bringas-Fernández et al., 2025; Carè et al., 2024; Pacelli et al., 2025). In this sense, the field now appears to combine a coherent conceptual core with a growing number of complementary subdomains.

The thematic map reinforces this interpretation by showing that the field is organised around a combination of basic themes, motor themes, niche themes, and emerging or declining themes. This configuration is typical of a maturing research domain: some themes constitute the stable conceptual foundation of the field, whereas others are driving current developments or remain peripheral and only partially integrated. Recent bibliometric work in climate finance and sustainable finance similarly suggests that mature thematic structures often coexist with evolving and specialised subfields, particularly where regulation, banking, and climate policy intersect

(Bhatnagar and Sharma, 2022; Wang and Xu, 2025; Chandran and Chandran, 2026).

Within this thematic structure, carbon tax, climate transition risk, and climate policy uncertainty appear as motor themes, indicating that they are both central and well developed. Their position suggests that recent scholarship is increasingly driven by transition-related and regulatory concerns, especially the financial effects of carbon pricing, policy shifts, and low-carbon transformation pathways. This is consistent with recent work showing that transition risk, environmental policy, and climate-related uncertainty have become central to the contemporary climate-finance agenda (Pacelli et al., 2025; Ahmi et al., 2025; Hoque et al., 2025; Trinh, 2024). By contrast, themes such as central banking, stress testing, temperature, and disasters emerge as niche themes. These topics appear to be internally developed but less strongly connected to the broader field, suggesting that they have evolved into specialised lines of inquiry without yet becoming fully transversal across the literature (Bringas-Fernández et al., 2025; Carè et al., 2024).

Finally, the thematic map indicates that physical risk, macroprudential regulation, carbon disclosure, and investment funds remain emerging or declining themes, meaning that they are either underdeveloped or only weakly integrated into the dominant research agenda. This does not imply that they are unimportant; rather, it suggests that their conceptual integration into the wider literature remains incomplete. By contrast, financial stability, climate change, climate risk, and policy clearly function as basic themes, confirming that they constitute the conceptual foundation of the field. Together, these findings portray a research area organised around a stable conceptual core but still expanding towards less consolidated and more specialised domains, particularly in relation to physical-risk transmission, prudential responses, disclosure frameworks, and investment-related mechanisms (Monasterolo, 2020; Roncoroni et al., 2021; Kouwenberg and Zheng, 2023; Carè and Weber, 2023; Chandran and Chandran, 2024).

Compared with the most closely related bibliometric studies .The present research provides a focused analysis of the intersection between climate risk, banking, and financial stability. Bringas-Fernández et al. (2025) examined the evolution of climate-risk research in banking and identified financial intermediation, risk management, monetary policy, and financial stability as major research areas. Similarly, Pacelli et al. (2025) analysed the relationship between climate risk and systemic risk, while Suciati (2025) examined the role of financial stability in mitigating climate-related vulnerabilities. Consistent with these studies, the present findings confirm the rapid growth and increasing interdisciplinarity of the field. However, this study extends the existing literature by jointly examining its core journals, authorship structure, influential publications, international collaboration networks, and thematic development, thereby providing a more integrated understanding of this specialised research domain.

IV- Conclusion:

This study examined the intellectual, conceptual, and thematic development of research on climate risk in banking and financial stability through a bibliometric analysis of 189 documents indexed in the Web of Science database over the period 2014–202*5*. The findings show that this field has developed rapidly in recent years, particularly after 2021, reflecting the growing importance of climate-related financial vulnerabilities within banking regulation, macroprudential governance, and sustainable finance debates.

The results reveal that the field is structured around a clear conceptual core centred on financial stability, climate risk, and climate change, while also expanding towards specialised themes related to banking, credit risk, regulation, central banking, and transition dynamics. The source analysis and Bradford distribution confirm the existence of a relatively concentrated publication nucleus, whereas the authorship analysis indicates a distributed but still consolidating research community shaped by a limited number of recurring contributors. At the same time, the most highly cited papers function as the main intellectual pillars of the field, especially in relation

to central banking, transition risk, climate policy, and lending behaviour.

The thematic structure further shows that the literature is organised around a combination of basic themes, motor themes, niche themes, and emerging or declining themes. In particular, carbon tax, climate transition risk, and climate policy uncertainty appear as major driving themes, while central banking and stress testing emerge as specialised but less widely connected areas. By contrast, physical risk, macroprudential regulation, carbon disclosure, and investment funds remain more peripheral, suggesting that they still require deeper conceptual integration within the field.

Despite these contributions, the study has some limitations. It relies exclusively on the Web of Science Core Collection and focuses on English-language publications, which may have excluded relevant studies indexed in other databases or published in other languages. Future research could combine multiple databases, such as Web of Science and Scopus, extend the analysis to additional document types and languages, and employ complementary bibliometric techniques to provide a more comprehensive understanding of the evolution of climate risk research in banking and financial stability. Furthermore, the findings may assist researchers, policymakers, and financial regulators in identifying emerging research priorities and strengthening evidence-based approaches to climate-related financial risk management.

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