



Emerging trends in cryptocurrency and global financial markets connectedness: A bibliometric and science mapping review

Siddhartha Sankar Saha¹, Abir Das²

¹ Professor, Department of Commerce, Social Welfare and Business Management, University of Calcutta, Kolkata, West Bengal, India

² Research Scholar, Department of Commerce, University of Calcutta, Kolkata, West Bengal, India

Corresponding Author: Abir Das

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Abstract

This study presents a bibliometric and science-mapping analysis of the growing body of research examining cryptocurrency connectedness with other financial markets. The analysis is based on 268 peer-reviewed articles indexed in the Scopus database, retrieved using the search string “Cryptocurrency” AND “Connectedness” along with relevant search restrictions and inclusion filters. The study combines performance analysis with VOSviewer-based science-mapping techniques to investigate publication growth, influential authors and sources, dominant research themes, keyword networks, and the intellectual foundations of the field. The findings indicate a substantial increase in research output since 2022, reflecting growing academic interest in the integration of cryptocurrency markets with traditional and alternative financial assets. Elie Bouri emerges as the most highly cited author, while the *International Review of Financial Analysis* is identified as the most influential source. Keyword co-occurrence analysis reveals a strong thematic concentration around cryptocurrency, connectedness, Bitcoin, and COVID-19, whereas decentralised finance (DeFi) and non-fungible tokens (NFTs) appear as relatively emerging research themes. Co-citation analysis further demonstrates that the intellectual foundation of the field is strongly anchored in the Diebold–Yilmaz connectedness and spillover-index framework. Overall, the study provides a structured overview of the evolution, intellectual structure, and thematic development of research on cryptocurrency connectedness. The findings offer useful insights for researchers, journal editors, and practitioners and highlight DeFi, cross-market connectedness, financial contagion, and the integration of crypto-assets with broader financial markets as promising avenues for future research.

Keywords: Cryptocurrency, Connectedness, Bibliometric Analysis, Science Mapping, Co-citation Analysis, Keyword Co-Occurrence

Introduction

Cryptocurrency markets have become deeply intertwined with traditional financial and commodity markets, resulting in a substantial body of research on volatility spillovers, connectedness, and risk transmission between digital assets and other asset classes. This study combines a performance-based bibliometric analysis with a science mapping study using VOSviewer. It provides a comprehensive picture of the intellectual structure of this research field. The study is based on 268 peer-reviewed journal articles indexed in Scopus. Bibliometric analysis is a scientific method that facilitates examination of existing literature to understand and identify publication patterns, research trends, intellectual structure, and scholarly impact within a field (Donthu *et al.*, 2021)^[8]. It comprises of two complementary aspects: performance analysis, which measures productivity and scholarly impact, and science mapping, which visualises the intellectual structure of a domain and identifies knowledge clusters. Several prior studies have examined cryptocurrency bibliometric research from adjacent angles, including its relationship with equity markets and its regulatory dimension, but none has combined full-scale performance analysis with VOSviewer-based science mapping specifically for cryptocurrency connectedness with other asset classes and commodities, the gap that this study addresses. The current study aims to address the following research questions (RQs):

1. **RQ1:** What are the publication trends and growth patterns in research on cryptocurrency connectedness with global financial markets?
2. **RQ2:** Who are the most influential authors contributing to the literature on cryptocurrency connectedness with global financial markets?
3. **RQ3:** Which articles, journals, and sources have had the greatest scholarly impact in the cryptocurrency-connectedness literature?
4. **RQ4:** What are the major thematic and keyword clusters in the cryptocurrency-connectedness literature, and how have these themes evolved over time?
5. **RQ5:** Which publications constitute the intellectual knowledge base of cryptocurrency-connectedness research, and what are the major co-citation clusters underlying the field?

RQ1-RQ3 are addressed through performance analysis (Section 4.1), while RQ4-RQ5 are addressed through science mapping using VOSviewer (Section 4.2). Bibliographic coupling, along with co-authorship and document-level citation mapping, was excluded from the

science mapping study by design to keep the analysis focused on thematic structure and intellectual foundations.

Literature Review and Research Gap

1. Bibliometric Analysis and Systematic Literature Review Methodology

Bibliometric analysis and the systematic literature review (SLR) are two established, complementary approaches to synthesising a body of scholarly work. The SLR tradition emphasises a transparent, replicable, and auditable search-and-screening protocol (Kitchenham & Charters, 2007; Tranfield *et al.*, 2003)^[14, 24]. These principles were later formalised for a broader research audience through structured overviews of literature review types and their appropriate use (Snyder, 2019)^[23]. Bibliometric analysis, by contrast, applies quantitative techniques - citation counts, co-authorship, co-occurrence, and co-citation - to large volumes of bibliographic metadata in order to map productivity, impact, and intellectual structure objectively (Donthu *et al.*, 2021)^[8]. The two approaches are frequently combined in practice. SLR protocols are used to define and screen the sample, while bibliometric software such as VOSviewer (Van Eck & Waltman, 2010)^[26] or the R-based bibliometrix suite (Aria & Cuccurullo, 2017)^[5] is used to analyse it, drawing on the broader taxonomy of bibliometric methods described by Zupic and Čater (2015)^[30]. Recent guidance stresses that raw bibliometric outputs require an interpretive step connecting them to substantive insight rather than being reported as bare descriptive statistics (Lim & Kumar, 2024)^[17]. The present study follows this combined tradition: an SLR-informed search protocol (Section 3.1) defines the sample, and both performance analysis and VOSviewer-based science mapping (Section 4.2) are used to analyse it.

2. Cryptocurrency Connectedness with Other Markets

A substantial empirical literature has examined return and volatility connectedness between cryptocurrencies and other asset classes, typically using variance-decomposition and time-varying-parameter VAR frameworks. Foundational contributions established that cryptocurrency markets are themselves highly interconnected, with Bitcoin frequently acting as a net transmitter of volatility to smaller coins (Ji *et al.*, 2019; Yi *et al.*, 2018). Antonakakis *et al.* (2019)^[4, 28] extended this to market-contagion dynamics under uncertainty and complexity.

Building on this base, a large stream of research has extended connectedness analysis to cryptocurrency-commodity relationships. Okorie and Lin (2020)^[18] examined crude oil price connectedness with cryptocurrencies, while Ren and Lucey (2022) and Sharif *et al.* (2023)^[21, 22] explored clean and dirty energy assets. Khalfaoui *et al.* (2022)^[13] broadened this to green-commodity portfolios more generally. A parallel stream examines connectedness with traditional financial markets and safe-haven assets, including technology equities and fiat currencies (Umar *et al.*, 2021)^[25], and interest-rate term structures (Xu *et al.*, 2021)^[25], often finding that cryptocurrencies' hedging role is time-varying and shock-dependent rather than stable.

The COVID-19 pandemic proved to be a major catalyst for this literature. Bouri *et al.* (2021) and Kumar *et al.* (2022)^[7, 15] documented shifts in connectedness during the pandemic and its associated media coverage, while Elsayed *et al.*

(2022)^[9] linked pandemic-era uncertainty indices to gold-cryptocurrency connectedness. More recently, research has extended to newer segments of the digital-asset ecosystem, including decentralised finance and non-fungible tokens (Yousaf & Yarovaya, 2022)^[29], examining their connectedness with both cryptocurrencies and traditional markets. Methodologically, this literature has increasingly adopted quantile- and frequency-domain connectedness techniques to capture asymmetries and time-horizon-specific spillovers (Le *et al.*, 2021; Attarzadeh & Balcilar, 2022; Ha & Nham, 2022; Omane-Adjepong & Alagidede, 2019)^[6, 16, 19].

Despite the substantial growth and breadth of empirical research on cryptocurrency connectedness, relatively limited attention has been devoted to systematically mapping the bibliometric and intellectual structure of this emerging field. To the best of the authors' knowledge, no prior study has specifically examined the cryptocurrency-connectedness literature by integrating performance analysis with VOSviewer-based keyword co-occurrence and co-citation science-mapping techniques within a unified framework. This study addresses this gap by systematically analysing the development, intellectual foundations, thematic structure, and emerging research directions of the cryptocurrency-connectedness literature. In doing so, it provides a consolidated research landscape that can help scholars identify influential contributions, dominant themes, methodological foundations, and promising avenues for future investigation.

Research Methodology

1. Data Collection

Consistent with SLR guidance on transparent and replicable search protocols (Tranfield *et al.*, 2003; Kitchenham & Charters, 2007)^[14, 24], the following search and filtering procedure was applied.

The bibliographic data for the study were retrieved from the Scopus database. The search strategy used the keywords "Cryptocurrency" AND "Connectedness", restricted to title, abstract, and keywords, and refined using exact keyword filters including Bitcoin, Cryptocurrencies, COVID-19, Financial Markets, Commodities, Gold, Investments, Volatility, Connectedness, Spillover Effect, Stock Market, and Currency, among others. Only journal articles indexed in their final publication stage were considered for analysis. After applying these filters, a sample of 268 articles was derived. The data were exported in BibTeX and CSV formats on 13th May 2026.

2. Search Query Process

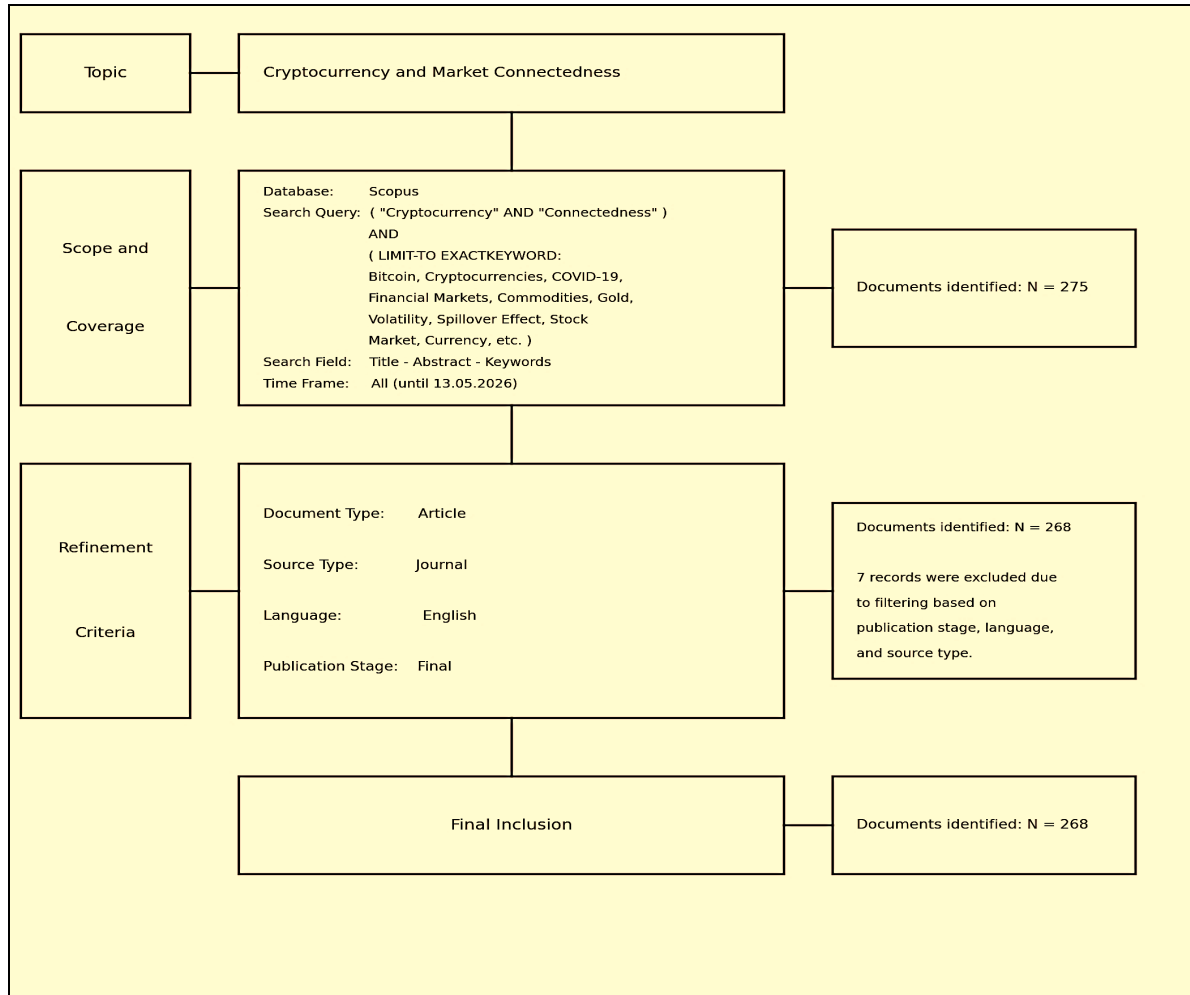
Fig 1 illustrates the end-to-end search query process, from the initial Scopus query through refinement to the final set of documents included in the study.

3. Data Analysis Tools

Performance analysis (publication trends, authorship, citation impact, and source-level metrics) was conducted through programmatic tabulation of the exported bibliographic records, following established bibliometric-analysis guidelines (Donthu *et al.*, 2021)^[8]. Science mapping was performed using VOSviewer (version 1.6.20), a widely used software tool for constructing and visualising bibliometric networks (Van Eck & Waltman, 2010)^[26]. Two

types of VOSviewer analysis were performed for this study: co-occurrence (unit: all keywords) and co-citation (unit: cited references), spanning part of the standard bibliometric-method taxonomy described by Zupic and Čater (2015) [30]. Co-authorship, document-level citation analysis, and bibliographic coupling were intentionally excluded from this study to keep the science-mapping scope focused on

thematic structure and intellectual foundations. For each analysis type, both a network/overlay visualisation (nodes coloured by cluster or by average publication year) and a density visualisation (highlighting concentration "hotspots") were generated and interpreted, in line with sensemaking-oriented guidance for bibliometric result interpretation (Lim & Kumar, 2024) [17].



Source: Compiled by Authors

Fig 1: Search Query Process in the Scopus Database

4. VOSviewer Map Generation Parameters

Table 1 summarises the analysis type, thresholds, and resulting network statistics for the two VOSviewer maps generated for this study.

Table 1: VOSviewer Map Generation Parameters

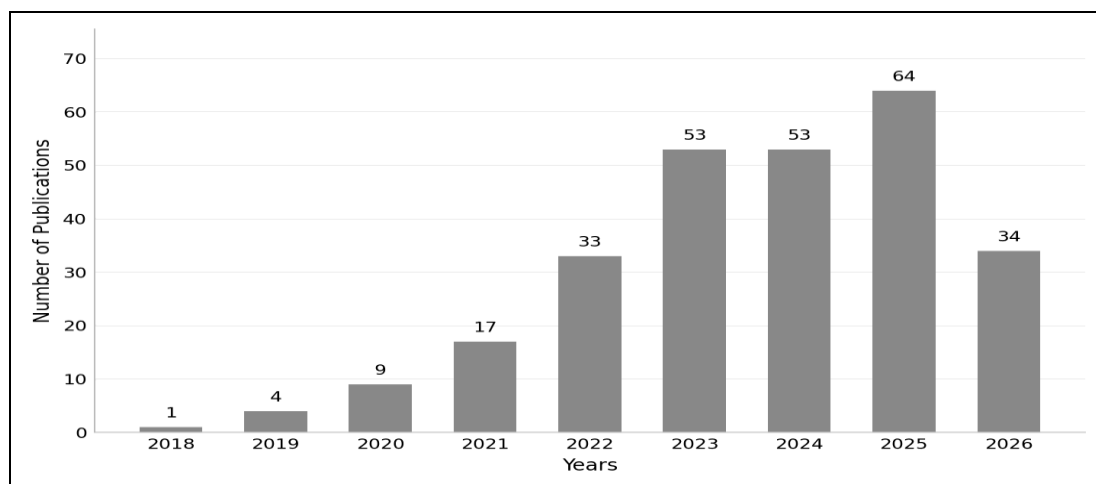
Analysis Type	Unit / Threshold	Items Meeting Threshold	Items in Final Map	Clusters	Links / Total Link Strength
Co-occurrence (Keywords)	All keywords; min. 5 occurrences	1,107 keywords -> 85 met threshold	85 items shown (all selected)	7 clusters	1,370 links, TLS = 2,947
Co-citation (Cited references)	Cited references; min. 10 citations/reference	12,160 references -> 74 met threshold	74 items shown (all selected)	4 clusters	1,292 links, TLS = 3,987
Note(s): Counting method = Full counting for both analyses; software = VOSviewer v1.6.20.					
Source: Source: Compiled by Authors					

Results and Analysis

1. Performance Analysis

Performance Analysis focuses on the identification of trends within the reviewed literature by evaluating the growth of publications, citation metrics, and authorship trends.

1.1 Publication trends over time



Source: Compiled by Authors

Note - Publication count for 2026 includes only documents indexed up to the export date (13th May 2026).

Fig 2: Publication trend over time for 268 documents

Publication trends over time

Note - Publication count for 2026 includes only documents indexed up to the export date (13th May 2026).

Source: Compiled by Authors

To examine RQ1, Figure 2 shows the annual publication count for the 268 retrieved articles. The earliest contribution in the sample is from 2018, and publication volume remained modest through 2021 ^[25] (fewer than 20 articles per year). From 2022 onward, output accelerates sharply, rising from 33 articles in 2022 to 53 in both 2023 and 2024, and peaking at 64 in 2025. A total of 237 of 268 articles (88.4%) were published from 2022 onward, indicating that cryptocurrency connectedness research has matured into an active and rapidly growing sub-field only in the past few years.

1.2 Significant Authors

To answer RQ2, an analysis of the most productive and cited authors is performed. Table 2 provides insights into the top-cited authors in the research field, while Table 3 presents the most productive researchers by number of publications. Bouri, Elie leads on total citations (1027 across 7 papers) and is the only author to also appear among the most productive authors, indicating sustained and high-impact engagement with the field. An analysis of the number of authors per paper was also performed. Among the 268 articles selected for study, 10.07% were authored by a single author, 24.25% by two authors, and 65.67% by three or more authors, suggesting a strong preference among researchers in the domain to collaborate.

Table 2: Top Authors based on citations

Authors	Affiliation	TC	TP	TC/TP
Bouri, Elie	Adnan Kassar School of Business, Lebanese American University, Lebanon	1027	7	146.7
Roubaud, David	Adnan Kassar School of Business, Lebanese American University, Lebanon	819	3	273.0
Vo, Xuan Vinh	Lahore Business School, The University of Lahore, Lahore, Pakistan	611	8	76.4
Lau, Chi Keung Marco	Department of Economics and Finance, The Hang Seng University of Hong Kong, Hong Kong	606	2	303.0
Ji, Qiang	Center for Energy and Environmental Policy Research, Institutes of Science and Development, Chinese Academy of Sciences, Beijing, 100190, China	507	1	507.0
Abakah, Emmanuel Joel Aikins	The University of Sydney, Business School, Australia	493	5	98.6
Yarovaya, Larisa	Department of Economics and Finance, Durham University, Durham, DH1 3LB, United Kingdom	491	5	98.2
Yousaf, Imran	College of Business and Public Management, Wenzhou-Kean University, China	463	7	66.1
Tiwari, Aviral Kumar	Department of Economics, Lahore College for Women University, Lahore, 35200, Pakistan	425	5	85.0
Yi, Shuyue	Business School, Hunan University, Changsha, 410082, China	369	1	369.0
Note(s): TC = Total Citations; TP = Total Papers; TC/TP = Average Total citations per paper				
Source: Compiled by Authors				

Table 3: Top Authors based on number of articles published

Authors	Affiliation	TP
Vo, Xuan Vinh	Lahore Business School, The University of Lahore, Lahore, Pakistan	8
Naeem, Muhammad Abubakr	Smurfit Graduate School of Business, University College Dublin, Dublin, Ireland	8
Ha, Le Thanh	National Economics University, Viet Nam	8
Corbet, Shaen	DCU Business School, Dublin City University, Dublin 9, Ireland	8
Bouri, Elie	Adnan Kassar School of Business, Lebanese American University, Lebanon	7
Source: Compiled by Authors		

1.3 Significant Studies

To address RQ3, Table 4 illustrates the top-cited documents from the sample of articles under study. Panel A states the top ten articles based on total citation counts, while Panel B lists the top ten based on average citations per year to correct for recency bias. All 10 of the top 10 articles in

Panel A also appear in Panel B, showing that citation impact in this literature tracks total citation counts very closely. The single most-cited Article examines dynamic connectedness and integration across cryptocurrency markets themselves (Ji *et al.*, 2019) ^[4], followed by a study of volatility connectedness and Bitcoin's dominance (Yi *et al.*, 2018) ^[28].

Table 4: Top Cited Articles - Panel A: Top papers based on Total Citations

Publication Year	Authors	Paper Title	Journal Title	TC	TC/Y
2019	Ji, Qiang and Bouri, Elie and Lau, Chi Keung Marco and Roubaud, David	Dynamic connectedness and integration in cryptocurrency markets	International Review of Financial Analysis	507	63.38
2018	Yi, Shuyue and Xu, Zishuang and Wang, Gang-Jin	Volatility connectedness in the cryptocurrency market: Is Bitcoin a dominant cryptocurrency?	International Review of Financial Analysis	369	41.00
2021	Le, TN-Lan and Abakah, Emmanuel Joel Aikins and Tiwari, Aviral Kumar	Time and frequency domain connectedness and spill-over among fintech, green bonds and cryptocurrencies in the age of the fourth industrial revolution	Technological Forecasting and Social Change	360	60.00
2021	Bouri, Elie and Saeed, Tareq and Vo, Xuan Vinh and Roubaud, David	Quantile connectedness in the cryptocurrency market	Journal of International Financial Markets, Institutions and Money	292	48.67
2022	Ren, Boru and Lucey, Brian	A clean, green haven? - Examining the relationship between clean energy, clean and dirty cryptocurrencies	Energy Economics	256	51.20
2022	Yousaf, Imran and Yarovaya, Larisa	Static and dynamic connectedness between NFTs, Defi and other assets: Portfolio implication	Global Finance Journal	246	49.20
2019	Antonakakis, Nikolaos and Chatziantoniou, Ioannis and Gabauer, David	Cryptocurrency market contagion: Market uncertainty, market complexity, and dynamic portfolios	Journal of International Financial Markets, Institutions and Money	240	30.00
2020	Okorie, David Iheke and Lin, Boqiang	Crude oil price and cryptocurrencies: Evidence of volatility connectedness and hedging strategy	Energy Economics	210	30.00
2022	Kumar, Ashish and Iqbal, Najaf and Mitra, Subrata Kumar and Kristoufek, Ladislav and Bouri, Elie	Connectedness among major cryptocurrencies in standard times and during the COVID-19 outbreak	Journal of International Financial Markets, Institutions and Money	161	32.20
2022	Khalfaoui, Rabeh and Ben Jabeur, Sami and Dogan, Buhari	The spillover effects and connectedness among green commodities, Bitcoins, and US stock markets: Evidence from the quantile VAR network	Journal of Environmental Management	159	31.80

Panel B: Top papers based on Average Citations Per Year

2019	Ji, Qiang and Bouri, Elie and Lau, Chi Keung Marco and Roubaud, David	Dynamic connectedness and integration in cryptocurrency markets	International Review of Financial Analysis	507	63.38
2021	Le, TN-Lan and Abakah, Emmanuel Joel Aikins and Tiwari, Aviral Kumar	Time and frequency domain connectedness and spill-over among fintech, green bonds and cryptocurrencies in the age of the fourth industrial revolution	Technological Forecasting and Social Change	360	60.00
2022	Ren, Boru and Lucey, Brian	A clean, green haven? - Examining the relationship between clean energy, clean and dirty cryptocurrencies	Energy Economics	256	51.20
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2018	Yi, Shuyue and Xu, Zishuang and Wang, Gang-Jin	Volatility connectedness in the cryptocurrency market: Is Bitcoin a dominant cryptocurrency?	International Review of Financial Analysis	369	41.00
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2020	Okorie, David Iheke and Lin, Boqiang	Crude oil price and cryptocurrencies: Evidence of volatility connectedness and hedging strategy	Energy Economics	210	30.00
<i>Note(s): TC = Total Citations; TC/Y = Average Total citations per year.</i>					
Source: Compiled by Authors					

1.4 Significant Sources

To further address RQ3, Table 5 presents the top-cited journals based on total citation counts, and Table 6 summarises the leading sources based on the number of

articles published. International Review of Financial Analysis is the most influential source with 1233 citations from 13 articles, while Finance Research Letters tops productivity with 22 publications.

Table 5: Top sources by citations

Source title	Total Citations
International Review of Financial Analysis	1233
Finance Research Letters	974
Journal of International Financial Markets, Institutions and Money	748
Energy Economics	741
Technological Forecasting and Social Change	731
Research in International Business and Finance	443
Financial Innovation	369
Global Finance Journal	331
International Review of Economics and Finance	233
Economic Modelling	213
Journal of Environmental Management	198
Resources Policy	159
Environmental Science and Pollution Research	153
Renewable Energy	142
North American Journal of Economics and Finance	103
Source: Compiled by Authors	

Table 6: Top Sources Based on Total Papers Published

Source title	2018-2021	2022-2026	TP	TC	TC/TP
Finance Research Letters	2	20	22	974	44.27
Financial Innovation	1	18	19	369	19.42
International Review of Financial Analysis	3	10	13	1233	94.85
North American Journal of Economics and Finance	0	12	12	103	8.58
Research in International Business and Finance	3	9	12	443	36.92
Applied Economics Letters	1	8	9	82	9.11
International Review of Economics and Finance	1	8	9	233	25.89
Energy Economics	1	7	8	741	92.62
Journal of International Financial Markets, Institutions and Money	3	4	7	748	106.86
Resources Policy	0	6	6	159	26.50
Applied Economics	0	6	6	96	16.00
Technological Forecasting and Social Change	2	4	6	731	121.83
Journal of Risk and Financial Management	0	4	4	29	7.25
Quality and Quantity	0	4	4	13	3.25
Quarterly Review of Economics and Finance	0	4	4	82	20.50
Others	14	113	127	2498	19.67
Total	31	237	268	8534	
<i>Note(s): TC = Total Citations; TP = Total Papers; TC/TP = Average Total citations per paper</i>					
Source: Compiled by Authors					

2. Science Mapping

Science mapping techniques are used to visualise and analyse bibliometric networks in order to discover the intellectual structure of a research domain. This section addresses RQ4-RQ5 using two VOSviewer analyses: keyword co-occurrence and co-citation of cited references. For each analysis, both a network/overlay visualisation and a density visualisation are presented and interpreted, alongside data tables extracted from the underlying VOSviewer map and network files.

2.1 Keyword Co-occurrence Analysis

To address RQ4, a keyword co-occurrence analysis was performed using Type of analysis: Co-occurrence, Unit of analysis: All keywords, and Counting method: Full counting. A threshold of a minimum of 5 occurrences was applied; of the 1,107 keywords identified in the dataset, 85 met this threshold and were all included in the final map, which comprises 7 clusters, 1,370 links, and a total link strength of 2,947.

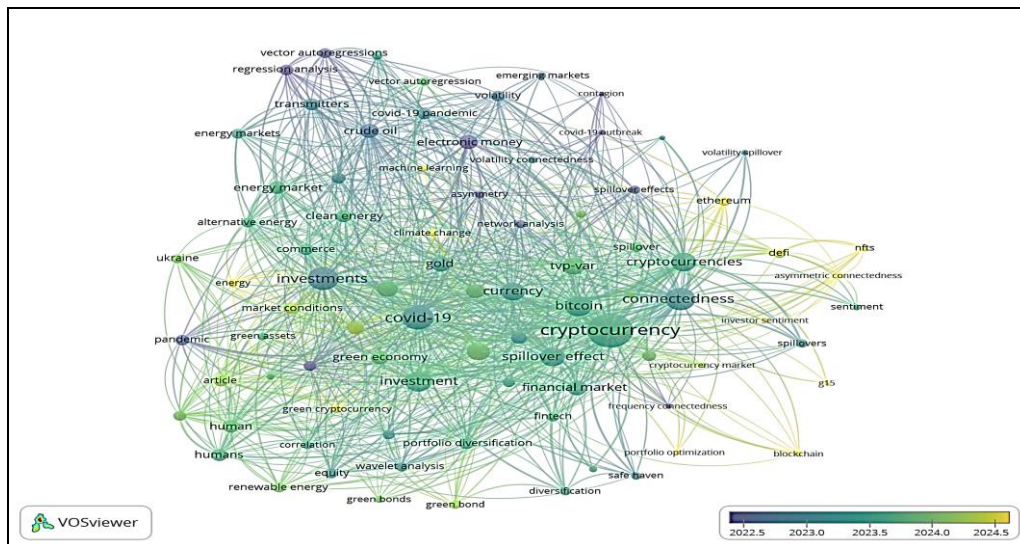
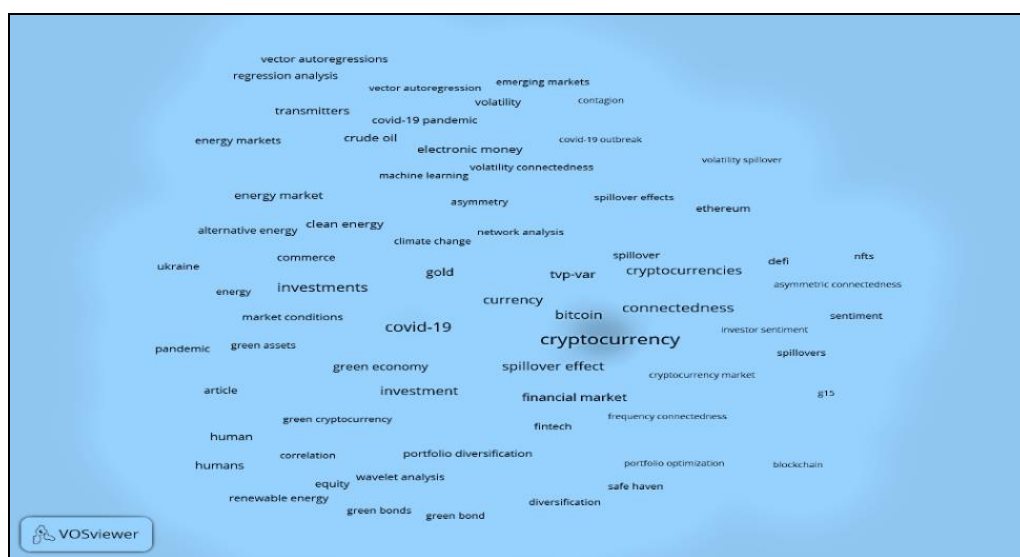


Fig 3: Keyword Co-Occurrence Overlay Visualisation (Colour = Average Publication Year)

Colours represent each keyword's average publication year, ranging from 2022.5 (dark blue) to 2024.5 (yellow). Keywords such as "regression analysis", "transmitters", and "electronic money" appear in blue-purple tones, indicating association with earlier publications tied to the COVID-19 shock period.

In contrast, "nfts", "defi", "blockchain", and "ethereum" appear in yellow-green tones, indicating these represent the most recently emerging themes - reflecting a shift in research attention toward decentralised finance and blockchain infrastructure in the most recent publication years.



Source: Compiled by Authors using VOSviewer v1.6.20

The density map shows a single, dominant and concentrated hotspot centred on "cryptocurrency", "connectedness", "bitcoin", "covid-19", and "spillover effect". This confirms that these as the saturated core of the field. A secondary, moderately dense region surrounds "gold", "currency", and

"energy market". The periphery of the map (right edge of the cluster) contains "nfts", "defi", "portfolio optimization", and "green bonds" which are lower-density, more peripheral or emerging topics that have not yet achieved the same research saturation as the core connectedness theme.

Table 7: Keyword Co-Occurrence Clusters (Thematic Interpretation)

Cluster	Thematic Label	Keywords	Total Occ.	Representative Keywords
1	COVID-19, Green Assets & Sustainable Investment	21	249	covid-19, investments, dynamic connectedness, investment, uncertainty, green economy, human, humans
2	Cryptocurrency Connectedness, DeFi & Digital Assets	18	431	cryptocurrency, cryptocurrencies, connectedness, tvp-var, defi, volatility spillovers, spillover, spillovers
3	Energy Markets, Volatility & Econometric Methods	15	122	electronic money, covid-19 pandemic, crude oil, energy market, volatility, clean energy, transmitters, vector autoregressions
4	Financial Markets, Gold & Portfolio	10	112	stock market, gold, financial markets, fintech, portfolio

	Diversification			diversification, market conditions, commerce, energy
5	Bitcoin, Network Analysis & Volatility Spillover	9	102	bitcoin, network analysis, precious metals, volatility connectedness, volatility spillover, asymmetry, covid-19 outbreak, emerging markets
6	Currency & Frequency-Domain Connectedness	8	104	spillover effect, currency, financial market, currency market, quantile connectedness, wavelet coherence, frequency connectedness, cryptocurrency market
7	Spillover Effects, Causality & Climate Change	4	23	spillover effects, granger causality, climate change, contagion
Source: Compiled by Authors				

Table 8: Top 15 Keywords by Occurrence

Keyword	Cluster	Occurrences	TLS	Avg. Pub. Year	Avg. Citations
cryptocurrency	2	147	495	2023.6	34.4
cryptocurrencies	2	64	168	2023.5	38.2
connectedness	2	59	225	2023.2	37.2
bitcoin	5	54	194	2023.5	37.2
covid-19	1	49	259	2023.3	34.3
tvp-var	2	35	138	2023.8	22.2
investments	1	32	250	2023.0	40.9
dynamic connectedness	1	26	101	2023.8	27.7
spillover effect	6	26	170	2023.5	58.7
investment	1	23	183	2023.6	33.4
currency	6	22	156	2023.4	49.2
stock market	4	21	139	2023.9	49.4
gold	4	20	113	2023.3	61.8
financial markets	4	18	119	2023.8	38.4
financial market	6	15	110	2023.5	24.3

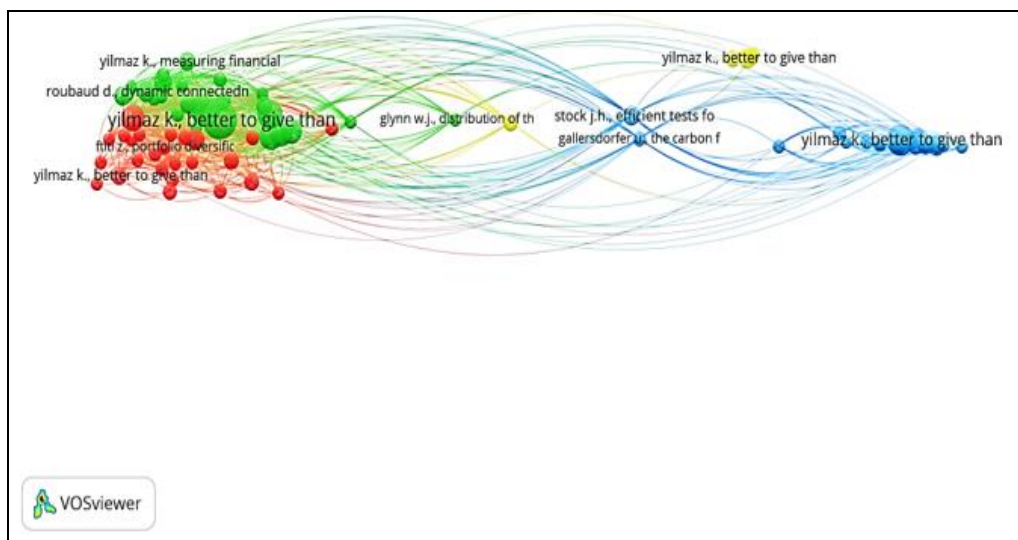
Note(s): TLS = Total Link Strength.

Source: Compiled by Authors from VOSviewer Map File Keywords.txt

"Cryptocurrency" is by far the most frequently occurring keyword (147 occurrences, TLS = 495), followed by "cryptocurrencies" (64) and "connectedness" (59) - all part of Cluster 2, the largest thematic cluster (18 keywords, 431 combined occurrences) centred on cryptocurrency connectedness, DeFi, and digital assets. Cluster 1 (COVID-19, green assets and sustainable investment; 21 keywords) is the largest by keyword count, reflecting the breadth of COVID-era and ESG-adjacent sub-topics connected to this literature.

2.2 Co-citation Analysis of Cited References

To address RQ5, a co-citation analysis was performed using Type of analysis: Co-citation and Unit of analysis: Cited references, with Full counting. A threshold of a minimum of 10 citations per cited reference was applied; of 12,160 distinct cited references extracted from the sample's bibliographies, only 74 met this threshold. All 74 were included in the final map, comprising 4 clusters, 1,292 links, and a total link strength of 3,987 - by far the densest network among the science mapping analyses, reflecting a strongly shared theoretical and methodological foundation across the literature.



Source: Compiled by Authors using VOSviewer v1.6.20

Fig 5: Co-citation Network Visualisation of Cited References (Colour = Cluster)

Four clusters are visible, distinguished by colour. The red cluster (Cluster 1, 25 references) and green cluster (Cluster 2, 24 references) together dominate the left/centre of the map and are the most densely interlinked, reflecting the methodological core of the field - principally the Diebold-Yilmaz connectedness/spillover-index literature together with its extensions. The blue cluster (Cluster 3, 20

references) sits to the right and centres on closely related variants of the same foundational works, while the small yellow cluster (Cluster 4, just 5 references) is comparatively peripheral. The map graphically illustrates that this literature's intellectual foundation is highly concentrated around a small set of connectedness-methodology papers rather than being theoretically fragmented.



Source: Compiled by Authors using VOSviewer v1.6.20

Fig 6: Co-Citation Density Visualisation of Cited References

A single, large, bright hotspot dominates the left side of the map, corresponding to the connectedness-methodology cluster described above. Thus, confirming that this is predominantly the most-cited and most-concentrated intellectual foundation of the field. Two smaller, moderate-intensity hotspots appear centre-right, corresponding to closely related methodological variants. The remainder of the map is sparse, which indicates limited co-citation density outside this core methodological base.

Discussions

The performance analysis and science mapping results compiled together, present a coherent picture of a research field entering rapid maturity. Publication output has accelerated sharply since 2022^[6] (RQ1), which suggests that cryptocurrency connectedness research is still in its growth phase rather than a settled sub-discipline. This leaves considerable room for new contributions to shape the field's trajectory. Citation and authorship patterns (RQ2, RQ3) reveal that influence is concentrated in a small set of highly cited studies and prolific authors, most notably Elie Bouri, and the two most foundational connectedness studies in the sample (Ji *et al.*, 2019^[12]; Yi *et al.*, 2018), both of which examine connectedness within the cryptocurrency market itself before the literature broadened outward to commodities and traditional assets. This pattern is consistent with typical citation dynamics in young, fast-growing fields, where early methodological contributions accumulate disproportionate influence as later studies adopt and extend their frameworks.

The keyword co-occurrence analysis (RQ4) shows that the field's thematic core remains cantered around the “cryptocurrency-connectedness-COVID-19-bitcoin” nexus, while decentralised finance, non-fungible tokens, and blockchain infrastructure form a smaller but clearly emerging periphery. This suggests that future high-impact contributions are likely to come from researchers who bridge the established connectedness methodology with these newer digital-asset segments, rather than from further

replication of COVID-era commodity-connectedness studies. The co-citation analysis (RQ5) reinforces this picture from the intellectual-structure side: the literature's theoretical foundation is heavily concentrated around the Diebold-Yilmaz connectedness and spillover-index tradition, rather than being fragmented across competing schools of thought. For researchers and practitioners alike, this convergence around a single dominant methodology offers both a reliable, well-validated path for new empirical work and a signal that genuine and novel contributions may need to look toward newer asset classes, alternative estimation techniques, or cross-market applications not yet well represented in the existing body of work.

Conclusion

This study explored with the intention to map both, the productivity and also the intellectual structure of cryptocurrency connectedness research by combining performance analysis with VOSviewer-based science mapping across 268 Scopus-indexed articles. The findings suggest that this field is in the middle of rapid expansion, with publication output more than tripling between 2021^[25] and 2025. However, the publications are concentrated around a small number of highly influential authors and studies, and organised around a thematically consistent yet steadily evolving keyword structure. Most notably, the co-citation analysis demonstrates that this literature's theoretical foundation is highly concentrated around the connectedness and spillover-index methodology. This gives the field an unusually strong and shared methodological backbone for a research area that is otherwise still young. The findings carry several important implications for researchers, practitioners, and policymakers. For researchers, the study identifies the most influential authors, journals, conceptual foundations, and methodological contributions within the literature, thereby facilitating a more efficient orientation to this rapidly expanding research domain. By highlighting the key intellectual and methodological works underpinning the field, the findings

can help scholars identify relevant theoretical perspectives, methodological approaches, and potential research gaps. For practitioners and policymakers, the strong concentration of research around established connectedness and spillover methodologies indicates the methodological importance of these approaches within the existing literature. This concentration provides a useful basis for interpreting evidence on cross-market linkages, volatility transmission, and financial spillovers. Such insights may support portfolio diversification, hedging, risk monitoring, and financial-stability assessments. However, the findings also underscore the importance of considering methodological diversity and emerging approaches when applying connectedness measures to rapidly evolving cryptocurrency markets.

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