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Review

A Decade of Cryptocurrency Investment Literature: A Cluster-Based Systematic Analysis

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Abstract: This study aims to systematically analyze and synthesize the literature produced thus far on cryptocurrency investment. We use a systematic review process supported by VOSviewer bibliographic coupling to review 482 papers published in the ABS 2021 journal list, considering all different areas of knowledge. This paper contributes an in-depth systematic analysis on the unconsolidated topic of cryptocurrency investment through the use of a cluster-based approach grounded in a bibliographic coupling analysis, revealing complex network associations within each cluster. Four literature clusters emerge from the cryptocurrency investment literature, namely, investigating investor behavior, portfolio diversification, cryptocurrency market microstructure, and risk management in cryptocurrency investment. Additionally, the study delivers a qualitative analysis that reveals the main conclusions and future research venues by cluster. The findings provide researchers with cluster-based information and structured networking for research outlets and literature strands.

Keywords: cryptocurrencies; bitcoin; investment; bibliometric analysis; systematic review

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1. Introduction

The first stone in the creation of the cryptocurrency market was the white paper published by Nakamoto (2008) explaining the creation and operation of a new digital currency which has the particularity of being decentralized and does not require the intermediation of any financial institution.

Although used as means of payment, cryptocurrencies tend to be explored more as investment assets (Almeida 2021; Almeida and Gonçalves 2023b; Blau 2017; Li et al. 2021). Cryptocurrencies have become a popular asset class in global financial markets, with their market experiencing rapid development that has spread to the four corners of the world, including both developed and developing countries, as one of the world's fastest growing financial markets (Białkowski 2020; Fang et al. 2021). The emergence of this new market, along with the creation of investment platforms, has brought investment opportunities with the dream of high and easy profits closer to regular people (many of them without any financial knowledge). This has led to a flood of new, non-institutional investors seeking to be millionaires in this highly volatile market. Some have made it, and some have lost everything. Thus, unsurprisingly, the cryptocurrency market has received significant attention from everyone: the media, regulators, and individual and institutional investors. It is also a current and important topic in academic research (Angerer et al. 2020; Li et al. 2021).

Due to the increasing popularity of cryptocurrencies, new empirical evidence is being produced very quickly; therefore, there is a great need to aggregate and synthesize the existing knowledge on cryptocurrency investments and to identify gaps in the literature (Angerer et al. 2020; Corbet et al. 2019). Therefore, in this study, we aggregate and synthesize what is currently known in the cryptocurrency investment literature, providing

important insights for investors to better assess their investment by maximizing returns and minimizing the risks, and helping researchers to better study the complexities of the cryptocurrency market.

In this regard, following the call of Angerer et al. (2020) and Corbet et al. (2019), we develop a bibliometric analysis of cryptocurrency investment with a threefold objective: to consolidate and map the knowledge of the growing academic literature on cryptocurrency investment; to facilitate future research by identifying gaps in the literature; and to provide useful research findings for investors, academics, professionals, and policymakers.

This paper contributes a cluster-based systematic analysis on the important and unconsolidated topic of cryptocurrency investment. We provide a more in-depth analysis than previous research (Aysan et al. 2021; Bariviera and Merediz-Solà 2021; García-Corral et al. 2022; Jalal et al. 2021; Liang et al. 2016; Merediz-Solá and Bariviera 2019) by using a cluster-based approach grounded in a bibliographic coupling analysis, revealing complex network associations within each cluster. A cluster analysis highlights time trends and topic networking and provides specific cluster-based authors and research outlets that provide guidance for academics and practitioners alike on specific strands of the literature. Furthermore, the use of more broad keywords in our search enables the possible contribution of more borderline studies on cryptocurrency investment. In addition, our study delivers a qualitative analysis, revealing the main conclusions and future research venues by cluster.

A study with these significant contributions is of the utmost importance for researchers, investors, regulators, and academics in general. Our findings provide researchers with valuable information for their future studies on cryptocurrency investment. In addition, it provides insights for regulators to effectively regulate cryptocurrencies.

The remainder of the study is organized as follows: Section 2 presents the data and outlines the methodology used. Section 3 presents the quantitative and the qualitative analysis. Finally, in Section 4, we provide concluding remarks.

2. Data and Methodology

Similar to the extant literature, we sampled the Web of Science Core Collection database (WoS) (Jiang et al. 2021; Liang et al. 2016; Milian et al. 2019; Yue et al. 2021).

As the initial landmark in cryptocurrency literature was published in 2008 by Satoshi Nakamoto, we decided to take the year 2009 as the starting date of our search. Thus, we searched for academic journals between 1 January 2009 and 11 April 2021.

In order to perform the search, we selected the keywords "cryptocurrenc*", "Bitcoin", "Portfolio diversification", "invest*", and "Alternative investment". The initial search results returned 3.744 articles. However, we only considered articles that addressed our research objective, that is, the articles needed to address the subject of cryptocurrency as an investment, providing any knowledge that might be of interest from the investment/investor perspective. Additionally, as a quality criterion, we decided to only select journal articles written in English and that belonged to the Academic Journal Guide ABS (Association of Business Schools) list of 2021, regardless of their field of knowledge. With the use of the ABS journal list as a quality criterion, we ensured that the studies included in the review had undergone a rigorous peer review process and were published in reputable journals. This process led to a final sample of 482 articles. Furthermore, the use of more broad keywords in our search enabled the possible contribution of more borderline studies on cryptocurrency investment. In Figure 1, we present our flow of information in addition to the different phases of our systematic review process, which was based on PRISMA (Page et al. 2021). We only used the WoS database since due to the use of the ABS journal guide list as a quality criterion, the articles provided by the Scopus database overlapped too significantly with WoS to be considered in this research.

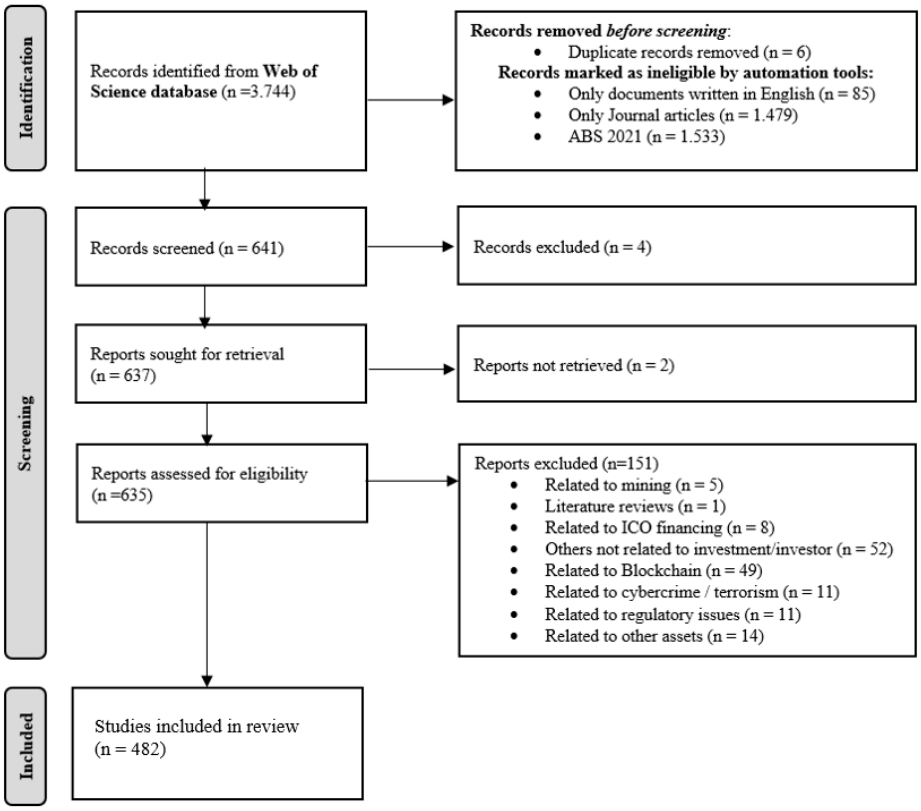

Figure 1. Flow of information through the different phases of our systematic review process (PRISMA).

In our analysis we used VOSviewer 1.6.17 (Bartolacci et al. 2020; Ding et al. 2014; Galvao et al. 2019; Rialti et al. 2019; Sadeghi Moghadam et al. 2021; van Eck and Waltman 2017) as a bibliometric tool and adopted bibliographic coupling in order to aggregate the selected articles (Bartolacci et al. 2020; van Eck and Waltman 2017). A bibliographic coupling analysis determines the relatedness of items based on the number of references they share (Bartolacci et al. 2020; Ding et al. 2014; Galvao et al. 2019; Rialti et al. 2019; Sadeghi Moghadam et al. 2021; van Eck and Waltman 2017). Unlike other bibliometric analysis on the literature on cryptocurrency (Aysan et al. 2021; Bariviera and Merediz-Solà 2021; García-Corral et al. 2022; Jalal et al. 2021; Liang et al. 2016; Merediz-Solá and Bariviera 2019), we used a bibliographic coupling analysis, highlighting its powerful and accurate analysis based on the number of references since those do not change over time as the number of citations does (Bartolacci et al. 2020; Ding et al. 2014; Galvao et al. 2019; Rialti et al. 2019; Sadeghi Moghadam et al. 2021; van Eck and Waltman 2017).

In addition, and in order to mitigate the bias against newer articles that might have fewer citations compared to older ones, we adopted the normalized citation option (Bartolacci et al. 2020; Caputo et al. 2019). In this option, the normalized citations are calculated as the total citations of an article divided by the average of the citations of all the articles that were published in the same year from the data collected (Bartolacci et al. 2020; van Eck and Waltman 2017).

3. Results

As a result of the VOSviwer bibliographic coupling, four clusters were obtained. Therefore, we decided to conduct our bibliometric analysis evidencing the differences between the resulting literature clusters. Namely, cluster 1 (red) included 166 articles that mostly investigated investor behavior, news effects, and investor sentiment. Cluster 2 (green) included 146 articles, particularly those that investigated portfolio diversification, hedge, and safe-haven properties. Cluster 3 (blue) included 138 articles that mainly explored the microstructure and efficiency of the cryptocurrency market. Finally, cluster 4 (yellow)

included 32 articles encompassing several issues related to volatility and risk management in cryptocurrency investments.

Recent years show a growing interest in this field (Figures 2 and 3), from 1 article published in 2015 to 195 articles in November 2021. The year 2021 delivered 81 and 71 articles in clusters 2 and 1, respectively, and was the most productive year in our dataset. In clusters 3 and 4, the largest contributions were made in 2019 (46) and 2020 (12). These results highlight the growing interest of academia and the novelty of the research field scrutinized herein.

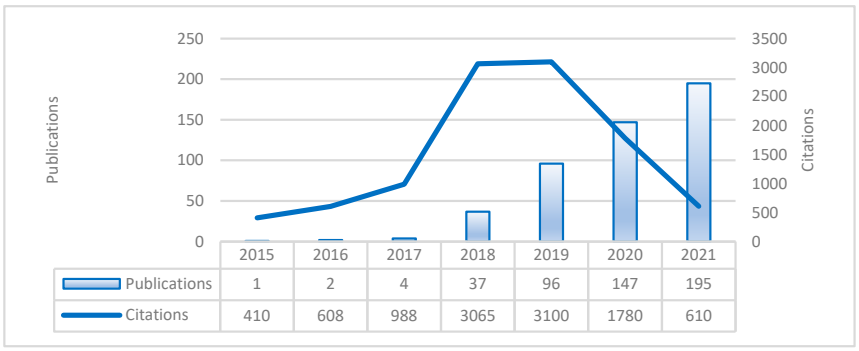

Figure 2. Dataset citations and publications over time.

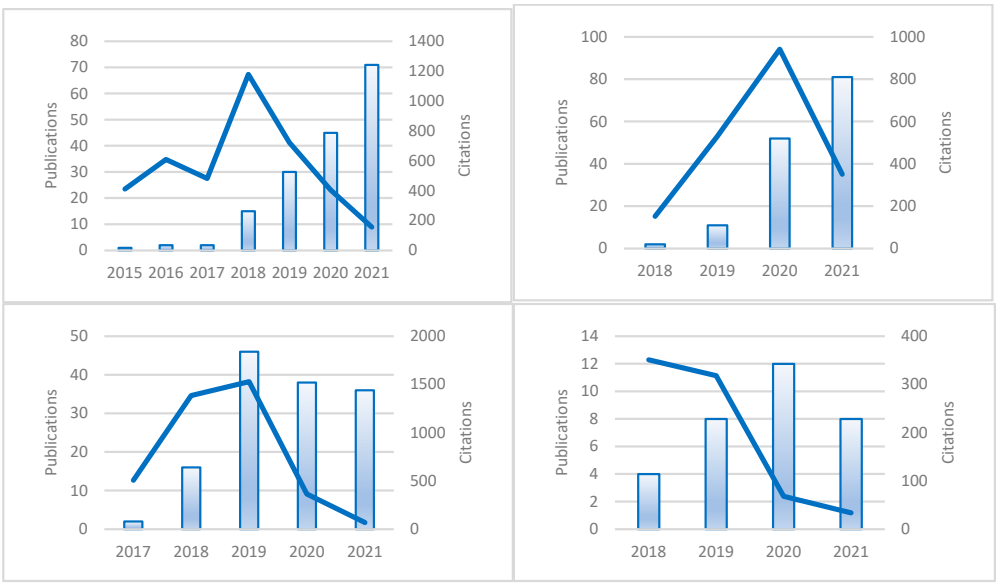

Figure 3. Citations/publications over time: cluster 1 (**upper left**), cluster 2 (**upper right**), cluster 3 (**lower left**), cluster 4 (**lower right**).

Figure 4 presents the most contributive areas of knowledge to this literature strand. As expected, finance and economics are the most relevant, with 276 and 165 publications, respectively.

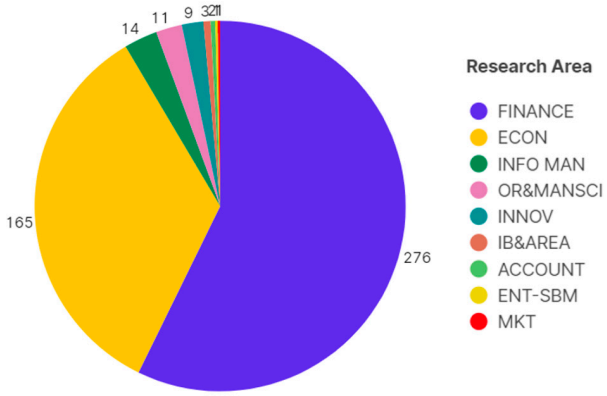

Figure 4. Most contributive research areas.

3.1. Cluster Network Analysis

Figure 5 shows that cluster 1 (red), cluster 2 (green), and cluster 3 (blue) express greater numbers of publications and citations. Cluster 4 (yellow) appears to be emerging from the other three clusters. However, until now, 2020 was the year that this cluster received more contributions, pointing toward a deceleration of publications in this theme, which may suggest that researchers and journals are now paying more attention to portfolio diversification, hedge, and safe-haven properties, investor behavior, news effects, and investor-sentiment-related themes. In addition, Figure 5 evidences that there are articles addressing thematics from more than one cluster, revealing that the boundaries between clusters are blurred. This is easily justified by the fact that the literature on cryptocurrency is still young; thus, many references are interconnected.

3.2. Cluster's Top Articles

Table 1 highlights the top 10 most-cited articles in each cluster. Therefore, we can point out that the most-cited article in cluster 1 was Urquhart (2016), the most-cited article in cluster 2 was Corbet et al. (2020), the most-cited article in cluster 3 was Corbet et al. (2018a), and, finally, he most-cited article in cluster 4 was Klein et al. (2018).

3.3. Journal Cluster Network Analysis

The average citations by a journal were 220, the mode was 16, and the median was 38, with a maximum of 3258 citations from *Finance Research Letters* with 109 publications and a minimum of 0 from *Electronic Markets* with 1 publication. In the dataset, *The Journal of Monetary Economics* presents the highest ratio of citations per publication, with 1 publication and 178 citations.

In Table A1 and Figure 6, we show that *The Finance Research Letters*, *Economics Letters*, and *The International Review of Financial Analysis* are the journals with more citations. In addition, the journal *Finance Research Letters* is present in all clusters and is the most-cited journal in clusters 1 and 2. The journal *Economics Letters* is the second most-cited journal in our dataset, and this fact remains in cluster 1. In cluster 3, *Economics Letters* is the most-cited journal. Therefore, it is evidenced that the journal *Finance Research Letters* contributed more to investor behavior, news effects, investor sentiment, portfolio diversification, hedge, and safe-haven properties. The journal *Economics Letters* contributed more on cryptocurrency market microstructure and efficiency. Finally, the journal *The International Review of Financial Analysis* contributed more to volatility and risk management in cryptocurrencies. In addition, Figure 6 shows that of the four clusters, cluster 1 presents the highest structured journal network. It is also shown that the journal with more recent citations in cluster 1 is *The European Journal of Finance*, in cluster 2 it is *Resources Policy*, in cluster 3 it is *The Annals of Operation Research*, and finally, in cluster 4, it is *Technological Forecasting and Social Change*.

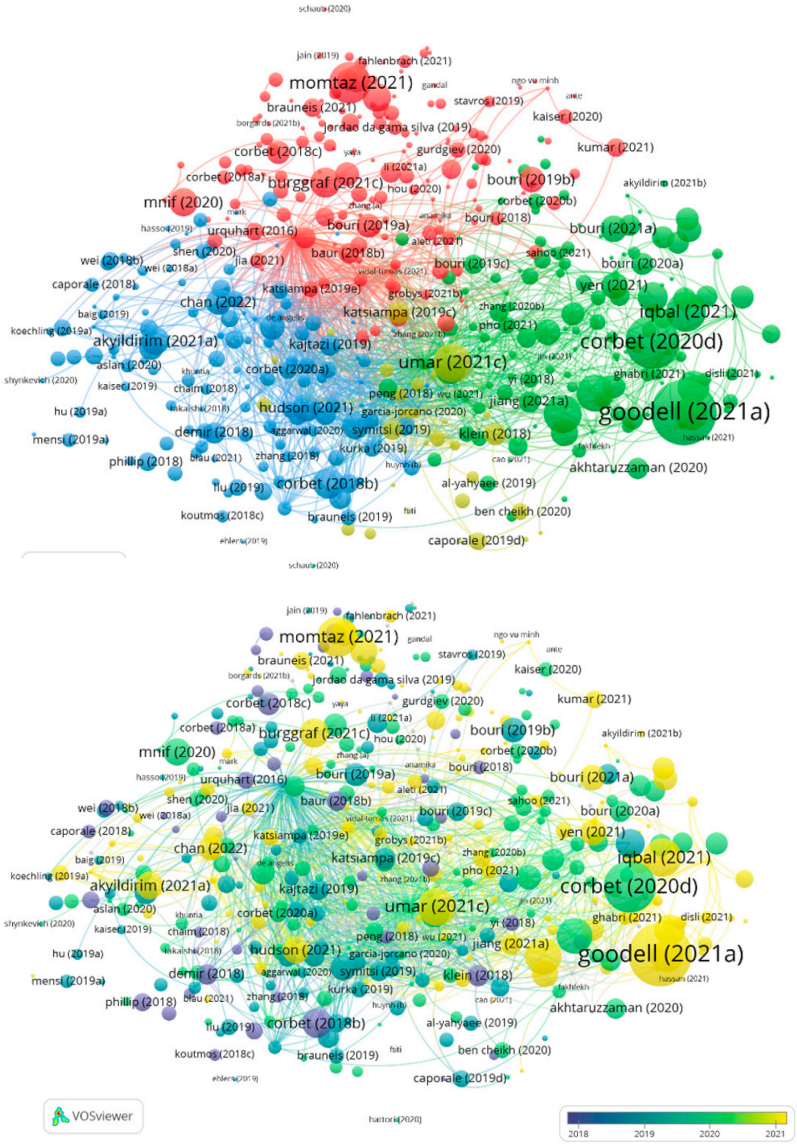

Figure 5. Cluster network visualization (**up**) overlay visualization by year (**down**).

Table 1. Top ten most-cited articles by cluster.

	Cluster 1 (3960 Citations and 166 Publications)		Cluster 2 (1975 Citations and 146 Publications)	
Rank	**Article**	**Ct [1]**	**Article**	**Ct [1]**
1	Urquhart (2016)	446	Corbet et al. (2020)	171
2	Cheah and Fry (2015)	410	Ji et al. (2019a)	136
3	Bouri et al. (2017b)	370	Yi et al. (2018)	104
4	Corbet et al. (2018b)	200	Colon et al. (2020)	83
5	Galvao et al. (2018)	178	Goodell and Goutte (2021)	74
6	Fry and Cheah (2016)	162	Ji et al. (2019b)	67
7	Baur et al. (2018)	159	Katsiampa et al. (2019a)	59
8	Bouri et al. (2017a)	111	Bouri et al. (2019a)	57
9	Bouri et al. (2019b)	96	Wang et al. (2019)	56
10	Bouri et al. (2019c)	88	Sun et al. (2020)	54

Table 1. *Cont.*

	Cluster 3 (3855 Citations and 138 Publications)		Cluster 4 (771 Citations and 32 Publications)	
Rank	**Article**	**Ct [1]**	**Article**	**Ct [1]**
1	(Corbet et al. 2018a)	348	Klein et al. (2018)	192
2	(Katsiampa 2017)	346	Baur and Dimpfl (2018)	81
3	(Demir et al. 2018)	173	Peng et al. (2018)	75
4	(Urquhart 2017)	161	Katsiampa et al. (2019b)	74
5	(Phillip et al. 2018)	129	Symitsi and Chalvatzis (2019)	61
6	(Brauneis and Mestel 2018)	123	Caporale and Zekokh (2019)	46
7	Wei (2018)	111	Chan et al. (2019)	36
8	Urquhart and Zhang (2019)	107	Walther et al. (2019)	34
9	Gkillas and Katsiampa (2018)	89	Omane-Adjepong and Alagidede (2019)	31
10	Sensoy (2019)	86	Phillip et al. (2019)	29

[1] Ct—citation.

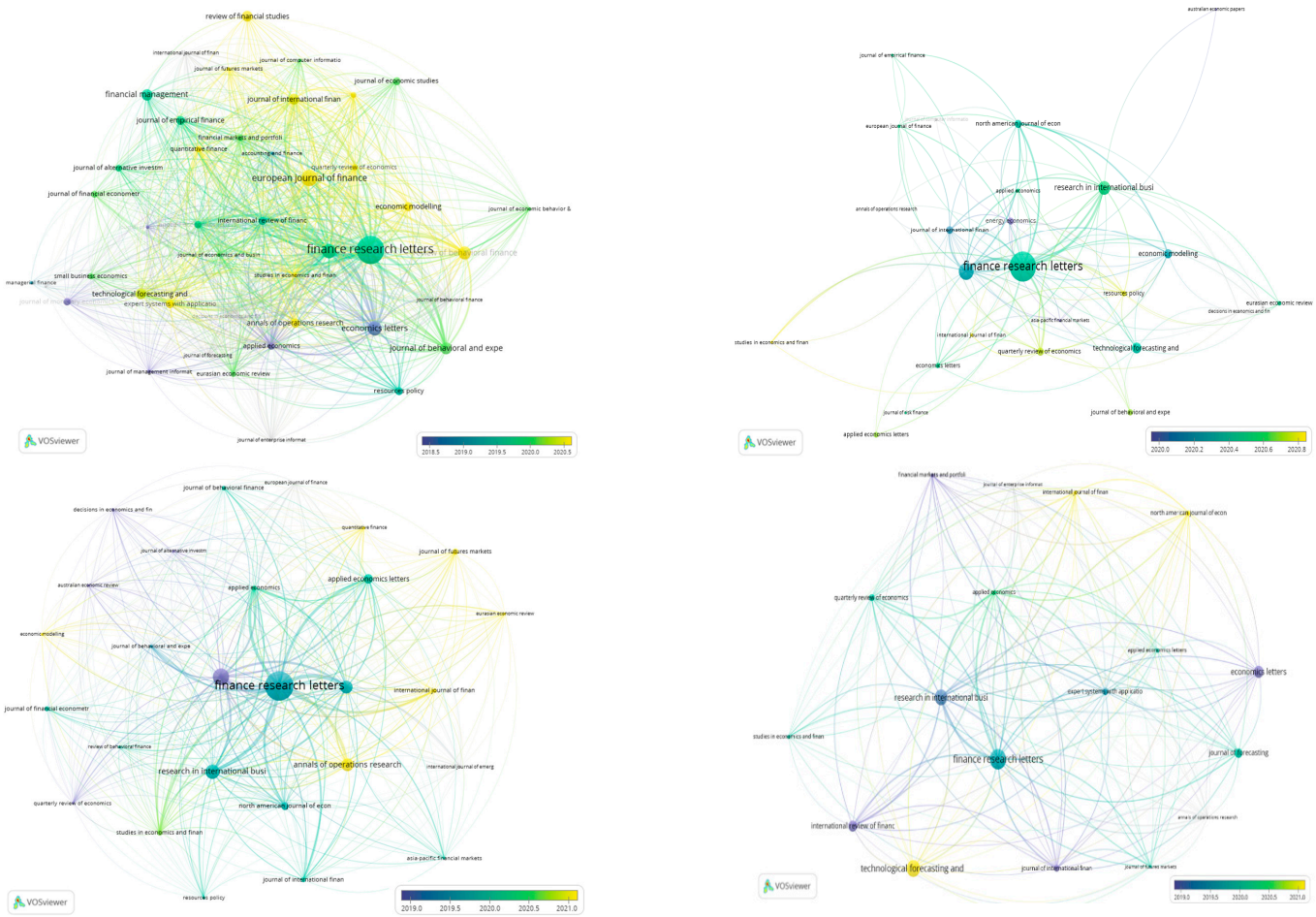

Figure 6. Cluster networks of the most-cited journals by year: cluster 1 (**upper left**), cluster 2 (**upper right**), cluster 3 (**lower left**), cluster 4 (**lower right**).

3.4. Country Cluster Network Analysis

Table A1 show the corresponding authors' countries, evidencing that England is by far the country that produced the most articles, with 101 publications and 4218 citations. The average number of citations per country was 302, the mode was 0, and the median was 79. Additionally, Table A1 and Figures 7 and 8 show evidence that England contributed more to investor behavior, news effects, investor sentiment, and cryptocurrency market microstructure and efficiency. Conversely, China contributed more to portfolio diversification, hedge, and safe-haven properties. Germany contributed more to volatility and risk management in cryptocurrencies. In addition, Figure 8 highlights the highly structured country networks in all clusters. It also shows that the country with more recent citations in cluster 1 is Tunisia; in cluster 2, it is Greece, in cluster 3, it is Lebanon, and in cluster 4, it is Pakistan.

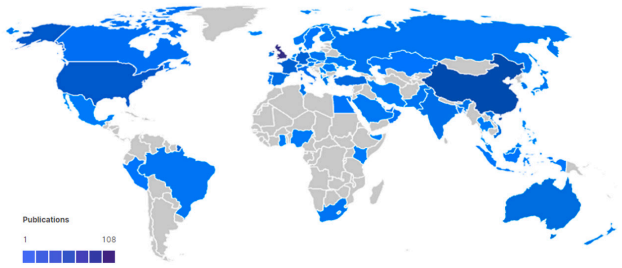

Figure 7. Publications by country world map.

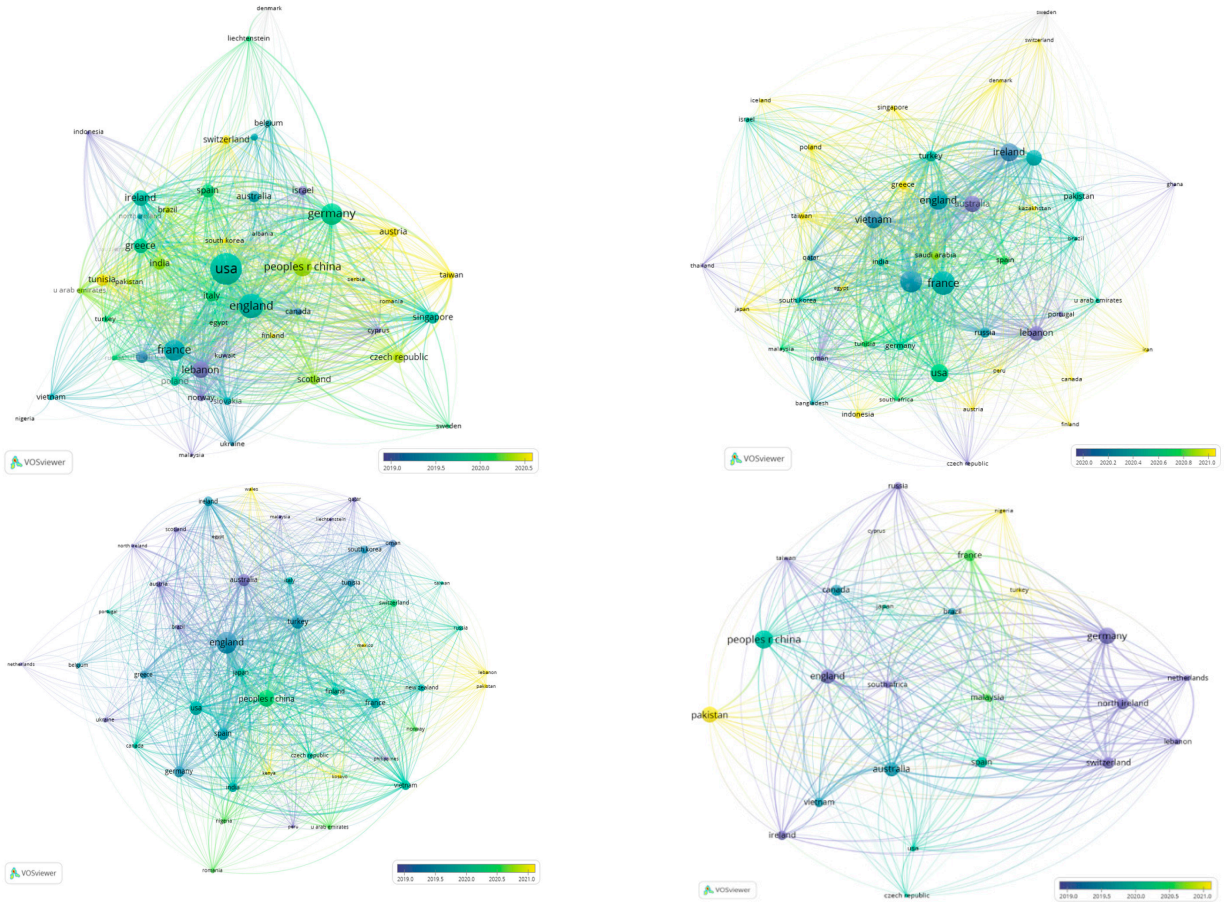

Figure 8. Cluster networks of the most-cited countries by year: cluster 1 (**upper left**), cluster 2 (**upper right**), cluster 3 (**lower left**), and cluster 4 (**lower right**).

3.5. Author Cluster Network Analysis

Table A1 and Figure 9 present the most-cited authors, evidencing Shaen Corbet, Elie Bouri, David Roubaud, and Brian Lucey as the four most-cited authors in the dataset, with more than 1000 citations each. However, Eng-Tuck Cheah appears in the ninth position with a citation per publication ratio of 286, with only 2 published articles with a total of 572 citations. The average citations per author was 33, the mode was 0, and the median was 6.

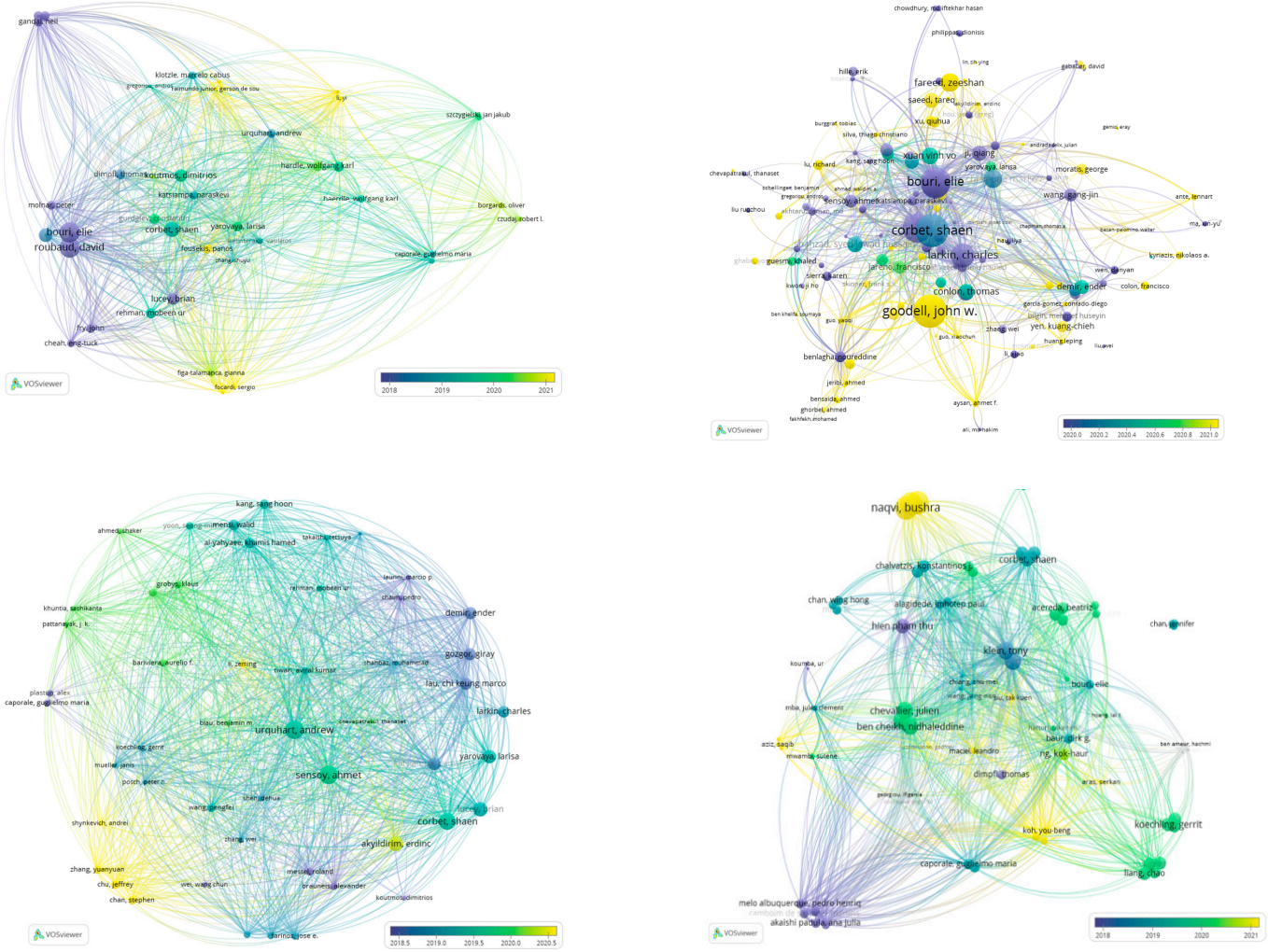

Figure 9. Cluster networks of the most-cited authors by year: cluster 1 (**upper left**), cluster 2 (**upper right**), cluster 3 (**lower left**), and cluster 4 (**lower right**).

This analysis highlights that Elie Bouri is the most published and cited in investor behavior, news effects, and investor sentiment, portfolio diversification, hedge, and safe-haven properties. Regarding cryptocurrency market microstructure and efficiency, Paraskevi Katsiampa is the most-cited author; however, the most published author was Andrew Urquhart (rank 5). Tony Klein and Thomas Walther share the rank of the most-cited and productive author in volatility and risk management in cryptocurrencies. In addition, Figure 9 emphasizes a highly structured author network in all clusters. It also shows that the author with more recent citations in cluster 1 is Panos Fousekis; in cluster 2, it is John Goodell, in cluster 3, it is Stephen Chan, and in cluster 4, it is Bushra Naqvi.

3.6. Institution Cluster Network Analysis

Table A1 and Figure 10 present the institutions that contributed the most to our research field. With 22 publications, Dublin City University is one of the institutions in the dataset that has contributed the most. It is also the institution for which the published articles have more citations (1198), which we can relate to our previous analysis, which revealed the most-cited author to be Shaen Corbet, who is solely responsible for Dublin City University's rank in our dataset. In addition, in the top three ranked positions are Trinity Coll Dublin (1188) and Montpellier Business School (1166). The average number of citations per institution was 44, the mode was 0, and the median was 8.

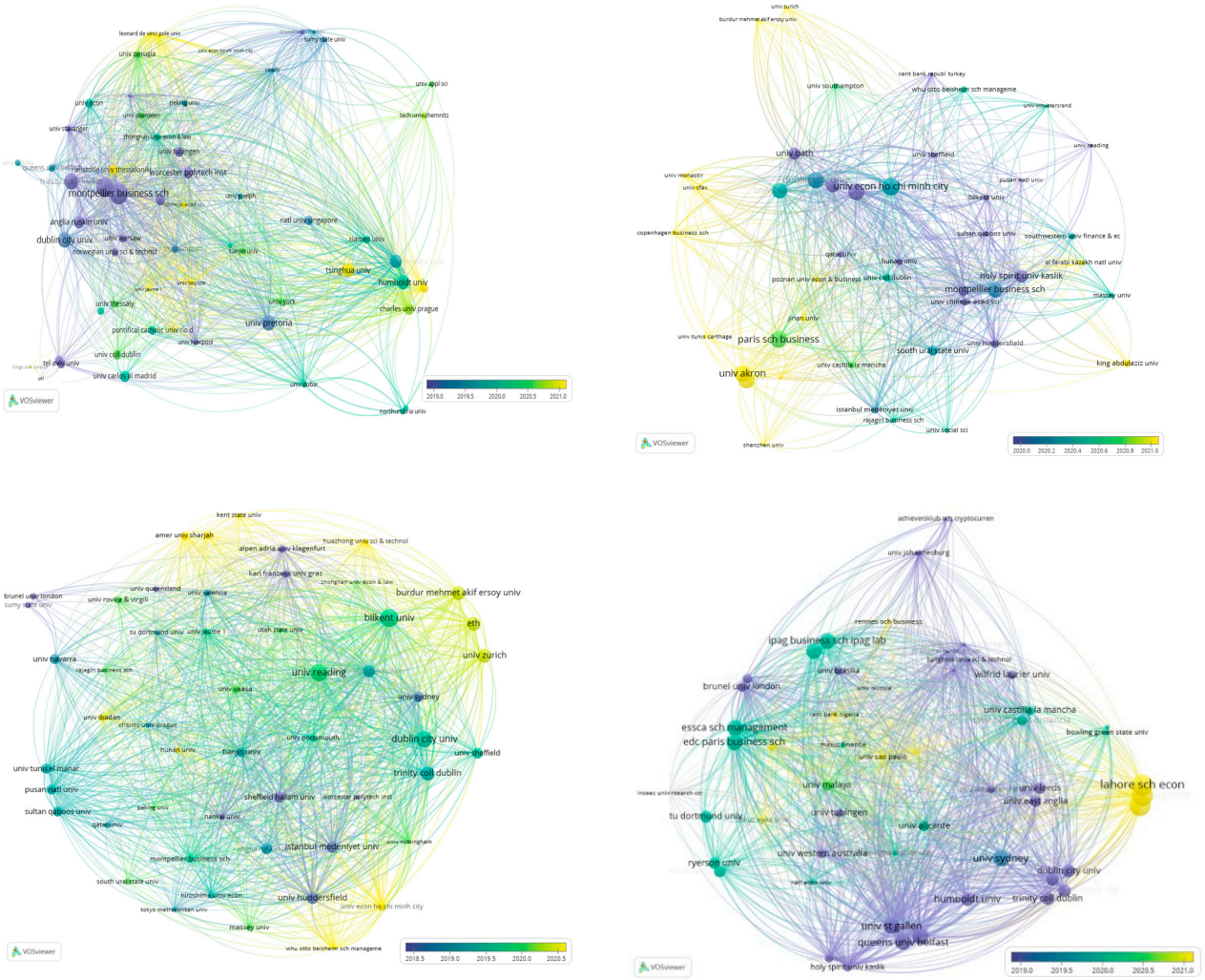

Figure 10. Cluster networks of the most-cited institutions by year: cluster 1 (**upper left**), cluster 2 (**upper right**), cluster 3 (**lower left**), and cluster 4 (**lower right**).

Montpellier Business School was the most-cited institution (747) that contributed to investor behavior, news effects, and investor sentiment; Trinity College Dublin was the most-cited institution (386) in portfolio diversification, hedge, and safe-haven properties, Sheffield Hallam University was the most-cited institution (507) in cryptocurrency market microstructure and efficiency; and Queens University Belfast was the most-cited institution (226) in volatility and risk management in cryptocurrencies. Figure 10 also reveals highly structured institution networks in all clusters. It shows that the institution with more recent citations in cluster 1 is Tsinghua University; in cluster 2, it is Akron University, in cluster 3, it is the Ho Chi Minh City University of Economy, and in cluster 4, it is the Lahore School of Economy.

3.7. Identification of Trend Topics

3.7.1. Cluster Keyword Co-Occurrence Analysis

Figure 11 shows the relationship between keywords based on the number of articles in which they occur together. The top three keywords in all clusters are Bitcoin, cryptocurrency, and cryptocurrencies, which is in line with the findings of Jiang et al. (2021) and Jalal et al. (2021). The most recent co-occurrence of keywords in cluster 1 reveals that research is implementing machine learning and technical analysis and is highly concerned with the impact of COVID-19; in cluster 2, research is more concerned with uncertainty, liquidity, and with the COVID-19 impact; in cluster 3, there is the implementation of more support vector machine techniques and a focus on informational efficiency as well as investor attention; in cluster 4, the focus is on analyzing risk management, volatility spillovers, and the implementation of Markov regime switching models.

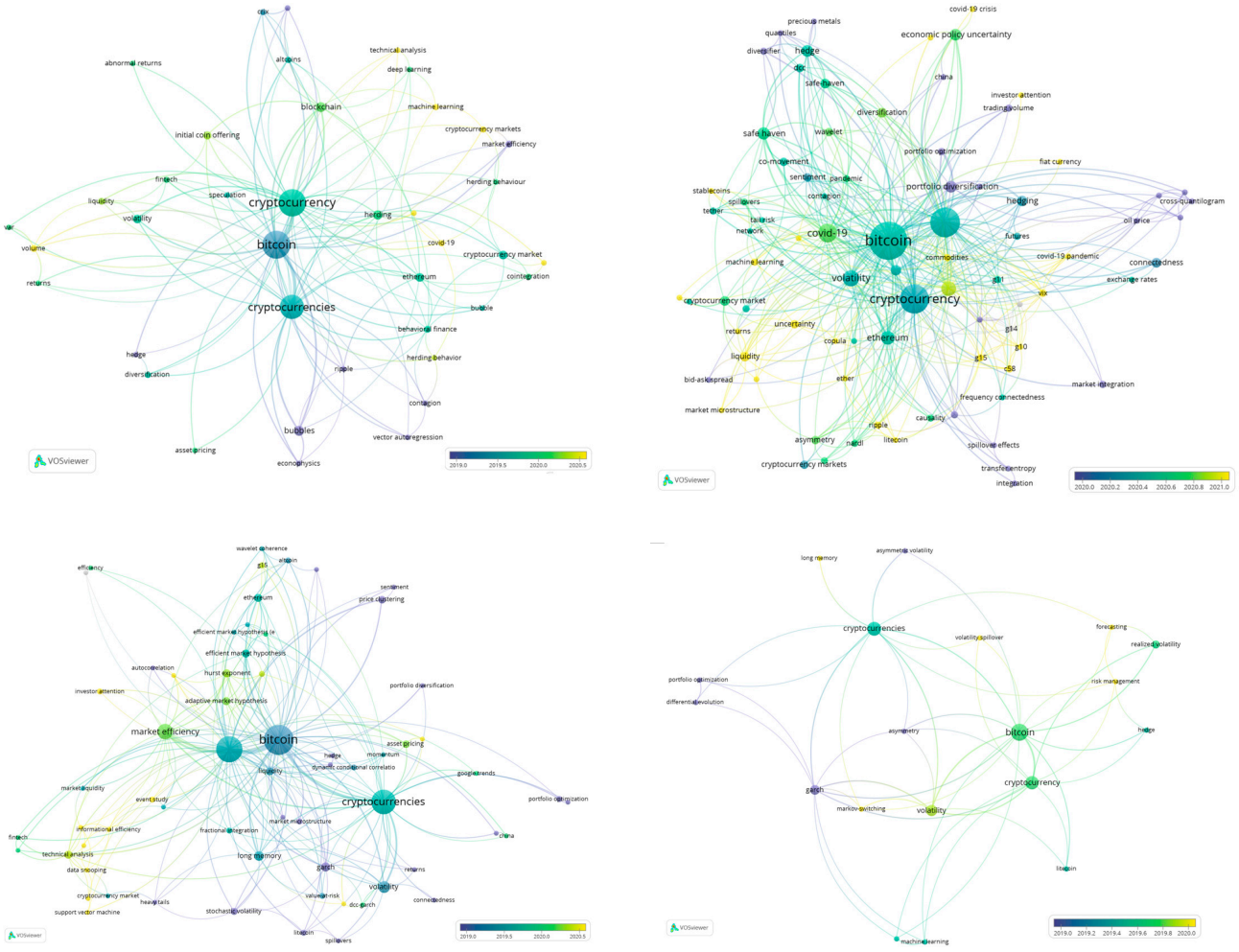

Figure 11. Keywords network: cluster 1 (**upper left**), cluster 2 (**upper right**), cluster 3 (**lower left**), and cluster 4 (**lower right**).

3.7.2. Research Stream Analysis

Following Jalal et al. (2021), we identified research streams in the literature. However, instead of using a co-citation analysis, as Alon et al. (2018) and Shonhe (2020), in which the relatedness of the items is determined based on the number of times they are cited together and therefore may change over time very easily, we adopted a bibliographic coupling analysis in which the relatedness of the items is determined based on the number of references they share, which do not change over time (Bartolacci et al. 2020; van Eck and Waltman 2017). We based our research stream on papers from the top 15 au-

thors, resulting in a sample of 90 papers. In Figure 12, we show the relationship of the top 15 authors in our dataset with the most-cited journals, their contributions to the research stream, and consequently, to each cluster. Figure 12 reveals that out of the top 15 authors' papers, cluster 2 seems to receive the highest flow, followed by cluster 1, cluster 3, and cluster 4. Cluster 1 and cluster 2 contribute to most of the research streams. On the other hand, Cluster 3 seems to contribute more to cryptocurrency, Bitcoin, market efficiency, spillovers, and asymmetry, and Cluster 4 contributes more to volatility, Bitcoin Ethereum, and spillovers. The main research stream are cryptocurrency, Bitcoin, and volatility, as found by Almeida and Gonçalves (2022).

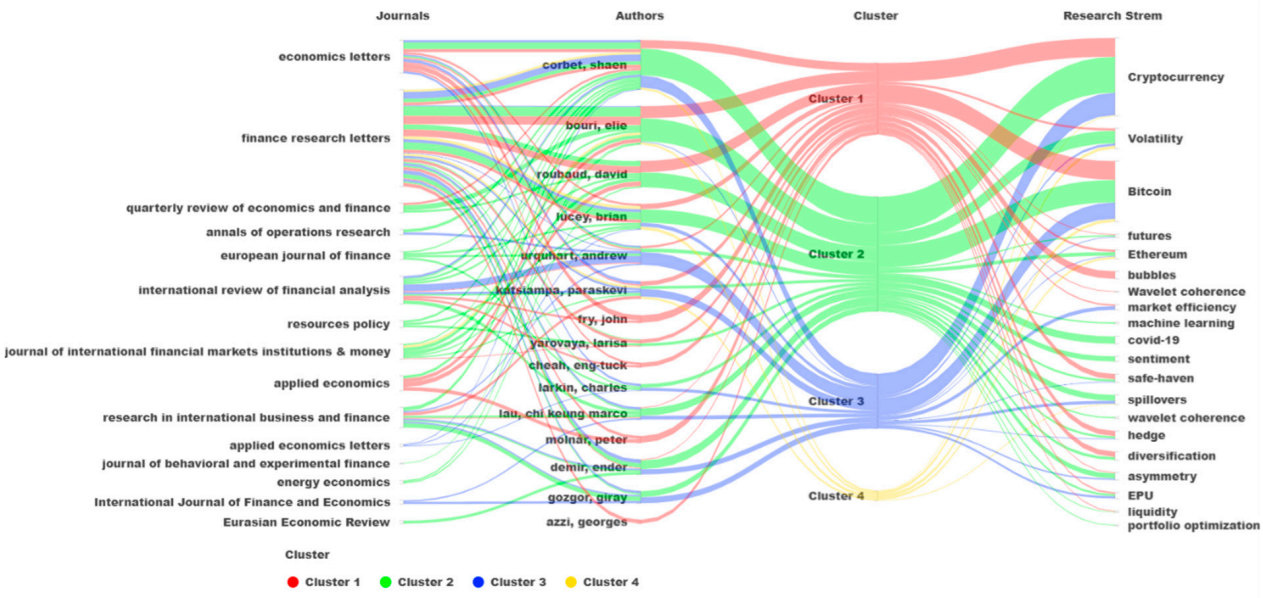

Figure 12. Journal–Author–Cluster–Research stream analysis.

3.8. Clusters' Main Contributions to the Literature

3.8.1. Main Conclusions

In cluster 1, we identified that the main conclusions regarding investor behavior in the cryptocurrency markets are that: (1) the crypto market is dominated by irrational investors (Kaiser and Stöckl 2020); (2) news and media attention seem to influence the demand for Bitcoin, suggesting that investors' beliefs can help in understanding the cryptocurrencies' behavior (Flori 2019); (3) there is high level of herding behavior that can lead to market inefficiency (Raimundo et al. 2020; Bouri et al. 2019b); (4) risk-seeking behavior drives crypto investors (Pelster et al. 2019).

In cluster 2, the main conclusions concerning portfolio diversification, hedge, and safe-haven properties in cryptocurrency investments are: (1) cryptocurrencies' ability to hedge against stocks, fiat currencies, geopolitical risks, and economic policy uncertainty (EPU) is time-varying (Mensi et al. 2020); (2) uncertainty is a determinant for cryptocurrency returns (Colon et al. 2021); (3) stablecoins have the ability to act as safe havens and diversifiers (Wang et al. 2020); (4) investors should consider gold, the European carbon market, CBOE Bitcoin futures, and crude oil to hedge against cryptocurrency market uncertainty (Huynh et al. 2020).

In cluster 3, we found the main conclusions about the cryptocurrency market structure to be that: (1) the level of inefficiency varies with time, thus supporting the adaptive market hypothesis (AMH) (Mensi et al. 2019); (2) when trade volume and market capitalization increase, liquidity uncertainty will tend to decrease (Koutmos 2018); (3) there is a connectedness with traditional assets (Kurka 2019); (4) cryptocurrencies' returns and liquidity seem to have impact on the size effect (Li et al. 2020).

Finally, in cluster 4, regarding volatility and risk management on cryptocurrency investment, the main conclusions are: (1) cryptocurrencies' new accepting venues can predict a cryptocurrency's volatility (Sabah 2020); (2) Bitcoin's price volatility presents an "anti-leverage effect" (Tan et al. 2020); (3) there are bidirectional volatility spillovers in the crypto market (Katsiampa et al. 2019b); (4) cryptocurrencies present diversification benefits on intraweek and monthly scales (Omane-Adjepong and Alagidede 2019).

3.8.2. Main Futures Lines of Research

As far as future lines of research, in investor behavior in the cryptocurrency markets, (cluster 1) we found: (1) the need to further investigate the disposition effect among cryptocurrency investors (Gemayel and Preda 2021); (2) the need to analyze the impact of monetary and governmental policies on cryptocurrency investors (Mnif et al. 2020); (3) the need to further investigate herding behavior in the crypto market (Papadamou et al. 2021); (4) the need to include variables such as perceived knowledge, emotional intelligence, profitability, anonymity, risk aversion, and convenience (Gupta et al. 2020).

Regarding portfolio diversification, hedge, and safe-haven properties in cryptocurrency investments, we found: (1) the need to further investigate the relationships between cryptocurrencies and other assets classes such as equities, bonds, currencies, and commodities (Bouri et al. 2021; Hsu et al. 2021); (2) the need to evaluate the change in efficient frontiers in a three-dimensional space (mean–variance–skewness) (Kwon 2020); (3) the use of more powerful deep learning algorithms and machine learning approaches (Huynh 2021); (4) the need to further investigate cryptocurrency futures and options (Qiao et al. 2020).

For cryptocurrency market structure, we found: (1) the need to explore market heterogeneity in the cryptocurrency market (Sapkota and Grobys 2021); (2) the need to use the generalized autoregressive score (GAS) framework (Matkovskyy 2019); (3) the need to investigate the time-varying market efficiency of the cryptocurrency markets (Charfeddine and Maouchi 2019); (4) the need to investigate how investor/borrower characteristics affect interest rates in bitcoin lending and defaults (Zhang et al. 2021).

Finally, for volatility and risk management in cryptocurrency investment, we found: (1) that GARCH models' great variety should be further explored from the staking ensemble perspective (Aras 2021); (2) the need to further use the heterogeneous autoregressive regression (HAR) model (Hattori 2020); (3) the need to analyze if cryptocurrency-realized volatility or its trading volume drive the long-term volatility (Walther et al. 2019); (4) the need to understand cryptocurrencies' returns and the magnitude of their volatility spillovers (Omane-Adjepong and Alagidede 2019).

4. Conclusions

Our study adds to the current literature a cluster bibliometric analysis which examines the literature's contributions to cryptocurrency investment since its inception. We searched the WoS database and focused only on journals listed on the 2021 ABS list. We obtained a final sample of 482 articles. Empirical results show evidence of a growing interest in this field over the past few years. From our analysis, four literature clusters emerged, namely, investigating investor behavior; portfolio diversification; cryptocurrency market microstructure; and risk management in cryptocurrency investment. The most contributing institutions are located in Europe and China, as in the findings of Jiang et al. (2021), Yue et al. (2021), García-Corral et al. (2022), Almeida and Gonçalves (2022, 2023a, 2023b); however, the conclusions are different from the conclusions made Alsmadi et al. (2022). *Finance Research Letters* is the most-cited and productive journal, as in and Almeida and Gonçalves (2023b); however, this is different from the conclusions made by Almeida and Gonçalves (2022).

Our study, unlike previous studies (Aysan et al. 2021; Bariviera and Merediz-Solà 2021; García-Corral et al. 2022; Jalal et al. 2021; Liang et al. 2016; Merediz-Solá and Bariviera 2019) adds to the bibliometric analysis on the cryptocurrency literature, an insightful cluster-based systematic analysis, revealing complex network associations within each cluster. Additionally, it delivers a qualitative analysis revealing: (1) The main conclusions by cluster,

in which we highlight the evidence of herding behavior in the cryptocurrency market that can lead to market inefficiency, the time-varying ability of cryptocurrencies to act as hedgers against stocks, fiat currencies, geopolitical risks, and economic policy uncertainty (EPU), the time-varying inefficiency of the cryptocurrency market, and the evidence of bidirectional volatility spillovers in the crypto market; (2) The future research venues by cluster in which we highlight the need to further investigate the disposition effect among cryptocurrency investors, to further investigate cryptocurrency futures and options, to investigate the time-varying market efficiency of the cryptocurrency markets, and to understand cryptocurrencies' returns and the magnitude of their volatility spillovers. Our results are in line with other cryptocurrency literature reviews (Almeida and Gonçalves 2022, 2023a, 2023b; Ballis and Verousis 2022; Hairudin et al. 2020; Haq et al. 2021).

A study with these contributions is of the utmost importance for researchers, investors, regulators, and academics in general. Our findings provide researchers with cluster-based information and structured networking for research outlets and literature strands, with time-trended information relevant for future studies on cryptocurrency investment. In addition, it provides insights for regulators to effectively regulate cryptocurrencies.

The use of only one database (WoS) could be considered a limitation of the research. However, due to the use of the ABS journal guide list as a quality criterion, the marginal articles provided by the Scopus database were not significant. Future research should evolve and implement more machine learning analyses, improve investor sentiment research, and explore how the crypto market can become greener. Future studies should also analyze the relationship between decentralized cryptocurrencies and Central Bank Digital Currencies (CBDC) (Alonso et al. 2020), consider the effect of exchange failures on cryptocurrencies (Briola et al. 2023), and consider the environmental impact of the cryptocurrency market (J. Li et al. 2019; Náñez Alonso et al. 2021). Future research may also consider our analysis with the use of other databases, such as Scopus, as well as a systematic literature review on the research field scrutinized herein.

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Appendix A

Table A1. Dataset and cluster top five journals, articles, countries, and institutions.

	Dataset	Ct	Pb	Ct/Pb	Cluster 1	Ct	Pb	Ct/Pb	Cluster 2	Ct	Pb	Ct/Pb	Cluster 3	Ct	Pb	Ct/Pb	Cluster 4	Ct	Pb	Ct/Pb
									Journals											
1	Finance research letters	3258	109	29.9	Finance research letters	1185	21	56.4	Finance research letters	716	34	21.1	Economics letters	1651	21	78.6	International review of financial analysis	192	1	192.0
2	Economics letters	2921	41	71.2	Economics letters	1125	12	93.8	International review of financial analysis	345	16	21.6	Finance research letters	1222	48	25.5	Research in international business and finance	145	4	36.3
3	International review of financial analysis	994	30	33.1	Applied economics	247	5	49.4	Research in international business and finance	178	17	10.5	Research in international business and finance	303	9	33.7	Finance research letters	135	6	22.5
4	Research in international business and finance	750	42	17.9	International review of financial analysis	205	6	34.2	Energy economics	100	2	50.0	International review of financial analysis	252	7	36.0	Economics letters	92	2	46.0
5	Applied economics	344	18	19.1	Journal of monetary economics	178	1	178.0	Journal of international financial markets institutions & money	93	6	15.5	North American journal of economics and finance	75	5	15.0	Expert systems with applications	76	2	38.0
									Countries											
1	England	4218	101	41.8	England	1503	36	41.8	Peoples R. China	686	35	19.6	England	1920	35	54.9	Germany	318	4	79.5
2	France	1474	46	32.0	France	801	12	66.8	England	614	27	22.7	Turkey	554	14	39.6	North Ireland	226	2	113.0
3	Ireland	1361	32	42.5	Lebanon	754	6	125.7	France	567	23	24.7	Ireland	450	7	64.3	Switzerland	226	2	113.0
4	Australia	1271	35	36.3	USA	662	27	24.5	Ireland	505	16	32.6	Australia	448	11	40.7	Australia	190	6	31.7
5	Lebanon	1192	19	62.7	Norway	487	4	121.8	Vietnam	415	18	23.1	Spain	305	11	27.7	England	181	3	60.3
									Authors											
1	Corbet, Shaen	1198	22	54.5	Bouri, Elie	747	5	149.4	Bouri, Elie	404	11	36.7	Katsiampa, Paraskevi	522	5	104.4	Klein, Tony	226	2	113.0
2	Bouri, Elie	1185	18	65.8	Roubaud, David	747	5	149.4	Roubaud, David	389	9	43.2	Corbet, Shaen	450	6	75.0	Walther, Thomas	226	2	112.0
3	Roubaud, David	1136	14	81.1	Fry, John	632	3	210.7	Corbet, Shaen	379	11	34.5	Lucey, Brian	420	4	105.0	Hien Pham Thu	192	1	192.0
4	Lucey, Brian	1121	13	86.2	Cheah, Eng-Tuck	572	2	286.0	Lucey, Brian	346	6	57.7	Yarovaya, Larisa	385	3	128.3	Baur, Dirk G.	81	2	40.5
5	Urquhart, Andrew	873	13	67.2	Molnar, Peter	481	2	240.5	Lau, Chi Keung Marco	206	6	34.3	Urquhart, Andrew	381	8	47.6	Dimpfl, Thomas	81	1	81.0

Table A1. *Cont.*

	Dataset	Ct	Pb	Ct/Pb	Cluster 1	Ct	Pb	Ct/Pb	Cluster 2	Ct	Pb	Ct/Pb	Cluster 3	Ct	Pb	Ct/Pb	Cluster 4	Ct	Pb	Ct/Pb
									Institutions											
1	Dublin City Univ.	1198	22	54.5	Montpellier Business School	747	5	149.40	Trinity College Dublin	386	9	42.89	Sheffield Hallam Univ.	507	4	126.75	Queens Univ. Belfast	226	2	113.00
2	Trinity College Dublin	1188	18	66.0	Univ. Sheffield	454	3	151.33	Dublin City Univ.	379	11	34.45	Dublin City Univ.	450	6	75.00	Technical Univ.of Dresden	226	2	113.00
3	Montpellier Business School	1166	20	58.3	Univ. Southamp-ton	446	3	148.67	Montpellier Business School	372	12	31.00	Trinity College Dublin	420	4	105.00	Univ. St Gallen	226	2	113.00
4	Holy Spirit Univ.	774	13	59.4	Holy Spirit Univ.	377	4	94.25	Holy Spirit Univ.	363	8	45.38	Anglia Ruskin Univ	368	2	184.00	Humboldt Univ.	192	1	192.00
5	Univ. Southampton	737	13	56.7	Norwegian Univ. Science Technology	370	2	185.00	Univ. Economics Ho Chi Minh City	361	15	24.07	Univ. Hud-dersfield	323	5	64.60	Univ. Sydney	108	3	36.00

Ct—citation; Pb—publications; Ct/Pb—citations per publications ratio.

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