

Behavioural Finance: A Review of Major Research Themes and Bibliometric Analysis

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Received: May 22, 2023. Revised: November 7, 2023. Accepted: November 17, 2023.

Abstract

This study explores the bibliometric attributes and reviews the literature in the domain of behavioural finance. Bibliometric analysis is applied to 1,523 articles from peer-reviewed journals of the Scopus database. VOS Viewer is applied for descriptive analyses of leading contributors (authors, sources, countries, and institutions). Biblioshiny and Gephi are used for clustering analysis and PageRank analysis, respectively. Future research directions are suggested based on keyword co-occurrence maps and clustering of recent articles. Five prominent themes in behavioural finance are identified: risk management and portfolio selection, market efficiency and investor behaviour, influence on investor behaviour, behavioural biases, and investor sentiment. In addition to the conceptual structure, the domain's intellectual and social networks are identified to clarify areas requiring further exploration. This study augments the knowledge of research scholars, finance academics, portfolio consultants, and other stakeholders about the overall structure and topics underpinning the literature.

Keywords: Behavioural finance, stock market, investor behaviour, market efficiency, investor sentiments.

JEL Classification Codes: G40, G41

UDC: 336.763

DOI: <https://doi.org/10.17015/ejbe.2023.032.01>

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1. Introduction

Behavioural finance, a recently developed branch of behavioural economics, aims to understand how investors behave when making financial decisions. Traditional finance theorists believe that finance is a scientific field, which implies that there is a perfect solution to a financial problem, similar to a scientific issue. Meanwhile, standard finance is founded on two fundamental assumptions: investors' rationality and the market's efficiency (Fama, 1970). Individuals exhibit a diverse approach to decision-making. Imperfections and abnormalities in the financial market pose challenges to investors' rationality and market efficiency, and classical theories in finance have yet to explain the tumultuous bubbles in the stock market. Therefore, behavioural finance attempts to clarify how real-world decision-makers make financial decisions and why their choices may not always seem reasonable (Paule-Vianez et al., 2020a).

Behavioural finance proposes the existence of psychological effects on financial practitioners and their subsequent impacts on financial markets. Shefrin (2001) defined behavioural finance as the study of how psychology influences financial decision-making and markets. The two main building blocks of behavioural finance include: 1) cognitive psychology (how humans think) and 2) limits to arbitrage (when the market is inefficient). sought to explain why investors oppose doing what they are supposed to do and act beyond the boundaries of rationality. In 1955, Herbert Simon first introduced models of bounded rationality based on individuals' cognitive and social limits in obtaining and processing information and societal influences.

The most profound and key development in behavioural finance is the prospect theory, which opposes the descriptive model of expected utility decision-making under risk to propose instead a pervasive effect in risky choices that are inconsistent with the basic tenets of the utility theory (Kahneman & Tversky, 1973).

Behavioural finance is a vast field encompassing numerous issues of human cognition in financial decision-making. Research on behavioural finance has taken various directions to discover how psychological, behavioural, and cognitive factors impact individuals' financial choices; the growing body of works illustrates the need for a bibliometric review of behavioural finance to systematically organize research in the field. To that end, we conducted a bibliometric study to explain the performance and productivity of behavioural finance and comprehend its essential topics and future research directions. Although we identified several bibliometric studies on behavioural finance, none of them broadly explored this research area independently. A bibliometric analysis by Paule-Vianez et al. (2020b) described bibliometric attributes and presented a thematic map of behavioural finance. Singh (2021) performed network analysis using the VOS Viewer. However, none of the studies included future research directions and the most prestigious articles on pertinent themes in behavioural finance. The growing body of literature on behavioural finance underscores the need for a bibliometric review to systematically

organise research in the field. Therefore, the current research aims to obtain a comprehensive overview of the field from a bibliometric perspective. To present a novel and broader perspective on behavioural finance, we conducted 1) a cluster analysis using Biblioshiny, 2) a PageRank analysis using Gephi, and 3) an analysis of future research directions and gaps in behavioural finance.

Hence, this study is intended as a unique endeavour to map the area of behavioural finance from a bibliometric perspective, where descriptive analysis, intellectual structure, and future research direction in behavioural finance take centre stage. The five research questions are as follows.

RQ1. What is the pattern of behavioural finance publications (number of research articles annually)?

RQ2. Where are the highly proficient publications linked to behavioural finance (outlets and articles)?

RQ3. Who are the top-tier authors, and which are the top-tier institutions and countries in the domain of behavioural finance?

RQ4. What does the prevailing literature communicate about behavioural finance (themes)?

RQ5. Where are the opportunities for future researchers to publish advanced and novel research (future avenues)?

The remainder of this article is structured as follows. Initially, we present a brief summary of the behavioural finance literature. Next, the bibliometric methods used in this review are outlined. Thereafter, we highlight the notable outcomes of the bibliometric review of the behavioural finance literature. Finally, future research directions are suggested to expand the field of behavioural finance.

2. Literature Review

Behavioural finance has emerged as a prominent field that integrates insights from psychology and economics to clarify deviations from conventional financial models. This review of literature aims to explore major concepts and discoveries in behavioural finance from highly cited articles.

In the 1980s, financial theorists began to consider the notion that investment laws might not be as clear-cut as previously theorized. According to the market efficiency theory, anomalies are chance outcomes. Prospect theory, which explains the inherent inconsistency in human risk assessment behaviour, is a pillar in the field of behavioural finance. It asserts that humans are not persistently risk-averse but rather, are risk-averse in the context of profits and risk-taking in the context of losses (Kahneman & Tversky, 1979). This seminal work paved the way for a paradigm shift in understanding investor behaviour. Subsequent studies, such as the work conducted by Shefrin and Statman (1985), have expanded the application of prospect theory to the realm of financial decision-making and highlighted its

resilience in elucidating investor behaviour. As we go further into the terrain, we come across the scholarly work of Shleifer & Vishny (1997), whose seminal piece titled "The Limits of Arbitrage," published in the *Journal of Finance* in 1997, emerged as a significant contribution to the field of behavioural finance. The papers provide light on the difficulties encountered by arbitrageurs in rectifying mispricing resulting from behavioural biases. This paper has significantly influenced the development of the narrative around the impact of investor mood and irrational behaviour on the creation of enduring market inefficiencies. Moving forward the study conducted by Odean (1998) examines the consequences of overconfidence in trading activities. Odean's analysis of individual investor portfolios reveals a positive correlation between overconfidence and increased trading activity, resulting in suboptimal performance. Furthermore, there has been a trend in the literature toward examining the influence of technology on the behavioural dimensions of finance. Contemporary research in academia, exemplified by the work of Baker and Wurgler (2007), explores the impact of social networking sites on investor sentiment and decision-making processes. In recent literature, scholars such as Glimcher (2011) have used neuroscientific approaches to elucidate the neurological mechanisms that contribute to the process of making financial decisions. The use of a multidisciplinary strategy in this study provides insight into the biological underpinnings of economic behaviour, so enhancing our understanding of the mental procedures involved in the human brain's handling of financial information (Camerer, 2013).

The unfolding literature on Behavioural Finance demonstrates a comprehensive exploration of contemporary research challenges that surpass conventional financial paradigms.

3. Methodology

3.1. Bibliometric search

This review conducted a bibliometric analysis of the behavioural finance literature. A total of 1,523 scholarly articles were selected after a bibliometric search of the Scopus database. As our review strongly focuses on 'behavioural finance', we used this phrase to search the Scopus database for research publications. We limited our search to data between 1994 and 2022, resulting in 2,345 articles. The article search was completed in 2022. It consisted of the following four steps: searching the databases and filtering results based on scholarly filtration, language filtration, and subject filtration.

Step 1: Database search. We selected Scopus for two reasons. First, it offers extensive coverage of publications that fulfil the requirements of indexing (e.g., scholarly and scientifically relevant). Second, the bibliometric information is comprehensive in publications that it indexes. Exposure to the Scopus database is vast; it has a large number of publications and has significantly enriched the bibliographic data in the social sciences (Kumar et al., 2021). Indeed, Scopus is suitable for extensive scientific bibliometric reviews.

Step 2: Scholarly filtration. We decided to only include journal papers, not book chapters or books because the former undergo a rigorous peer-review process and are assessed based on their novelty and originality, which are essential measures for assessing and reporting the highest quality. Accordingly, 470 articles were excluded, and only 1,875 articles were considered for language filtration (Pattnaik et al., 2020).

Step 3: Language filtration. We chose to cover English language documents from the articles retained in Step 2. As most of the present study's target readers are native English speakers, this filtration was required. Moreover, translation was not feasible, given the massive size of the dataset. In this stage, we rejected 102 articles—1,773 articles were retained. This criterion is consistent with the suggestions of (Donthu et al., 2021).

Step 4: Subject filtration. For subject filtration, we included articles from the following fields: 1) business management and accounting; 2) economics, econometrics, and finance; and 3) social sciences. This filtering was essential because these domains were the broadest and therefore, were most relevant to 'finance', the umbrella field in which behavioural finance resides. We excluded 250 articles in the subject-filtering process. This criterion is consistent with the suggestions of (Donthu et al., 2021). Overall, 822 articles were excluded after filtering for scholarly language and subject. Finally, 1,523 documents were retained for bibliometric evaluation.

3.2. Bibliometric analysis

Using 1,523 research papers extracted from the Scopus database, we conducted several bibliometric analyses. We illustrated the publication pattern (RQ1), identified publications (outlets and articles) of behavioural finance research (RQ2), and performed publication, citation, and social network analyses to identify the leading contributors (institutions, authors, and countries) (RQ3). VOS Viewer was utilized to enrich our understanding of the most prolific contributors (RQ3) and publication outlets (RQ2). Additionally, Biblioshiny and Gephi were used to explore the existing research themes (RQ4) in behavioural finance through thematic clusters and PageRank analyses, respectively. Finally, keyword co-occurrence analysis was conducted to identify future research (RQ5) avenues. We used a set of bibliometric analysis techniques and enrichment procedures consistent with the suggestions for an accurate bibliometric analysis.

4. Results

The following sections reveal comprehensive information on the bibliometric properties and well-known themes in behavioural finance.

4.1. Publication pattern and trends (RQ1)

The growth in behavioural finance research is due to the inability of the standard finance framework to answer many empirical patterns, including tumultuous bubbles in the stock markets of Japan, Taiwan, and the U.S. (Ritter, 2003). The above

chart depicts the growing trend in behavioural finance research. Initially, from 1994 to 2003, research on behavioural finance was insignificant, but as the participation of retail investors increased and the market began to exhibit abnormal empirical patterns, scholarly interest in the area escalated. The Scopus database shows that in the last 28 years, approximately 91% of the research articles were published between 2009 and 2022. The momentum in research on behavioural finance was due to the 2008 global financial crisis, which raised the big question of theories of standard finance. A growing trend in the publication of research articles represents the future scope in the domain of behavioural finance.

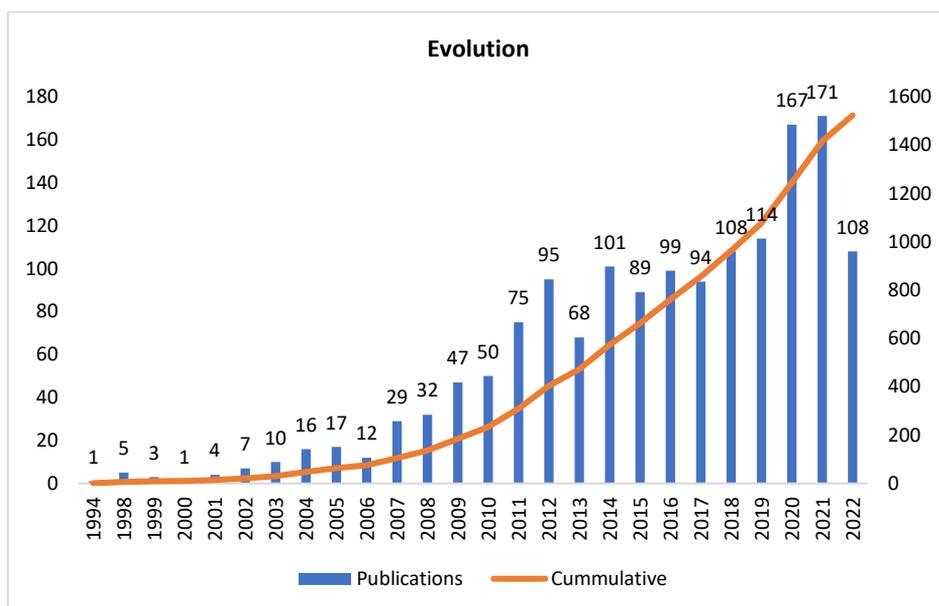


Figure 1. Publication trends of behavioural finance research (1994–2022).

4.2. Publication outlet (RQ2)

These are major journals that have ten or more articles on behavioural finance. Most of these journals are listed by the Australian Business Deans Council (ABDC) and the Association of Business Schools (ABS) and also have higher ratings. It is evident from Table 1 that the *Journal of Behavioural Finance* is a prolific outlet for behavioural finance research, followed by the *Journal of Behavioural and Experimental Finance* (n=50 articles) and the *Review of Behavioural Finance* (n=45 articles). Most of these journals have received an 'A*', 'A', or 'B' grade (based on the ABDC or a '4*', '4', '3', or '2' rating system of the ABS). These ratings represent theme relevance, as recognized by the top-category journals.

Table 1. Leading journals in behavioural finance research

Sources	Documents	Citations	ABS Rank	ABDC Rank
<i>Journal of Behavioural Finance</i>	112	1,258	2	A
<i>Journal of Behavioural and Experimental Finance</i>	50	574	1	B
<i>Review of Behavioural Finance</i>	45	257	1	B
<i>Journal of Banking and Finance</i>	43	1,532	3	A*
<i>Quantitative Finance</i>	38	552	3	A
<i>Journal of Economic Behaviour and Organisation</i>	31	1,028	3	A*
<i>Journal of Financial Economics</i>	31	4,277	4*	A*
<i>Pacific Basin Finance Journal</i>	23	727	2	A
<i>European Journal of Finance</i>	22	225	3	B
<i>Research In International Business and Finance</i>	21	240	2	B
<i>Qualitative Research in Financial Markets</i>	19	214	1	C

Note: Leading journals publishing 10 or more research articles on behavioural finance.

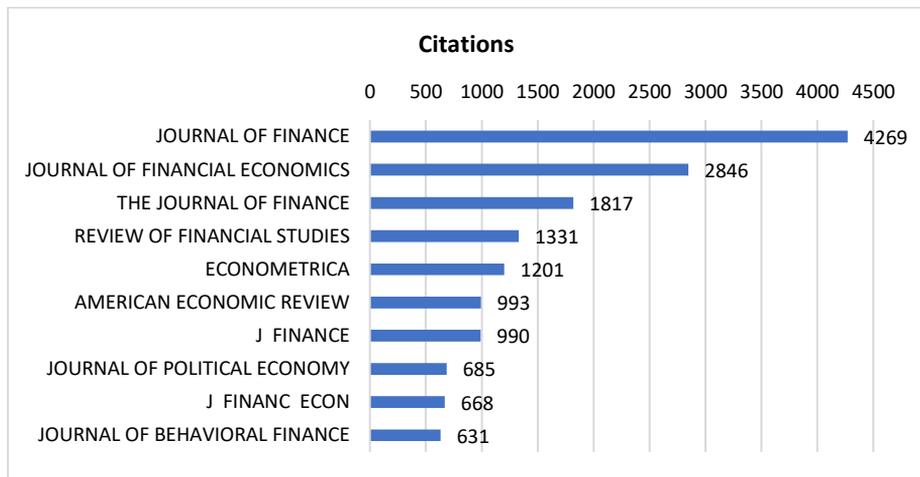


Figure 2. Highly cited journals in the behavioural finance literature.

4.3. Proficient publications (RQ2)

4.3.1. Citation analysis

Citation analysis, which shows an article’s influence, refers to the number of times other publications cite a particular document. Identifying highly cited articles is crucial for discerning influential works that pave new avenues within the field (Noori & Azmi, 2021). It determines an article’s popularity and quality in the academic community. The citation process can be approached in two ways: (a) local citation analysis and (b) global citation analysis. Both analyses are included in the following section.

Local citations and global citations: Local citations are the number of times a paper has been cited in the review corpus. (Baker et al., 2020). In this study, they were calculated from the 1,523 articles retrieved after conducting scholarly, language, and

subject filtrations on the behavioural finance database. In the review, the paper titled 'Behavioural Finance Studies' received the most local citations in the analysis ($x=235$; x refers to the number of citations), followed by 'Market Efficiency, Long-Term Returns, and Behavioural Finance' ($x=69$). Notably, behavioural finance appears to be the primary focus in most articles in this title list, highlighting the significance of local citations.

Global citations represent the overall total citations without any discipline-specific filtering (Baker et al., 2020). In this comprehensive review, the paper titled 'Market Efficiency, Long-Term Returns, and Behavioral Finance' received the most global citations ($x=2,073$), followed by 'Investor Psychology in Capital Markets: Evidence and Policy Implications' ($x=305$).

4.4. Author's performance analysis (RQ3)

4.4.1. Top authors

Prolific authors have written many articles and contributed to the growth and development of the scientific field. In the previous subsection, the authors' distribution of articles indicates that Kudryavtsev from the Department of Economics, University of Haifa, published the most articles ($n=12$), with a total of 90 citations. This was followed by Ahmad ($n=11$) and Durand ($n=10$), the second and third most significant contributors. Of the 11 articles published by Ahmad, seven were co-authored with Tuyon. By contrast, Hirshleifer only published eight articles but has 1,298 citations, which is significantly higher than that of other authors.

Table 2. Leading author's collaborations in behavioural finance research.

Author 1	Author 2	Articles
Ahmad Z.	Tuyon J.	7
Muga I.	Santamaría R.	6
Blasco N.	Zorredor P.	5
Hirshleifer D.	Teoh S.H.	5
Chen Y.	Li Q.	4
Gómez-Martínez R.	Paule-Vianez J.	4
Kliger D.	Kudryavtsev A.	3
Teoh S.H.	Zhang Y.	3
Yang C.	Zhang R.	3
Yang C.	Zhou I.	3

Note: Leading author collaborations with three or more published articles on behavioural finance.

4.4.2. Prolific authors' associations

An analysis of co-authorship clarifies the type and extent of collaboration among authors, which is similar to a social network of researchers in the same field. Indeed, studies have demonstrated that collaboration improves the likelihood of publication in high-quality journals, where teamwork facilitates the exchange of ideas that may result in novel outcomes (Donthu et al., 2021). Our review indicates that the most

substantial co-authorship network exists between Ahmad Z. and Tuyon (n=6). They are also among the most prolific authors of behavioural finance research. Both writers are based in Malaysia but affiliated with different institutions. Muga and Santamara are next on the list of author collaborations, with six co-authored documents.

4.5. Three-field plots

The three Sankey field plots below help us establish the relationships between the three different fields. The portion size represents the value of the node. On the right-hand side of the Sankey plots are countries. The rows are keywords. The left-hand side refers to the sources for analysis (Ingale & Paluri, 2022). Each item represents the main keywords, such as behavioural finance, investor sentiment, market efficiency, and overconfidence, in addition to their sources and countries. All 10 of the most influential journals encompass the keyword ‘behavioural finance’ as the core theme in the field. Likewise, all 10 of the most prominent countries encompass the keyword ‘behavioural finance’. ‘Investor sentiment’, ‘market efficiency’, ‘overconfidence’, ‘asset pricing’, ‘disposition effect’, ‘herding’, ‘prospect theory’, and ‘stock market’ emerged as influential sub-topics linked to and addressed by these influential journals and countries. The *Journal of Behavioural Finance* was the most prolific, with the largest node size representing the linkages among publications with the main keywords and countries

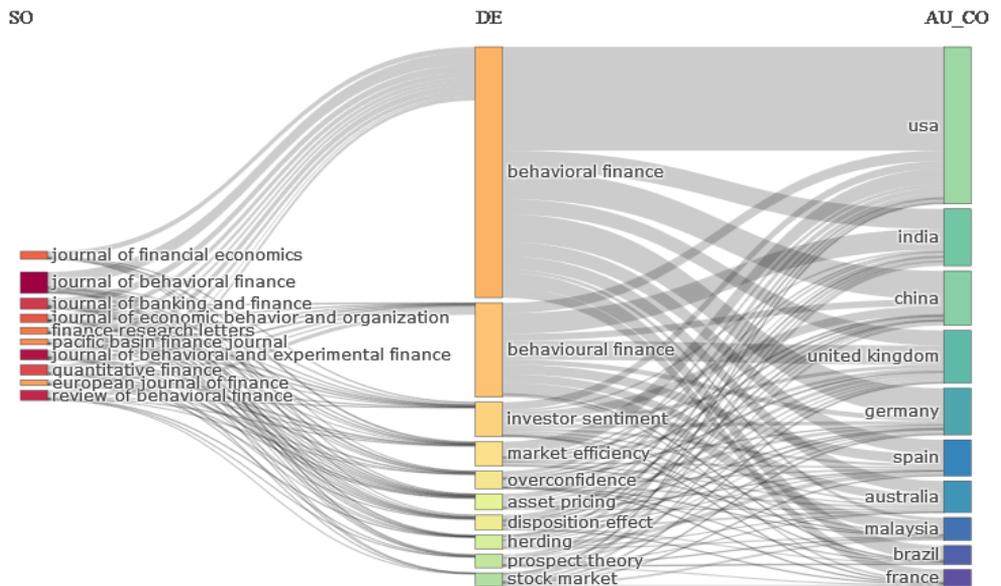


Figure 3. Three-field plot.

4.6. Countries

4.6.1. Leading countries

Country-wise distributions of publications demonstrate that 48 countries have contributed at least five articles to behavioural finance research. The five leading countries are the U.S., the U.K., India, China, and Germany—they have collectively contributed 876 articles or approximately 57% of this study’s total number of articles. The U.S. ranks first, having published 26% of the articles, followed by the U.K. (9%), and India (7%).

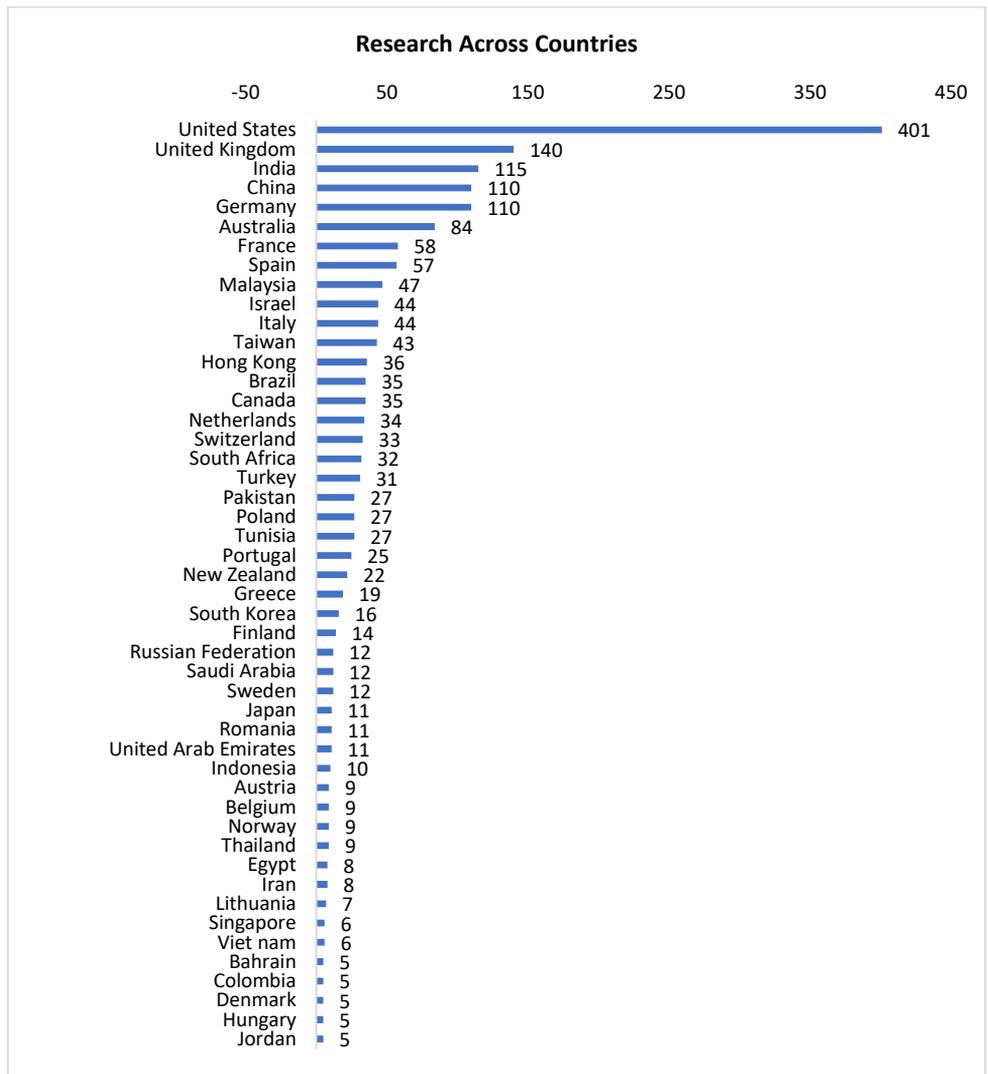


Figure 4. Leading countries in behavioural finance

4.6.2. Leading Country Collaborations

The social networks of the top country collaborations in behavioural finance research were depicted using VOS Viewer network visualization (see Figure 5). For instance, among the top four networks in the field of behavioural finance, the most prominent network comprises India, France, Italy, Pakistan, Poland, South Africa, Tunisia, and Turkey. This is followed by the following networks in particular order: 1) Australia, China, Hong Kong, Malaysia, Taiwan, and the U.S.; and 2) Brazil, Canada, Israel, Portugal, and Spain; and Germany, the Netherlands, New Zealand, Switzerland, and the U.K.

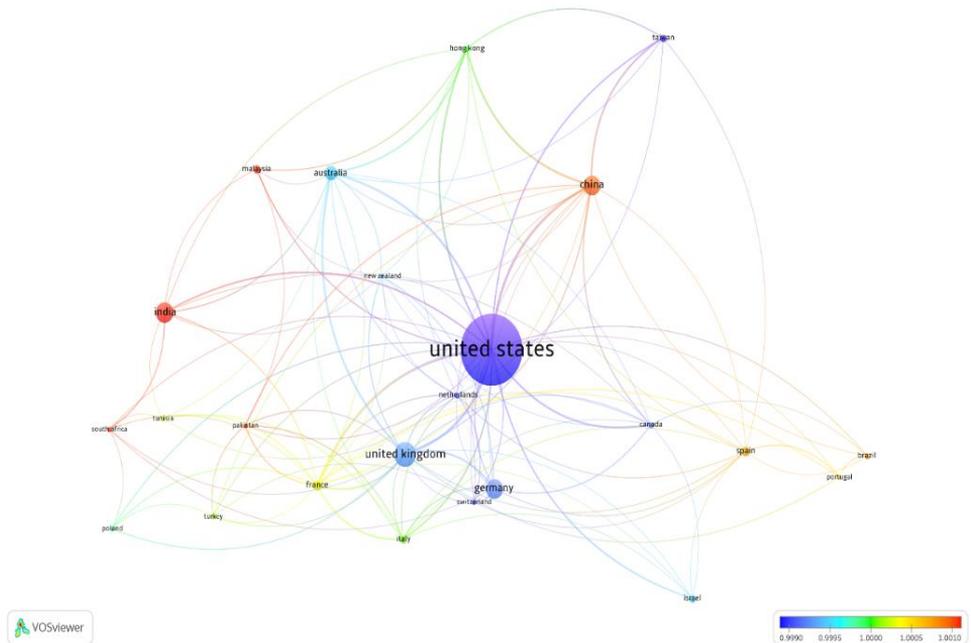


Figure 5. Country collaborations in behavioural finance research.

4.7. Leading institutions (RQ3)

The breakdown of papers by organizations demonstrates that the School of Economics and Commerce in China is the top contributing institution to research in the field of behavioural finance (n=6). This is followed by Curtin University in Australia, the School of Accounting in Dongbei, the Hong Kong Polytechnic University in Hong Kong, and the Public University of Navarre in Spain. Each of them contributed four articles on behavioural finance. Of the top five contributing institutions, two are from China: The School of Accounting and the University of Finance and Economics.

Table 3. Leading institutions publishing articles in behavioural finance.

Institution	Country	Documents
School of Economics and Commerce	China	6
Curtin University	Australia	4
School of Accounting, Dongbei	China	4
Hong Kong Polytechnic University	Hong Kong	4
Public University of Navarre	Spain	4

Note: Top five institutions publishing four or more research articles in behavioural finance.

4.8. Themes and topics (RQ4)

4.8.1. Themes

The most prominent themes underlying the conceptual structure of behavioural finance were discovered using PageRank analysis, which helps measure the overall prestige of articles by counting the number of citations of articles from the most-cited articles (Ding & Cronin, 2011). Thus, an article with a high PageRank score may have a lower citation score, and vice versa (Ding et al., 2001). Hence, PageRank is a significant statistic to include in bibliometric evaluations because it can be used to evaluate an article's quality. In the context of highly cited publications, high-quality articles are deemed relevant; in other words, they 'must be cited' (Kumar et al., 2021).

Additionally, we can use the PageRank score to create clusters to unpack significant themes in the review domain. Furthermore, it provides dual advantages in bibliometric analysis. In this analysis, we proposed five clusters (see Table 4), with the 10 most prestigious articles identified in each cluster.

Cluster 1 contains the theme of risk management and portfolio selection, which is included (n=223). The theme of risk management and portfolio selection includes Guo et al.'s (2017) article titled 'A Bayesian approach to excess volatility, short-term underreaction and long-term overreaction during financial crises', which has the highest PageRank score (PR=0.016622), indicating that it has the most citations from highly cited articles with only 23 global citations. This is followed by Haley (2018) (PR=0.003378) and Horwitz (2019) (PR=0.00300).

Cluster 2 is the second biggest cluster (n=337). It embodies the theme of 'Market Efficiency and Investor Behaviour', with Abrahamson's (2016) article titled 'Rookies to the stock market: A portrait of new shareholders' receiving the highest PageRank score (PR=0.024003). This is followed by Leigh et al. (2004) (PR=0.005759) and Hasanhodzic et al. (2011) (PR=0.004629).

Cluster 3 epitomizes the theme of influences on investor behaviour. It was identified as the most prolific (n=559), with Patil and Bagodi's (2021) article titled 'A study of factors affecting investment decisions in India: Receiving the highest score on page rank' (PR=0.040013). This is followed by articles by Mangala and Sharma (2014) (PR=0.007124) and MacCowan and Orr (2008) (PR=0.005868).

Cluster 4 is the next largest cluster (n=226 articles). It represents the theme of behavioural biases, with Fuertes *et al.*'s (2014) article titled 'A behavioural analysis of investor diversification' (PR=0.015729). This is followed by Hibbert *et al.*'s (2008) article titled 'A behavioural explanation for the negative asymmetric return-volatility relation' (PR=0.011301), which has the highest PageRank score.

Finally, **Cluster 5** (n=172) reflects the theme of investor sentiment—a recently emerging theme in the area of behavioural finance—with Igual and Santamaría's (2015) article titled 'Breaking news and breaking noise' receiving the highest PageRank score (PR=0.024994). This is followed by articles by Reis and Pinho (2021) (PR=0.003606) and by Zaremba (2020) (PR=0.002044).

Table 4. Most prestigious behavioural finance articles.

Author(s)	Article title	Year	Source Title	Page Rank
Risk management and portfolio selection				
Guo, X., McAleer, M., Wong, W.-K., Zhu, L.	A Bayesian approach to excess volatility, short-term underreaction, and long-term overreaction during financial crises	2017	<i>North American Journal of Economics and Finance</i>	0.01662
Haley, M.R.	A moment-free nonparametric quantity-of-quality approach to optimal portfolio selection: A role for endogenous shortfall and windfall boundaries	2018	<i>Journal of the Operational Research Society</i>	0.00337
Horwitz, E.J., Klontz, B.T., Zabek, F.	A financial psychology intervention for increasing employee participation in and contribution to retirement plans: Results of three trials	2019	<i>Journal of Financial Counselling and Planning</i>	0.00300
Yang, Y., Tsoi, A.	A level set analysis and a nonparametric regression on S&P 500 daily returns	2016	<i>International Journal of Financial Studies</i>	0.00289
Bowden, M.P.	A model of information flows and confirmatory bias in financial markets	2015	<i>Decisions in Economics and Finance</i>	0.00228
Silvester, M., Kumar, V., Nawaz, N.	A kaleidoscopic view of the impact of financial knowledge on investment decisions of individual investors	2020	<i>International Journal on Emerging Technologies</i>	0.00218
Peeperkorn, J., Seetharam, Y.	A learning-augmented approach to pricing risk in South Africa	2016	<i>Eurasian Business Review</i>	0.00154
Akhtar, F., Thyagaraj, K.S., Das, N.	A review of literature on financial investment decisions of individual investor: Behavioural- and risk-related explanations	2015	<i>International Journal of Applied Business and Economic Research</i>	0.00154
Ferreira, S.J., Redda, E., Dunga, S.H.	A structural equation model of reputational risk in South Africa	2019	<i>Cogent Economics and Finance</i>	0.00117
Theobald, T.	Agent-based risk management: A regulatory approach to financial markets	2015	<i>Journal of Economic Studies</i>	0.00117

Table 4 (Cont.). Most prestigious behavioural finance articles.

Author(s)	Article title	Year	Source Title	Page Rank
Market efficiency and investor behaviour				
Abrahamson, M.	Rookies to the stock market: A portrait of new shareholders	2016	<i>Research in International Business and Finance</i>	0.02400
Leigh, W., Modani, N., Hightower, R.	A computational implementation of stock charting: Abrupt volume increase as a signal for movement in New York Stock Exchange Composite Index	2004	<i>Decision Support Systems</i>	0.00575
Hasanhodzic, J., Lo, A.W., Viola, E.	A computational view of market efficiency	2011	<i>Quantitative Finance</i>	0.00462
Xu, Y.	Aversion of information ambiguity and momentum effect in China's stock market	2016	<i>China Finance Review International</i>	0.00081
Shu, H.-C., Hung, M.-W.	Effect of wind on stock market returns: Evidence from European markets	2009	<i>Applied Financial Economics</i>	0.00081
Mushinada, V.N.C.	Are individual investors irrational or adaptive to market dynamics?	2020	<i>Journal of Behavioral and Experimental Finance</i>	0.00080
Liu, K., Lai, K.K., Yen, J., Zhu, Q.	A model of stock manipulation ramping tricks	2015	<i>Computational Economics</i>	0.00080
Mandaci, P.E., Taşkin, F.D., Ergün, Z.C.	Adaptive market hypothesis	2019	<i>International Journal of Economics and Business Administration</i>	0.00080
Jiang, J., Li, H.	A new measure for market efficiency and its application	2020	<i>Finance Research Letters</i>	0.00079
Mugerman, Y., Yidov, O., Wiener, Z.	By the light of day: The effect of the switch to wintertime on stock markets	2020	<i>Journal of International Financial Markets, Institutions and Money</i>	0.00079
Influences on Investor behaviour				
Patil, S., Bagodi, V.	A study of factors affecting investment decisions in India: The KANO way	2021	<i>Asia Pacific Management Review</i>	0.04001
Illiaschenko, P.	Tough Guy' vs. 'Cushion' hypothesis: How does individualism affect risk-taking?	2019	<i>Journal of Behavioral and Experimental Finance</i>	0.02043
Mangala, D., Sharma, M.	A brief mapping of theory and evidence of investors' behavioural biases	2014	<i>Indian Journal of Finance</i>	0.00712
MacCowan, R.J., Orr, A.M.	A behavioural study of the decision processes underpinning disposals by property fund managers	2008	<i>Journal of Property Investment and Finance</i>	0.00586
Mishra, S.K., Kumar, M.	A comprehensive model of information search and processing behaviour of mutual fund investors	2012	<i>Journal of Financial Services Marketing</i>	0.00544
Beugelsdijk, S., Frijns, B.	A cultural explanation of the foreign bias in international asset allocation	2010	<i>Journal of Banking and Finance</i>	0.00537

Table 4 (Cont.). Most prestigious behavioural finance articles.

Author(s)	Article title	Year	Source Title	Page Rank
Woo, H., Sohn, S.Y.	A credit scoring model based on the Myers–Briggs type indicator in online peer-to-peer lending	2022	<i>Financial Innovation</i>	0.00510
Shantha, K.V.A., Xiaofang, C., Gamini, L.P.S.	A conceptual framework on individual investors' learning behaviour in the context of stock trading: An integrated perspective	2018	<i>Cogent Economics and Finance</i>	0.00442
Bergsma, K., Fodor, A., Tedford, E.	A closer look at the disposition effect in U.S. equity option markets	2020	<i>Journal of Behavioral Finance</i>	0.00388
Cheriyian, V., Kleywegt, A.J.	A dynamical systems model of price bubbles and cycles	2016	<i>Quantitative Finance</i>	0.00299
Behavioural biases				
Fuertes, A.-M., Muradoglu, G., Ozturkkal B.	A behavioural analysis of investor diversification	2014	<i>European Journal of Finance</i>	0.01572
Hibbert, A.M., Daigler, R.T., Dupoyet, B.	A behavioural explanation for the negative asymmetric return-volatility relation	2008	<i>Journal of Banking and Finance</i>	0.01130
Boujelbène, M.A.	A behavioural explanation for the asymmetric volatility effect	2011	<i>Journal of Applied Economic Sciences</i>	0.01077
Paudel, J., Laux, J.	A behavioural approach to stock pricing	2010	<i>Journal of Applied Business Research</i>	0.01043
Ramiah, V., Zhao, Y., Moosa, I., Graham, M.	A behavioural finance approach to working capital management	2016	<i>European Journal of Finance</i>	0.00899
Lavoie, M., Daigle, G.	A behavioural finance model of exchange rate expectations within a stock-flow consistent framework	2011	<i>Metroeconomica</i>	0.00765
Paule-Vianez, J., Gómez-Martínez, R., Prado-Román, C.	A bibliometric analysis of behavioural finance with mapping analysis tools	2020	<i>European Research on Management and Business Economics</i>	0.00336
Peón, D., Antelo, M., Calvo, A.	A dynamic behavioural model of the credit boom	2015	<i>Journal of Economic Issues</i>	0.00322
Seiler, M.J., Walden, E.	A neurological explanation of strategic mortgage default	2015	<i>Journal of Real Estate Finance and Economics</i>	0.00191
Herrmann-Pillath, C.	A neurolinguistic approach to performativity in economics	2010	<i>Journal of Economic Methodology</i>	0.00156
Investor sentiments				
Igual, M.G., Santamaría, T.C.	'Breaking news' and... breaking noise	2015	<i>Journal of the Knowledge Economy</i>	0.02499
Reis, P.M.N., Pinho, C.	A dynamic factor model applied to investor sentiment in the European context	2021	<i>Investment Management and Financial Innovations</i>	0.00360

Table 4 (Cont.). Most prestigious behavioural finance articles.

Author(s)	Article title	Year	Source Title	Page Rank
Zaremba, A.	A factor model for country-level equity returns	2020	<i>Eurasian Studies in Business and Economics</i>	0.00204
Obaid, K., Pukthuanthong, K.	A picture is worth a thousand words: Measuring investor sentiment by combining ML and photos from news	2022	<i>Journal of Financial Economics</i>	0.00191
Yadav, A., Yadav, D., Hazarika, I.K.	A new conceptualization of investor sophistication and its impact on herding and overconfidence bias	2022	<i>Investment Management and Financial Innovations</i>	0.00183
Alrabadi, D.W.H.	A new proxy for investor sentiment: Evidence from an emerging market	2015	<i>Afro-Asian Journal of Finance and Accounting</i>	0.00117
De Bondt, W.F.M.	A portrait of the individual investor	1998	<i>European Economic Review</i>	0.00087
Sturm, R.R.	A turning point method for measuring investor sentiment	2014	<i>Journal of Behavioral Finance</i>	0.00080
Hachicha, N., Bouri, A., Khlifi, F.	Abnormal returns: Econometric problems or psychological bias	2008	<i>Corporate Ownership and Control</i>	0.00077
Eachempati, P., Srivastava, P.R.	Accounting for unadjusted news sentiment for asset pricing	2021	<i>Qualitative Research in Financial Markets</i>	0.00077

4.8.2 Topics

To uncover the themes that can reflect the interest in behavioural finance research, keyword co-occurrence analysis of 1,523 articles in VOS Viewer was performed using the authors' keywords (see Figure 6). The premise of this study is that the authors' keywords accurately represent an article's content. The keyword co-occurrence network is a significant tool for decoding the intellectual structure of the domain; (Ding et al., 2001; Donthu et al., 2021). It also provides other exciting insights. Until 2008, behavioural finance studies centred on investment decision-making and market efficiency issues. However, the new waves of behavioural finance literature in 2008 and 2014 focused on inefficient prices and information asymmetry, respectively. These topics include risk perception, overreaction, disposition effect, and asset pricing models.

5. Discussion and future research directions

To explore the bibliometric parameters and knowledge structure of behavioural finance, a bibliometric study was conducted. This bibliometric study provided general information on the top authors, nations, organizations, publications, themes, and topics in behavioural finance research for 1994–2022. Specifically, our review's performance analysis and science mapping allowed us to respond to four key research questions and provide the following eight main takeaways.

Santamaría (2015) received the maximum PR metric in their corresponding clusters (RQ3).

- Science mapping showed five clusters with research themes as risk management and portfolio selection (Cluster 1), market efficiency and investor behaviour (Cluster 2), influences on investor behaviour (Cluster 3), behavioural biases (Cluster 4), and investor sentiment (Cluster 5) (RQ4).
- The evolving research areas in behavioural finance are based on asset pricing theory (up to 2008), the efficient market hypothesis and behavioural biases (2008–2015), trading volume and investor traits (2015–2018), and the investor sentiment disposition effect (2018 onwards), with investor sentiment being the most significant emerging theme in behavioural finance (RQ5).

Reading the ten most popular articles from each cluster based on clustering analysis and carefully examining the co-occurrence networks enabled us to fully grasp the current state of behavioural finance research and to make suggestions for future research directions in the field. Specifically, existing research on behavioural finance focuses on investor rationality, investment biases, and cognitive effects in investment decision-making. In the following section, we provide suggestions on topics for further research, summarised as follows:

- Investor sentiment using machine learning (ML) techniques
- Cryptocurrencies and investor behaviour
- Big data analysis in behavioural finance
- Herding behaviour
- Impact of COVID-19 on stock market behaviour

5.1. Investor sentiment using ML techniques

Recently, there has been a significant increase in interest in the use of artificial intelligence (AI) and ML for various quantitative finance issues. Focus areas include market forecasting, derivatives pricing, risk management, and algorithmic trading. ML and AI are now seen as the primary drivers of competitive advantage in the financial sector. Stock market news feeds significantly impact market trends, and prices tend to decrease whenever bad news appears in the market. This understanding helps generate new insights into investor behaviour in financial decision-making and market forecasting. Previous studies have shown that stocks tend to emulate one another during a crisis and cause market crashes. Specifically, in modern times, Twitter is the fastest and most reliable medium to gather information. Stock sentiments can be formulated using Twitter feeds and other news sources. Sentiment analysis and text mining are two prominent analysis methods that generate new insights into investor behaviour in financial decision-making and market forecasting.

RQ1 Impact of large language models (LLMs) (chatbot) news feeds on investor sentiment.

5.2. Cryptocurrencies and investor behaviour

Cryptocurrencies are a new form of financial instruments whose mechanism is based on blockchain technology that represents real market monetary value. Cryptocurrency prices are highly volatile and serve as a platform for speculation for traders of financial assets. The first cryptocurrency was Bitcoin. Since then, more than 1,500 cryptocurrencies have been created. In the future, cryptocurrency may be considered an alternative to national currencies.

Nonetheless, short-term cryptocurrency prices are highly inefficient as people enter the market mainly for speculative gain, causing herding bias. Indeed, as the behaviour of the crypto market is centred on investors' psychological behaviour, it is essential to understand investors' investment rationale in the future crypto market. To this end, we suggest analysing investors' cognitive and sociological influences to better understand herding and volatility in the cryptocurrency market.

RQ2 Analysing investors' cognitive and sociological influences to understand herding and volatility in the crypto market.

5.3. Big data analysis in behavioural finance

Big data analytics applies cutting-edge analytical methods to large heterogeneous datasets comprising structured, semi-structured, and unstructured information. These datasets may range in size from terabytes to zettabytes and originate from various sources. The use of big data is a fundamental aspect of several cloud computing services, which actively facilitate the dissemination of such data (Arcuri, 2020). The application of big data analytics in the financial sector provides diverse benefits, including real-time stock analytics, analyses of investor behaviour, predictive financial models, and assurances regarding regulatory compliance. To appropriately comprehend behavioural finance, we require updated information regarding investor behaviour. Thus, with the help of big data analytics, we can use data from various consumer behaviour indexes to formulate predictive financial models. The results from big data are crucial and beneficial for better financial decision-making. Big data can track the stock market and serve as an early indicator of price fluctuations, which may, in turn, provide financial firms with a significant trading edge. It may also help improve financial services and offerings. We suggest that future research seeks to understand risk aversion and disposition effects in retail individuals using the consumer behaviour index.

RQ3. Analysis of the disposition effect and risk aversion using big data analytics in investment decision-making.

5.4. Herding behaviour

Herd mentality bias in behavioural finance refers to investors' propensity to follow and imitate their peers' actions. Investors are mostly affected by emotion and instinct rather than their independent analyses. Investors' herding behaviour is a

primary driver of speculative bubbles because it indicates identical trading choices, resulting in deviations in stock prices arising from their intrinsic values. The existing research on herding behaviour has mainly focused on the presence of herding in various financial market domains. Moreover, previous studies have indicated that herding bias persists in the crypto, equity, commodity, and currency markets. Therefore, we suggest that cognitive and sociological influences should be analysed using theories of psychology and advanced statistical tools (e.g., structural equation modelling).

RQ4. How SEM–ANN-based research of factors impacts herding bias in retail investors.

5.5. Impact of COVID-19 on investor's behaviour in stock market

The COVID-19 pandemic has posed an unexpected threat, resulting in investors exhibiting flurry behaviour. The global economy and financial systems, including stock markets, were impacted by the pandemic, as stated by the International Monetary Fund in its Financial Stability Report released in April 2020 (Ramakrishna & Kalpakam, 2022). However, despite volatility and panic, realistic economic expectations underpin fluctuations in the stock prices of individual firms. Consequently, society ought to understand the nature of our current difficulties.

RQ5. Change in investors' risk perception philosophies during and post-COVID-19.

6. Conclusion

The field of behavioural finance seeks to investigate how investors' psychology influences their financial choices. We observed that theorists in behavioural finance reveal the realities of crashes, bubbles, and anomalies in the stock market by excluding behavioural variables in asset pricing models.

This review indicates that behavioural finance is a rapidly developing area of study. The publication outlets of behavioural finance can assess the significance of the domain, as the majority of leading journals are ranked A* or A. The growing trend in the publication of research articles represents the future scope in the domain of behavioural finance.

To map the broad bibliographic information, this review employed multiple analysis methods. For descriptive analysis of leading contributors (authors, sources, and institutions), we used VOS Viewer. Biblioshiny and Gephi were utilized for clustering and PR analysis.

The bibliometric analysis enabled us to identify the bibliometric properties and intellectual structure of behavioural finance and propose future research avenues to enhance our understanding of the domain. The most prominent themes underlying the conceptual structure of behavioural finance were discovered using clustering and PageRank analysis: risk management and portfolio selection, market efficiency and

investor behaviour, influences on investor behaviour, behavioural biases, and investor sentiment. This review depicts the entire structure of behavioural finance, including its bibliometric attributes, intellectual structure, and future research directions. Furthermore, it is hoped that behavioural finance research will continue to assess how human emotions impact financial decision-making using ML methods.

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