Irrationalities in Investment Decisions: A Bibliometric Analysis

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Abstract

Behavioural biases are a branch of behavioural finance which focuses on irrationalities in the decision-making of investors. The present study is a bibliometric analysis of the research in the area of "behavioural biases" to bring out the evolution, growth, major contributions, and trend topics in the field. Through bibliometric analysis, the study made a time-line based scientific mapping of publications in behavioural biases. Biblioshiny, a web interface tool in the bibliometrix R software package, is employed for mapping the literature. A total of 340 documents were extracted from the Web of Science database using the keyword "behavioural biases". The documents were refined using the PRISMA framework, and 172 of them were included in the study. The analysis shows that the first article on the topic was published in 1995 by Schweitzer, and the year in which the most articles were published was 2020. Alok Kumar, University of Texas, has made the highest contribution in the field. The United States is the leading contributor. 'Prospect theory' remains the most used keyword, and the thematic analysis reveals that 'investment' is the main theme around which more articles are written. The most globally cited article is Frank Zhang's 'Information Uncertainty and Analyst Forecast Behavior,' published in 2006. By analysing the results, it is evident that there is a wide scope for exploration into the various dimensions of behavioural finance. Prospective researchers can effectively utilise the gaps prevailing in the discipline of behavioural finance.

Keywords: Behavioural biases, Behavioural finance, Bibliometric analysis, Biblioshiny, Science mapping.

Introduction

Behavioural finance, a subfield of behavioural economics, is a new paradigm that supplements the standard finance theories by explaining the behavioural aspects of financial decision-making. At its core, behavioural finance studies how the psychology and emotions of individuals affect their investment decisions. By describing how the irrational behaviour of investors affects security market prices and leads to market irregularities and anomalies, behavioural finance challenges the fundamental tenets of traditional finance theories, namely rationality and market efficiency. The two main drivers of irrationality are cognitive and emotional biases induced by heuristics and psychology, respectively. Shefrin and Statman (2010) state that biases are systematic errors or offshoots of constraints that individuals themselves place on resources

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due to feelings, emotions, rumours, and limited information. The growing number of studies on behavioural biases demands a scientific mapping of the existing literature to gain deeper insights into the field. As a literature review tool, bibliometrics allows structured analysis to infer trends and identify prolific authors, sources, and prominent themes in a specific domain (Aria & Cuccurullo, 2017). As an extensively used scientific mapping tool, the present study adopted bibliometric methods aided by biblioshiny in the R bibliometrix package to map the literature on behavioural biases.

Background of the Topic

Behavioural finance is a discipline that studies the financial markets using less narrow models than those based on Von Neumann–Morgenster expected utility theory and arbitrage assumptions (Ritter, 2003). By and large, behavioural finance theories have answered and explained the reasons for investors' behaviour deviating from rational decision-making (Zahera & Bansal, 2018). Behavioural scientists have successfully developed new models that formalise and explain behaviours violating the standard economic model (Dowling et al., 2020). These behavioural finance models substitute classical models, for instance, Behavioural Portfolio Theory for Mean-variance Portfolio Theory, Behavioural Asset Pricing Model for the Capital Asset Pricing Model, and other models where expected returns are determined only by risk (Statman, 2014). Prospect Theory has evolved as a more realistic alternative to Expected Utility Theory to explain how people make decisions under risk, accounting for their greater sensitivity to losses than gains (Kahneman & Tversky, 1979).

Behavioural finance is more focused on studying errors in judgment and decision-making characteristics in investments (Costa & Bruno, 2018). It is centered on the fact that investors are not always rational, have limits to self-control, and are influenced by their own biases. It claims that people's behaviour and mood have a significant impact on their investment preferences. Thus, by analysing the cognitive and emotional biases those individual investors, financial advisors, and traders exhibit in the securities markets (Ricciardi, 2011). The emergence of the new paradigm of cognitive psychology is concerned with internal processes, mental limitations, and the way in which the processes are shaped by limitations (Kahneman et al., 1982). Behavioural finance identifies the mental mistakes that investors make regularly. Behavioural finance has emerged due to the inability of traditional finance theory to explain market phenomena like beating the market, bubbles and crashes. It involves the application of psychological and economic principles to improve financial decision-making (Olsen, 1972). At present, studies in behavioural finance pitch its tent time and again, especially in the international arena, with a growing literature on decision-making and risk, momentum, overconfidence, emotional effects, and neuro-finance by addressing the cognitive issues of individual behaviour (VitorJordão da Gama Silva et al., 2019).

Less than fully rational financial decisions are influenced by irrational elements in human thinking (Byrne et al., 2008), and the sources of irrationality are heuristics and biases. Accordingly, the terms 'heuristics' and 'cognitive biases' have become discussion themes in financial and managerial decision-making processes, mainly when decisions are made in risky and uncertain environments (Costa et al., 2017). Heuristics are defined as simplified strategies to cope with complex issues and problems (Caputo, 2014). It refers to the mental shortcuts or rules of thumb, which people apply to make decisions in an environment that is complex and uncertain. Any decision-making process requires the judicious use of mental and financial resources to gather and process information. While making quick and easy decisions, individuals tend to violate rationality or deviate from what is required for a standard decision-making process if they are rational. Behavioural biases cause perceptual alteration, inaccurate

judgment, and illogical interpretation, eventually leading to irrationality (Gordon, 1968). These biases are related to the way we process information (Shefrin, 2010). Individual investors' behaviours are influenced by various biases highlighted in the growing discipline of behaviour finance to a great extent (Madaan & Singh, 2019). In addition to risk, return, safety, and liquidity, behavioural biases also influence the investment decision-making of an investor. Behavioural biases have a huge impact on one's spending and investing decisions.

Because "behavioural biases" is an emerging and fast-growing topic in behavioural finance, a systematic review of literature can reveal its evolution and growth trajectory. A systematic review of literature as a comprehensive search to analyze the existing literature can be complemented by science mapping, and thus can produce qualitative research on the topic. The paper aims to examine the research trend and the various factors that led to the growth of studies on behavioural biases. A science mapping analysis is conducted with the help of the Bibliometrix R package by extracting relevant datasets from the repository of the Web of Science.

Objectives

The paper aims to provide a systematic report of the literature on behavioural biases through bibliometric analysis. The main objectives are:

- To examine the trend in the growth of studies on behavioural biases over the years.
- To identify the prolific scholars, their contributions in studying behavioural biases, and the relevant sources for documents.
- To analyse the country-wise contributions and the emerging themes and trend topics in behavioural biases.

Research Methodology

The study adopted bibliometric analysis as its methodology. This section covers the whole procedure of performing bibliometric mapping analysis, including data collection, screening, extraction, and synthesis.

Literature search and data collection

The study commenced with a document search on the web of science database on 26 March 2021 using the search string TOPIC and the watchword "behavioural biases". The search result yielded 340 documents in the area of behavioural biases. The documents were refined using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) framework, a graphical way of presenting the identification, screening, and inclusion processes of records extracted from the database (Figure 1).

Figure 1
PRISMA Framework
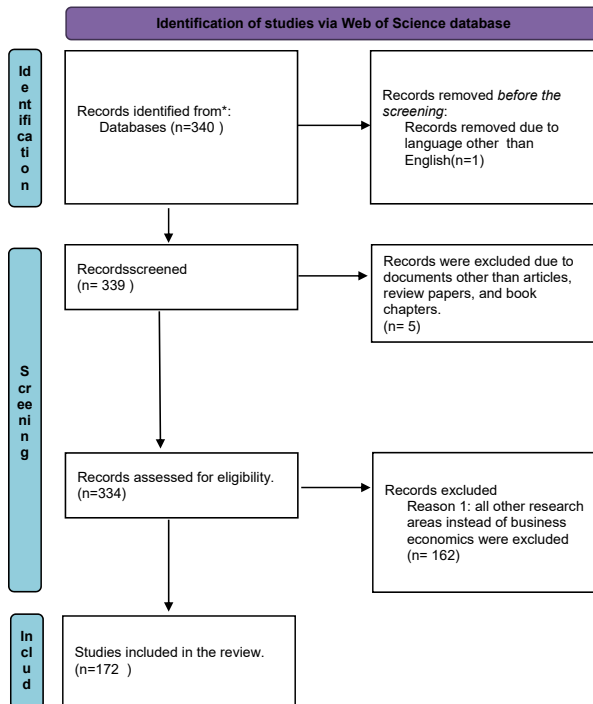
Note. Data from Web of Science

Bibliometric analysis and software package

The bibliometrix R-package, open-source software that provides a set of tools for performing quantitative research in bibliometrics (Agbo et al., 2021), is used to perform the analysis for the study. The software is equipped with all the essential algorithms for statistical and scientific mapping analysis. The bibliometrix R-package in its recent versions contains a web interface tool, Biblioshiny, to assist users with no coding skills in conducting bibliometric analysis. Data can be easily imported in BibTex, CSV, or Plain Text format from the Web of Science or Scopus databases using the Biblioshiny interface.

Summary information of the data set.

The characteristics of the data extracted for the period from1995 to 2021 are shown in Table 1. There were 172 articles available in total. The author's keywords (DE) are a comma-separated set of words that the authors of a publication specify (typically less than ten) to hints at the main contents of the manuscript, and the dataset for the study contained 469 DEs altogether.

On the other hand, Keyword plus (ID) refers to the extended keywords and phrases generated by the Web of Science database, which are the main units in Co-word analysis, and the ID count is 611 here. In addition, the term "authors per document" refers to the average number of authors on a given document. In contrast, co-author per document is the average number of author appearances per document; both authors per document and co-author per document are used for assessing author collaboration (Agbo et al., 2021). The author collaboration index (2.41) is high in this dataset.

Table 1

Summary Information of the Dataset

| Description	Results
Time span	1995:2021
Sources (Journals, Books, Review papers)	89
Documents	172
Average years from publication	6.35
Average citations per document	30.12
Average citations per year per doc	2.916
Article	153
Article; book chapter	3
Article; early access	6
Article; proceedings paper	6
Review	3
Review; early access	1
Keywords Plus (ID)	611
Author's Keywords (DE)	469
Authors	370
Author Appearances	409
Authors of single-authored documents	30
Authors of multi-authored documents	340
Single-authored documents	31
Documents per Author	0.465
Co-Authors per Documents	2.38
Collaboration Index	2.41

Note. Biblioshiny

Results and Discussions

Article Production per Year

The annual production of articles in the subject of behavioural biases is depicted in Figure 2. The bibliometric analysis shows that, as per the dataset, the first published article in the topic was a study by Schweitzer in 1995 that investigated the roles of status quo and framing biases in the selection of reference alternatives in health-care budget decisions. The results revealed that status quo bias can operate in multiple levels and it does not interact with framing bias (Schweitzer, 1995). Between 1996 and 2003, there was virtually no scientific production on behavioural biases. However, after 2003, the number of articles published began to rise, the key themes were decision making, investor sentiments, behavioural biases, overconfidence, and so on These terms and concepts grew more familiar from there onwards and the year 2020 saw the largest number of articles published.

Figure 2

Annual Scientific Production
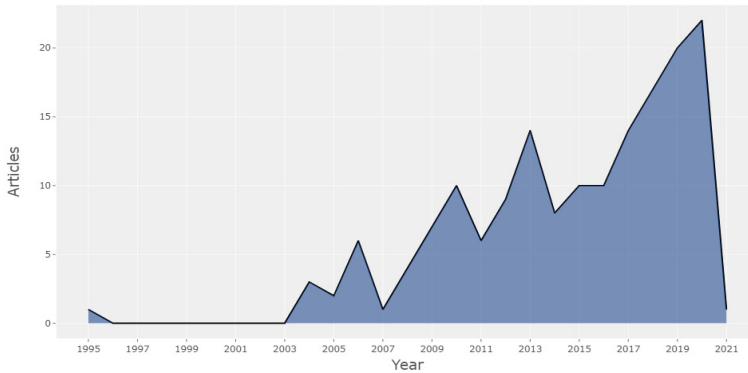
Note. Biblioshiny

Average Citations per Year

The average number of citations per annum for articles on behavioural biases is presented in Figure 3. It depicts the average number of times a piece of work is cited in other publications in a year and shows how these publications contribute to new research. Year-wise, 2006 topped the list of most cited publications, with the works of Zhang, Peng and Chen receiving the most citations. The paper of Zhang investigates the role of information uncertainty in price con- tinuation anomalies and cross-sectional variations in stock returns. As the paper is addressing the theme of stock market anomalies it has got a large number of citations. The average number of citations per year in 2005 was the second-highest. Though the highest number of articles were published in 2020, the average annual citation was only 0.8. Hence, it is evident that the articles on behavioural biases received most of their citations in 2005 and 2006.

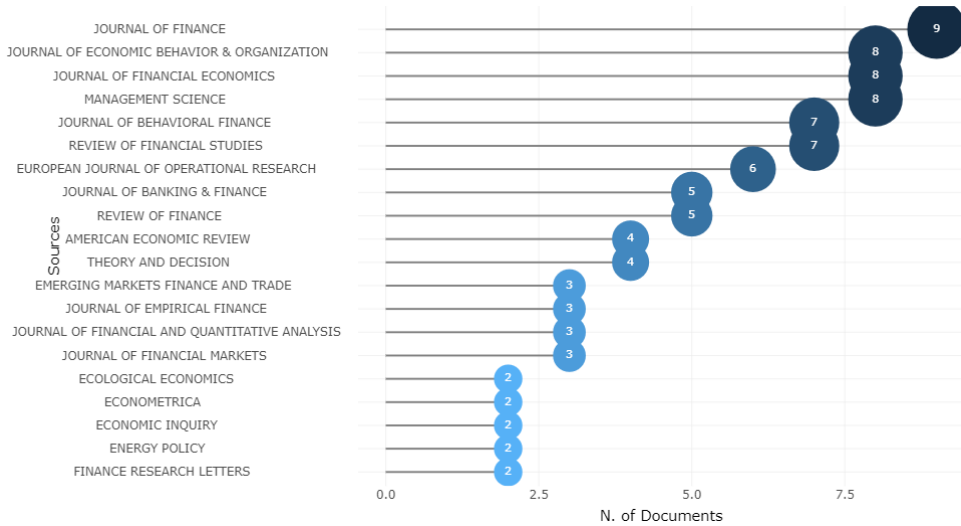**Figure 3**

Average Article Citations per Year
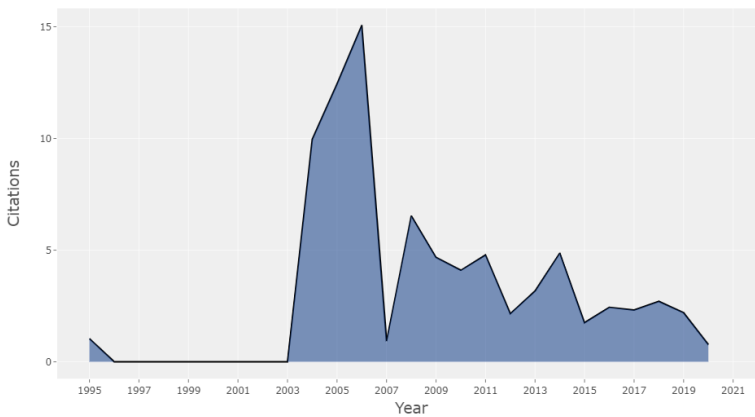
Note. Biblioshiny

Most Relevant Sources for Documents

The Journal of Finance, which produced nine publications on behavioural biases over the study period, was the most relevant source. The works of prominent authors in the field like Paul Slovic and X. Zhang etc got published in Journal of Finance. It is followed by the Journal of Economic Behavior and Organization, the Journal of Financial Economics, and Management Science, each with eight articles. As sources for documents, journals like Econometrica, Economic Inquiry, Energy Policy, and Finance Research Letters were less relevant compared to others.
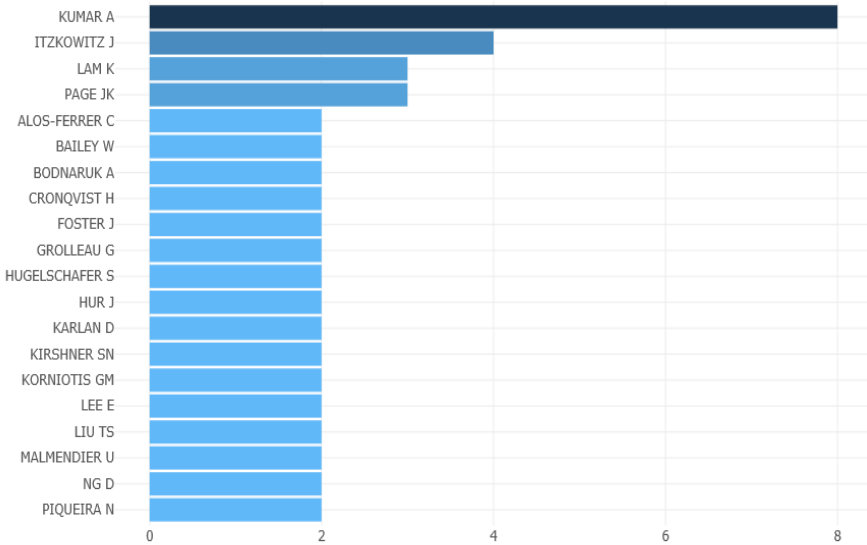
Figure 4

Most Relevant Sources

Note. Biblioshiny

Most Contributing Authors

Alok Kumar is the most prolific contributor to behavioural biases by authoring eight articles with the central themes of behavioural biases, information ambiguity, and prospect theory (Figure 5). Behavioural biases and its influence on several factors like investors sentiments, market returns, foreign investments, macro economy, mutual fund investments etc got addressed in his papers. Itzkowitz has written four articles, all of them focusing on behavioural biases and its effects on disposition effect, investors' immunity and stock turnover etc. Lam and Page each authored three articles, and the contributions of all the others were two articles each.

Figure 5

Most Relevant Authors

Three Field Plots of Country, Author, and Keywords.

Figure 6 presents a visual representation of prolific scholars vis-a-vis their countries and specific areas of interest in the field of behavioural biases. It is a three-field plot of article contributions by countries, authors, and themes in the field of behavioural biases. The left-most column represents the countries, the middle column shows authors contributing from those countries, and the right-most column represents the most used keywords by authors. The number of occurrences of these keywords forms the 'themes 'in this study (Agbo et al., 2021). The box heights and the thickness of the connecting lines reveal that the most contributing country is the USA, with 80 articles, and the most contributing author is Alok Kumar, with 8 articles. The most widely used keywords are behavioural biases and prospect theory. Prospect theory propounded by Daniel Kahneman and Amos Tversky in 1979 becomes the central theme of papers. After the USA, the second most contributing country is China, and the author is Lam. The most contributing keywords are performance, cross-section, prospect theory, and behavioural biases.

Figure 6
Three - field Plot
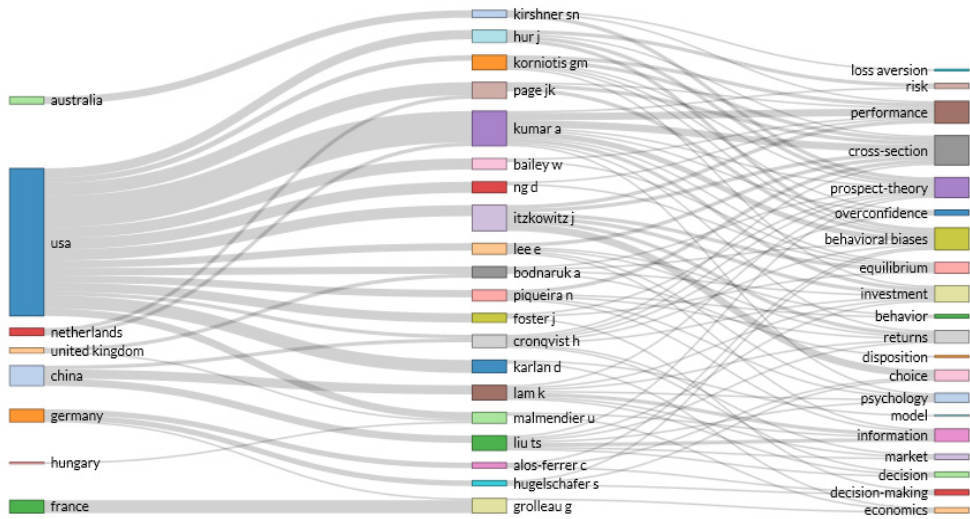
Note. Biblioshiny

Most Cited Countries

The study also looked at the contribution of scientific production (i.e., the number of publications) on behavioural biases in different regions/countries. The results showed that the United States has the highest number of citations (4011) followed by Germany (442), China (210) and France (130) respectively.

Table 2
Most cited countries

Country	Total Citations	Average Article Citations
USA	4011	47.75
Germany	442	22.10
China	210	9.13
France	130	14.44
Netherlands	71	71.00
Canada	68	13.60
Australia	56	5.60
United Kingdom	55	5.50
Denmark	16	16.00
Switzerland	7	7.00
Singapore	5	5.00

Thus, United States is the country that has contributed the most to the study of behavioural biases. The total and average citations are nil in the case of Austria and Pakistan. USA is the most contributing country in the field of Behavioural Finance. Countries like India have a wider scope and research gap to be addressed as the theme is less researched in our own contexts.

Spain	4	4.00
Israel	3	3.00
Sweden	2	2.00
Chile	1	1.00
Austria	0	0.00
Pakistan	0	0.00

Note. Biblioshiny

The Most Globally Cited Document

The paper titled Information Uncertainty and Analyst Forecast Behavior authored by Frank Zhang, published in the year 2006 received the highest number of global citations Till date, the paper got cited 555 times and the average citations per year for this paper is 34.The theme of the paper centered around earnings forecast, investor psychology, risk,

and biases. The results revealed that greater information uncertainty should produce relatively higher expected returns following good news and relatively lower expected returns following bad news (Zhang, 2006).

Table 3

Most Globally Cited Document

| Document	Total citations	Average citations per year
Zhang X F, 2006, J Financ	555	34.668
Lo Aw, 2004, J Portfolio Manage	480	26.667
Peng L, 2006, J Financ Econ	375	23.438
Ramnath S, 2008, Int J Forecating	247	17.643
Chen MK, 2006,J Polit Econ	224	14
Coval JD, 2005, J Financ	213	12.529
Oechssler J, 2009, J Econ Behav Organ	206	15.846
Karlan D, 2010, Rev Financ Stud	197	16.417
Davidoff T,2005, Am Econ Rev	185	10.882
Kumar A, 2009, J Financ,Quant Anal	105	8.077
Karlan D, 2014, Rev Income Wealth	101	12.625
Bailey W,2011, J Financ Econ	101	9.182
Caeurdacier N, 2013, J Econ Lit	99	11
Zhang X F, 2006, Contemp Account R	85	5.312
Chen Q, 2006, Rev Financ Stud	84	5.25
Ben David I, 2012, Rev Financ Stud	81	8.1
Hoppe E I, 2011, Econ Lett	78	7.091
Astebro T, 2014, J Econ Perspect	72	9
Dittmann I, 2010, J Financ	71	5.917

Note. Biblioshiny

Most Relevant Words

The most used word in the articles in the dataset is ''prospect theory'' (6%), followed by ''market'' (5%) and ''performance'' (5%) as shown in Figure 7. Prospect theory, one of the significant contributions to the field of behavioural finance, states that investors value gains and losses differently, and they make decisions based on perceived gains instead of perceived losses. The concept of 'loss aversion' is also an offshoot of the prospect theory. The paramount role of prospect theory in behavioural finance causes its first place in most relevant word in the area. Other relevant words in the articles are risk, information, choice, cross-section, and returns. The keyword for this study, ''behavioural biases'', which is used to extract data from the web of science database, has been used 16 times, with a share of 3 per cent. The frequent usage of the term ''prospect theory'' in the publications indicates that the theory has such a great influence on the literature on behavioural biases.
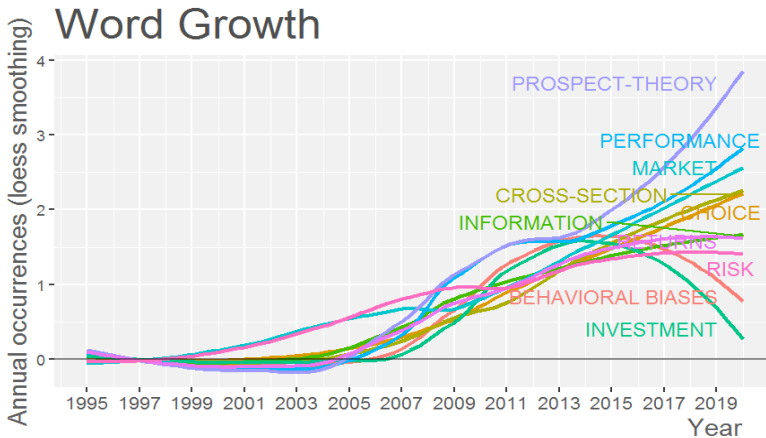
Figure 7

Most Relevant Words
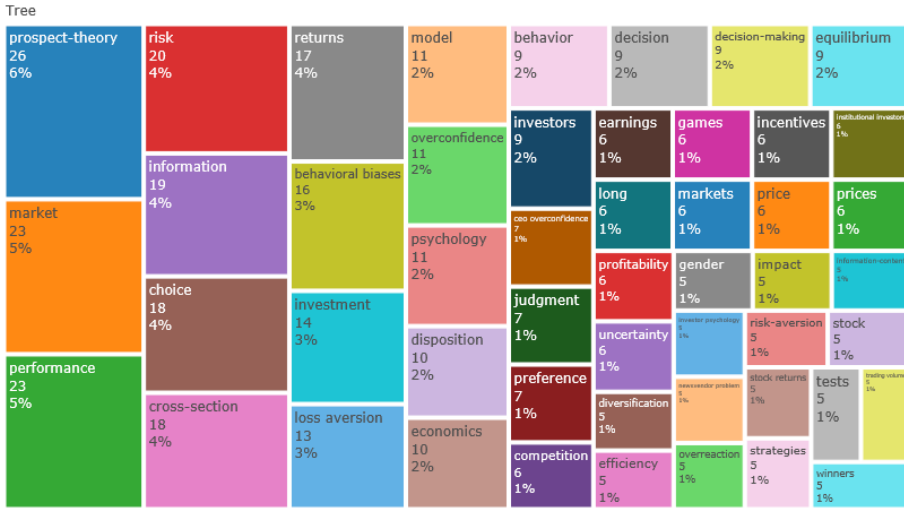
Note. Biblioshiny

Word Growth

A visual representation of the authors' most frequently used keywords as word dynamics is given in Figure 8. Overall, the use of keywords has increased from the year 2005. Interestingly, after 2007, the term "prospect theory" began to gain more popularity along with other terms "performance" and "market". The keywords "behavioural biases," "investment," "risk," and "returns," on the other hand, have experienced a decline after 2013. The results endorse the fact that the recent behavioural bias research has adopted a market-based, choice-driven, cross-sectional, and performance-oriented approach. From the figure it is evident that the specialized themes in the area is showing growth trend recently rather than broader themes.

Figure 8

Word Growth

Note. Biblioshiny

Word Cloud

The word cloud shows the most frequently used keywords in publications on behavioural biases. These are the keywords in the area with the greatest number of repetitions. From Figure 9, could be seen that the most repetitive keyword is performance, followed by market, risk, and information. It indicates that, a larger number of publications in the area are clustered around these keywords. Along with the above-mentioned keywords, investors' decision, earnings, behavior, over reaction etc has got a significant place in the figure. It shows that the use of these words in publications of behavioural biases is getting higher.

Figure 9
Word Cloud

Note. Biblioshiny

Trend Topics

A visualization of the trend topics in behavioural biases from 2006 to 2020 by arranging various topics into a hierarchy is given in Figure 10. Topics such as prospect theory, cross-section, return, and model were discussed highly in 2016. The major themes of papers published in that period were about these keywords. Behavioural bias was the trending topic in 2014, and more trend topics emerged after this year. After this so many papers got published on the theme of behavioral biases. Stock returns, decision making, competitions etc become trending topics after 2016. The several sub fields in behavioural finance becomes trending topics over different years. In 2020, the most used topic was 'earnings'.

Figure 10
*Trend Topics*

Note: Biblioshiny

Thematic Map

The study also conducted a thematic mapping of behavioural biases to highlight the potential for future research by examining the growth of themes within the field (Figure 11). The thematic analysis takes clusters of authors' keywords and their linkages to derive the themes. Then the themes are characterized by the properties of density and centrality, which measure whether or not the topics are well-developed and relevant. The vertical axis represents density, whereas the horizontal axis represents centrality. The degree of correlation between different topics is measured by centrality, while the cohesion of the nodes is measured by density (Esfahani et al., 2019). The more connections a node has with other nodes in the thematic network, the centrality and its importance will be higher. It indicates that the topic is located in a prominent place within the network.

According to Agbo et al. (2021), the cohesiveness of a node, which represents the density of a research field, determines its ability to grow and sustain itself. The thematic map of behavioural biases, split into four quadrants (Q1 to Q4), is shown in Figure 11.

Motor themes lie in the upper right quadrant (Q1), basic themes are in the lower right quadrant (Q4), very specialised themes are in the upper left quadrant (Q2) and emerging or disappearing themes are in the lower left quadrant (Q3). Notably, the theme "investment" positioned between Q1 and Q4 is highly developed and capable of structuring the study area, as seen in the figure. It implies that investment is the most relevant theme in the field. Themes like "risk" and "prospect-theory," which appeared in Q4, are fundamental to the development of the discipline. Themes in Q2 formed internal links, although they contributed only a little to the study of behavioural biases. This study shows that themes from Q2, such as "information" and "choice," need to be linked more to behavioural biases. As the third quarter theme, the term "market" seems to be emerging.

Figure 11

Thematic Map
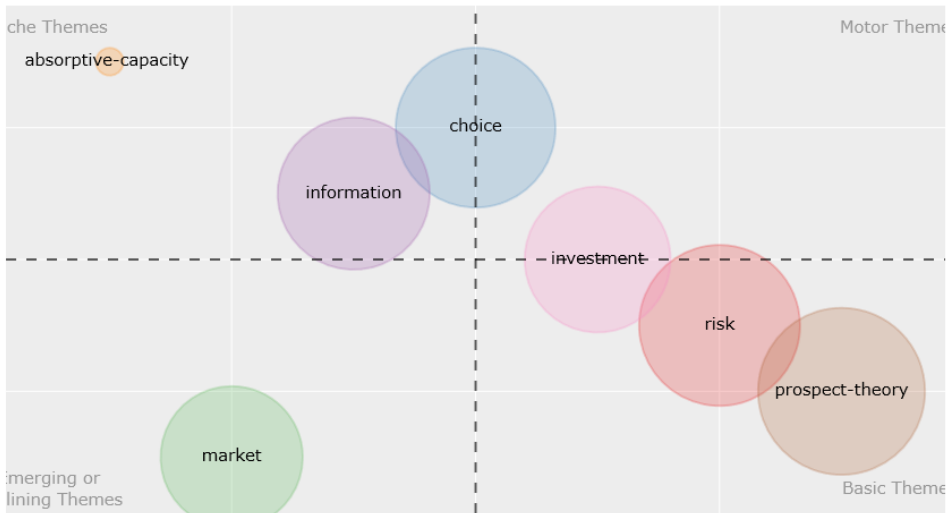
Note. Biblioshiny

Topic Dendrogram

In the study, the result of a hierarchical clustering calculation is visualised using a topic dendrogram, which is a tree-structured graph. It lists the objectives clustered along the x-axis and the distance at which the cluster was formed on the y-axis (Figure 12). It displays the hierarchical order and links between the keywords obtained by hierarchical clustering (Secinaro et al., 2020). Figure 12 shows three significant clusters, with the first cluster standing out as thematically distinct from the other two. Cluster 1, which is blue in colour, solely deals with the trade volumes and the intricacies of the stock market. Clusters 2 and 3 form part of a single cluster that deals with behavioural theories and financial market practices.

Figure 12

Topic Dendrogram
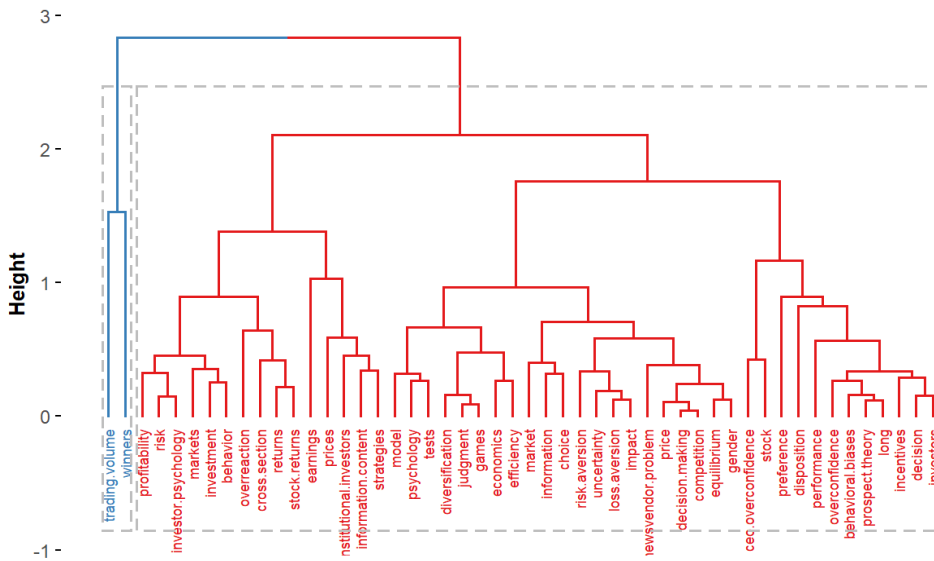
Note. Biblioshiny

Conclusion

Through bibliometric analysis, the study made a time-line based scientific mapping of publications in behavioural biases. It provides information on annual scientific production, average citations per annum, the most globally cited documents, and the topics covered in publications. The analysis also looks into the most contributing country, author, most relevant keywords, trend topics and word growth over the years. After applying the inclusion and exclusion criteria, 172 articles were extracted from the Web of Science database for the study.

As per the database, Schweitzer published the first article in 1995.The United States contributes most, as the field of behavioural biases is widely studied and explored there. Countries such as Austria and Pakistan have no citations, although scientific activities in these countries are progressing. As a result, the scope for research in behavioural biases in these countries is very high.

Alok Kumar is the author who has made the most significant contributions to the field of behavioural finance. He authored eight articles on different themes like behavioural biases, information uncertainty and prospect theory. The most often used keyword is the prospect theory, one of the fundamental theories in behavioural finance. There are other theories and pertinent areas in this field that have yet to investigate thoroughly. The year in which the highest number of articles published is 2020, and the trend themes for the year were earnings, decision-making, and competition. Thematic analysis shows that the driving theme of the majority of articles was 'investment', and 'risk' is also a contributing theme. Article on information uncertainty authored by Frank Zhang in 2006 has received the most global citations. Behavioural finance, particularly its core area of behavioural biases, is a relatively new field that has been continually evolving. Even though the first article got published in 1995, the growth rate has been modest. The study found that behavioural biases had a low

annual growth rate of scientific productivity from 1995 to the first quarter of 2021. More in-depth studies on several sub-areas in behavioural biases must be conducted for the discipline to grow further.

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