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Behavioral Biases In Investment Decision Making–A Bibliometric Analysis Of Twenty Years

Rakesh Punia, Dr. Neetu Ahmed

Abstract
It is difficult to overstate the importance of behavioural biases in investment decision-making because they play the most crucial role. This article's primary objective is to assist researchers in developing a theoretical framework and to assist new research on behavioural biases in determining which themes, journals, and authors to consider when researching this subject. In this research, 934 articles from 228 Web of Science (WoS) sources published between 2002 and 2022 are subjected to bibliometric analysis. The analysis was conducted using the R statistical programming language package Bibliometrix. Using bibliometric analysis, researchers identified and interpreted five thematic research clusters describing factors influencing financial decision-making, such as market efficiency and momentum; various emotional and cognitive biases, such as overconfidence and anchoring bias; theories, such as prospect theory; and general domains, such as behavioural finance, behavioural economics, and experimental economics. In the literature, cognitive biases were examined more frequently than emotional biases, but when researchers compared the three most prevalent types of cognitive and emotional biases, emotional biases came out on top. In addition, the results have confirmed the significance of Hirshleifer D, Kumar A, Wang Y, and Zhang H to this research field. In the present study, Overconfidence was the most prevalent bias in behavioural finance.

Keywords: Bibliometric analysis, behavioural finance, behavioural biases, cognitive bias, emotional bias.

INTRODUCTION

Financial management has been the economic system's lifeline for decades. To explain how financial decisions are made, especially by irrational investors, well-known scholars have proposed several theories and assumptions. Behavioural finance is the study of how psychology affects the actions of investors or financial analysts. It also covers any subsequent market effects. It focuses on the idea that investors are influenced by their own biases, have limited self-control, and are not always rational (Paule-Vianez, Gómez-Martínez, & Prado-Román, 2020). Behavioural finance studies how psychological factors and biases influence people's reasoning.

Behavioural psychologists and financial academics have found several behavioural biases in investors. Moreover, individual investor abnormalities are frequently caused by behavioural biases. When people make bad financial or investment decisions, it is generally due to biases and heuristics; they lead to suboptimal decisions

For the present study, we define behavioural biases as preconceived notions or prejudices that often lead investors to make irrational decisions while making investment decisions. Biases play a significant part in a person's financial decision-making process. As a result, rational investors can reap the benefits by investing in profitable stocks and promising prospects that irrational investors do not perceive.

The two categories of behavioural biases are cognitive biases and emotional biases. One form of bias may predominate, but both may be present in a single bias. Cognitive biases are caused by simple statistical, information-processing, or memory flaws, commonly caused by erroneous reasoning (Wright, 1980). Emotional biases arise from instinct or intuition and often result from feelings

influencing reasoning (Al-Dahan, Hasan, & Jadah, 2019). Cognitive biases are easier to remedy because they result from incorrect reasoning rather than an emotional inclination. However, Emotional biases are more difficult to overcome since they are founded on emotions, which can be challenging to shift.

Among the various biases studied in the past, the most studied behavioural bias found are disposition effect (Erfan, Gangwani, & Belgacem, 2021) and (Hincapié-Salazar & Agudelo, 2020); Overconfidence (Gügercin & Richter, 2021), (Abreu & Mendes, 2020), and (Costa, Melo Carvalho, de Melo Moreira, & do Prado, 2017); home bias (Aren, Aydemir, & Şehitoğlu, 2016); herding bias (Hidajat, 2019); (Nair & Yermal, 2017); Optimism Bias (Cervellati, 2012). Therefore this research tried to explore the most common bias in the literature.

As the field is proliferating, so is the number of articles in the domain being published, making it imperative to analyse the same to develop a holistic view. In the recent past, numerous studies have summarised the research on behavioural biases (Sharma, Misra, & Pathak, 2021; Paule-Vianez, Gómez-Martínez, & Prado-Román, 2020; Baker, Kumar, Goyal, & Gaur, 2018); cognitive biases (Özen & Ersoy, 2022; Carpena, Cole, Shapiro, & Zia, 2019); emotional biases (Kishor, 2022; Akinkoye & Bankole, 2020), and comparative analysis between cognitive and emotional biases (Al-Dahan, Hasan, & Jadah, 2019).

Several academics have previously carried out bibliometric analyses in related fields, Behavioural Economics (Costa, Carvalho, & Moreira, 2019) and Financial Planning (Tomar, Kumar, & Sureka (2021). In addition, Jain, Walia, Singh, & Jain (2021) also conducted a bibliometric analysis on behavioural biases using the Scopus database. , But Bibliometric analysis paper on the subject conducted using Web of Science Database were very scarce, therefore, researchers used the Web of Science Database for the current study.

Objectives of the study are to study the change in the publication trends in behavioural bias research documents published between 2002 and 2022. To explore the authors and their affiliations and countries that have published research on behavioural biases in investment decisions. To identify influential publications with outstanding contributions to Behavioural Biases in investment decision-making. To identify emerging themes in the area of behavioural biases. And suggesting directions for future research.

The remainder of the study is structured as follows by the researchers, in the first section introduction of the study with existing literature was mentioned followed by the methodology section. After that, researchers presented the results. And in the concluding chapter the conclusions, limitations and the future scope of research is mentioned.

METHODS

The current research is descriptive and quantitative in nature. It is defined as a bibliometric analysis in which statistical analysis of publications was performed to investigate the impact of behavioural biases in investment decision-making. The bibliometric analysis is a reliable and pertinent instrument for evaluating the scientific output (Liu et al. 2014), including the social sciences field (Carlson and Ji 2011). Articles for the study were collected from the Web of Science (WoS) database by Thomson Reuters. No restrictions were placed when refining publications to ensure that the study didn't overlook any good material. A total of 934 articles from 228 sources, were considered for this research. The study's sample spans the years 2002 through 2022. Bibliometrix, a package (Aria & Cuccurullo, 2017) of the R statistical programming language for bibliometric analysis, was used in this study.

RESULT

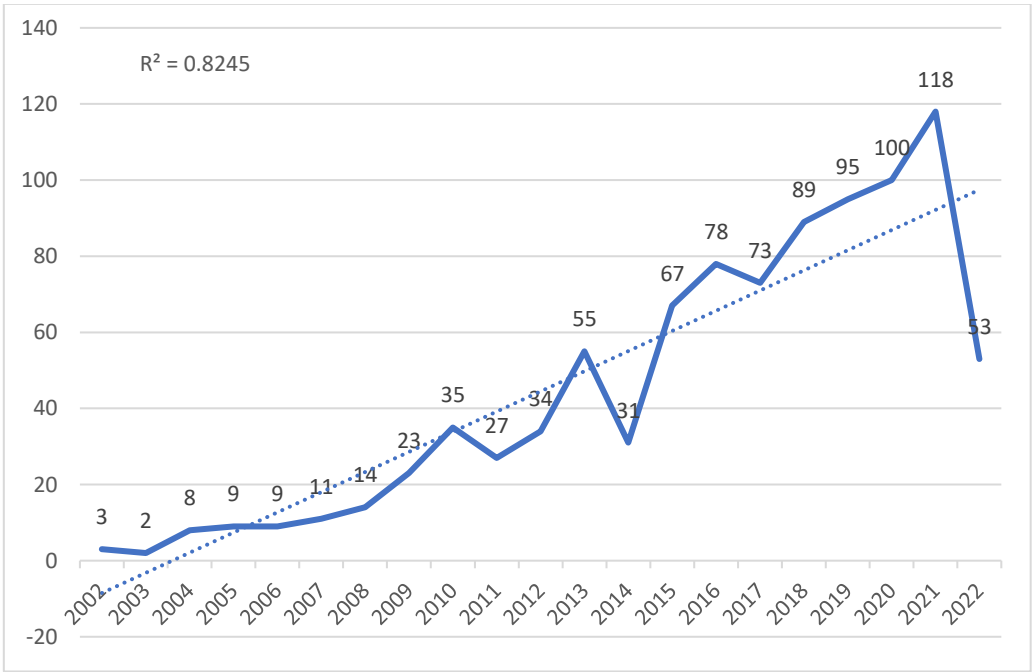
The data were analysed in the current study using a variety of relationship and evaluation bibliometric techniques. The most influential behavioural bias studies, journals, and authors were found using a variety of bibliometric tools. In addition, the bibliometric analysis showed that the conceptual and intellectual structure of the literature on behavioural bias followed a chronological publication trend. To understand trends and future framework development scope of research, this section includes data on annual trends, affiliation statistics, contributing organisations, journal quality analysis, influential authors, citation analysis, page rank analysis, keyword statistics, and creation of themes of the past publications.

In total, 934 articles (906 articles and 28 review papers) from 228 sources, contributed by 2368 authors, were considered for this research. More than 90% of the authors published a single article, 7% had two articles published, and the remaining 3% had more than two articles published. Documents were from the period of 2002 to 2022. The average number of citations per document was 26.65, showcasing the high quality of the content. In addition, the collaboration Index of 2.78 highlights high collaborative interest in the theme.

Figure 1 depicts the historical development of publications on behavioural biases. It shows the annual number of research articles published between 2002 and 2022. The statistic shows that the number of research articles published each year has increased, from 3 in 2002 to 118 in 2021. From 2010 forward, this rise is most visible. The number of publications in 2021 was the greatest, at 118. So far, in 2022, 53 publications have been published in seven months.

Furthermore, the R square of 0.8245 suggests statistical significance and an increase in the number of papers published throughout the review period. As a result, the topic remains promising in the realm of research. The pattern clearly shows that the topic's interests are expanding and that researchers are paying more attention to it.

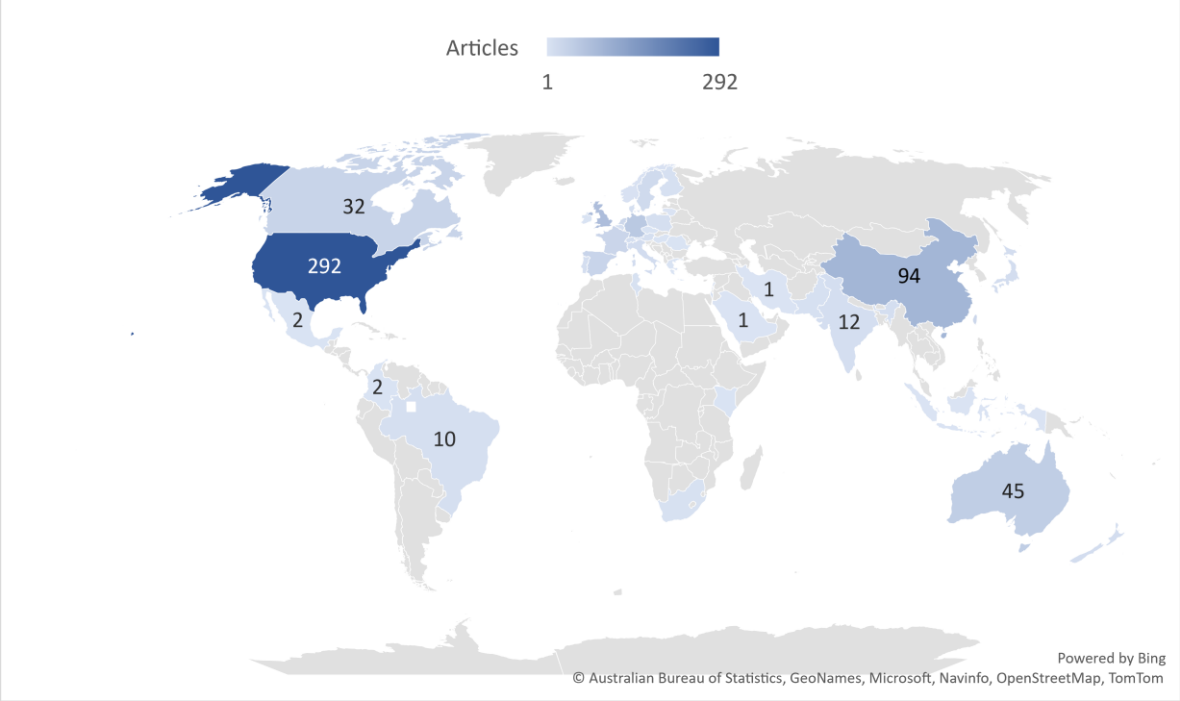
Figure 1 Annual Scientific Production



The University of California, Berkeley (USA); Erasmus University Rotterdam (Netherlands); Maastricht University (Netherlands); National Chengchi University (China); University of Warwick (United Kingdom) were the institutions with maximum affiliated papers, i.e., 27, 21, 21, 21, and 21 respectively. When analysing countries according to the corresponding authors, the USA (n=292),

China (n=94), and the United Kingdom (n=78) were leading, with India's position at 16th position with 12 papers, as shown in figure 2. In contrast, when analysing based on most citations, the USA (n=14747), Germany (n=1390), United Kingdom (n=1180) were at the top place, with India at 15th position with 241 citations. In terms of collaborations, the USA had maximum collaborations with China (n=42) United Kingdom (n=34), and France (n=17). Overall, India had single collaborations with authors from Finland, France, Norway, South Africa, Tunisia, the United Kingdom, and the USA.

Figure 2 Country-Specific Production



There were 934 articles published in 228 journals in total. Table I presents the distribution of sample papers by the journal. The Journal of Behavioural Finance published the most articles from the dataset (72 documents). It is followed by PLOS One (56 papers), and the Journal of Behavioural and Experimental Finance (39 papers) shares third place as the most prominent journal in the sample. In terms of total citations Journal of Financial Economics was leading with 2417 citations, and in terms of H-Index, PLOS One was leading with an H-Index of 21. According to figure 3, the Journal of Behavioural Finance and Journal of Banking and Finance were relatively more consistently producing articles than other top journals on behavioural biases. The most cited articles found in the database are mentioned in table II, "Investor sentiment in the stock market" by Baker & Wurgler (2007) and "Psychology and economics: Evidence from the field" by DellaVigna (2009), which were the most cited documents. Hirshleifer D, Kumar A, Wang Y, and Zhang H were the most contributing authors with six publications each.

Table I. Top 10 Most Productive Journals

Sources	Articles	h_index	Total Citations
Journal of Behavioral Finance	72	15	669
PLOS One	56	21	1235
Journal of Behavioral and Experimental Finance	39	6	153
Journal 0f Banking & Finance	35	16	1057
Journal of Economic Behavior & Organization	27	10	526

Sources	Articles	h_index	Total Citations
Frontiers In Psychology	24	8	321
Journal of Financial Economics	19	16	2417
Journal of Economic Psychology	19	9	478
Journal of Behavioral Decision Making	15	8	1584
Journal of Finance	14	13	1639

Figure 3 Yearly Distribution Of Top 5 Journals In Terms Of Article Production

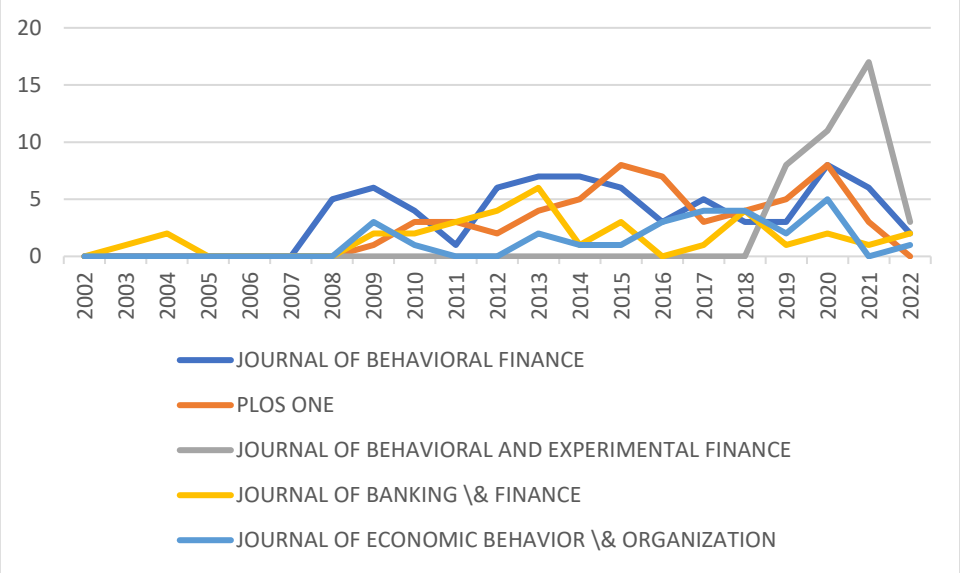


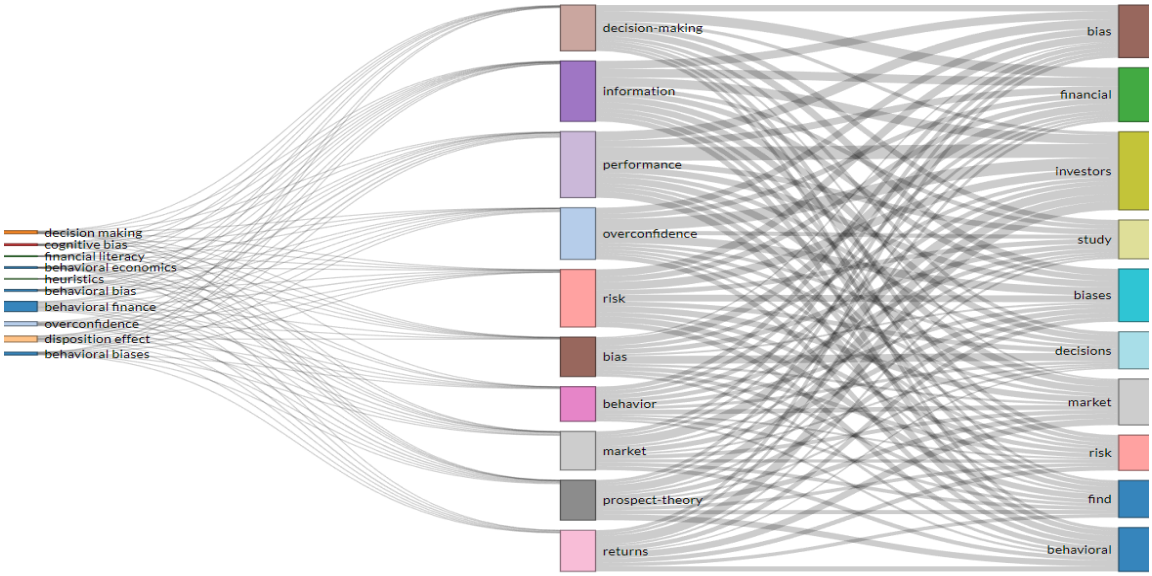
Table Ii Most Global Cited Documents

Reference	Paper Title	Total Citations
Baker & Wurgler (2007)	Investor sentiment in the stock market.	1263
DellaVigna (2009)	Psychology and economics: Evidence from the field.	953
Zhang (2006)	Information uncertainty and stock returns.	682
Peng & Xiong (2006)	Investor attention, Overconfidence and category learning.	485
Daniel, Hirshleifer, & Teoh (2002)	Investor psychology in capital markets: Evidence and policy implications.	265
Porcelli & Delgado (2009)	Acute stress modulates risk-taking in financial decision-making.	255
Glaser & Weber (2007)	Overconfidence and trading volume.	251
Coval & Shumway (2005)	Do behavioural biases affect prices?	245
Oechssler, Roider, & Schmitz (2009)	Cognitive abilities and behavioural biases.	240

Reference	Paper Title	Total Citations
Malmendier & Shanthikumar (2007)	Are small investors naive about incentives?	227

In the Three-Field Plot, as mentioned in figure 4, the middle field highlights Keywords Plus, the left field mentions keywords, and the right field indicates the abstracts. As seen in the plot, behavioural biases' impact on financial decision-making was studied. This relationship is also impacted by financial literacy, information availability, risks, return, and market performance.

Figure 4. Three-Field Plot



An analysis was performed to determine the frequently used keywords/phrases in the author's keywords of publications. The list comprising the top 50 keywords used in the author's keywords of papers is summarised in table III. Themes extracted from those top 50 words are mentioned in table II, where the factors impacting financial decision-making are mentioned, which were mainly market-related, firms related, and individual investor related; followed by various emotional Bias and cognitive Bias are explained in which different types of cognitive biases were more prominent; trailed by various theories and domains studied in the published literature. These themes reflect the areas studied on the subject during the last two decades more prominently and help develop a framework for future research. Figure 5. Illustrates the visual representation of the texts, WordCloud based on Authors' Keywords, the importance of each word is indicated by text size or colour, apart from Behavioural Finance and decision making the behavioural biases such as Overconfidence and disposition effect were most studied topics.

Table Iii. Most Frequent 50 Words (Authors' Keywords)

Rank	Words	Frequency	Rank	Words	Frequency
1	Behavioural Finance	81	26	Investor Sentiment	8
2	Decision Making	47	27	Risk Aversion	8
3	Behavioural Biases	47	28	Risk Taking	8
4	Overconfidence	39	29	Corporate	7

Rank	Words	Frequency	Rank	Words	Frequency
				Governance	
5	Disposition Effect	32	30	Disclosure	7
6	Cognitive Bias	29	31	Individual Differences	7
7	Financial Literacy	25	32	Information Asymmetry	7
8	Behavioural Economics	17	33	Bounded Rationality	6
9	Heuristics	17	34	Exponential Growth Bias	6
10	Experiment	17	35	Familiarity	6
11	Market Efficiency	12	36	Herding	6
12	Experimental Economics	11	37	Sentiment	6
13	Gender	11	38	Trust	6
14	Household Finance	11	39	Volatility	6
15	Investor Behaviour	11	40	Anchoring Bias	5
16	Home Bias	10	41	Cognitive Reflection	5
17	Present Bias	10	42	Earnings Announcement	5
18	Risk Perception	10	43	Gambler's Fallacy	5
19	Behavioural Finance	9	44	Heuristics And Biases	5
20	Loss Aversion	9	45	Hindsight Bias	5
21	Momentum	9	46	Information Processing	5
22	Mutual Funds	9	47	Investor Psychology	5
23	Prospect Theory	9	48	Managerial Decision Making	5
24	Anchoring	8	49	Mental Accounting	5
25	Familiarity Bias	8	50	Optimism Bias	5

Table Iv. Themes Extracted From The Top 50 Keywords.

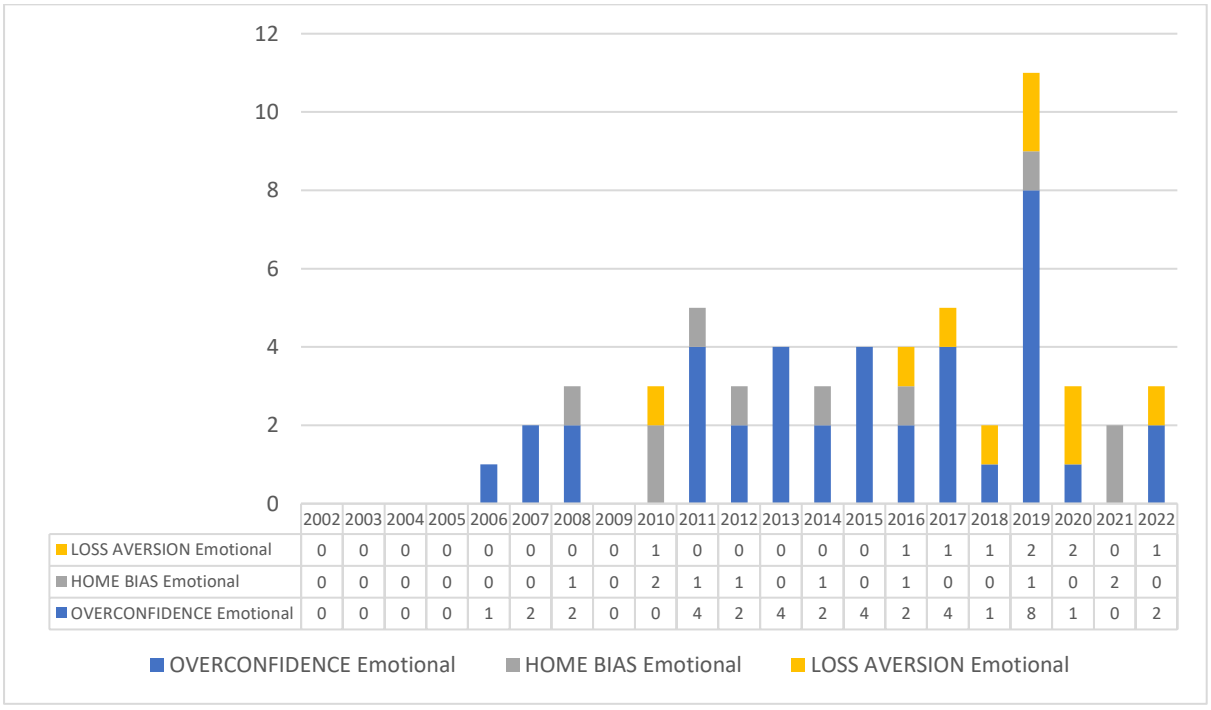
Factors impacting financial decision making	Market Efficiency, Momentum, Volatility, Corporate Governance, Disclosure, Information Asymmetry Trust, Bounded Rationality, Financial Literacy, Gender, Individual Differences, Investor Sentiment
Emotional Bias	Overconfidence, Home Bias. Loss Aversion
Cognitive Bias	Heuristics, Anchoring, Familiarity, Herding, Familiarity Bias, Disposition Effect, Optimism Bias, Gambler's Fallacy, Exponential Growth Bias
Theories	Prospect Theory

Domains	Behavioural Finance, Behavioural Economics, Experimental Economics

Figure 5. Wordcloud Based On Authors' Keywords

Figure 6, figure 7, and figure 8 represent Word Dynamics of the top three most frequent emotional biases (Overconfidence, Home Bias, and Loss Aversion); Word Dynamics of the top three most frequent cognitive biases (Heuristics, Anchoring, and Familiarity bias; and Aggregate representation of top three cognitive and emotional biases (aggregate of the biases mentioned above) respectively. In Emotional biases, Overconfidence was usually the most frequently studied bias, and in Cognitive Bias, Heuristics Bias was the most commonly studied bias). In themes discussed in table IV, more cognitive biases were studied in the research. But when examined in aggregate of the top three most frequent biases, emotional biases were most leading over the other three most common cognitive biases. Tables V and VI explain a few studies exploring the top three emotional and cognitive biases. Among theories Prospect Theory was found in the top 50 keywords. Prospect theory holds that losses and gains are valued differently, so people make decisions based on perceived gains. The "loss-aversion" theory states that if two equal options are presented in terms of potential gains and losses, an individual will choose the first option (Kahneman, 1979).

Figure 6. Word Dynamics Of Top Three Most Frequent Emotional Biases



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
LOSS AVERSION Emotional	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	2	2	0	1
HOME BIAS Emotional	0	0	0	0	0	0	1	0	2	1	1	0	1	0	1	0	0	1	0	2	0
OVERCONFIDENCE Emotional	0	0	0	0	1	2	2	0	0	4	2	4	2	4	2	4	1	8	1	0	2

Figure 7. Word Dynamics Of Top Three Most Frequent Cognitive Biases

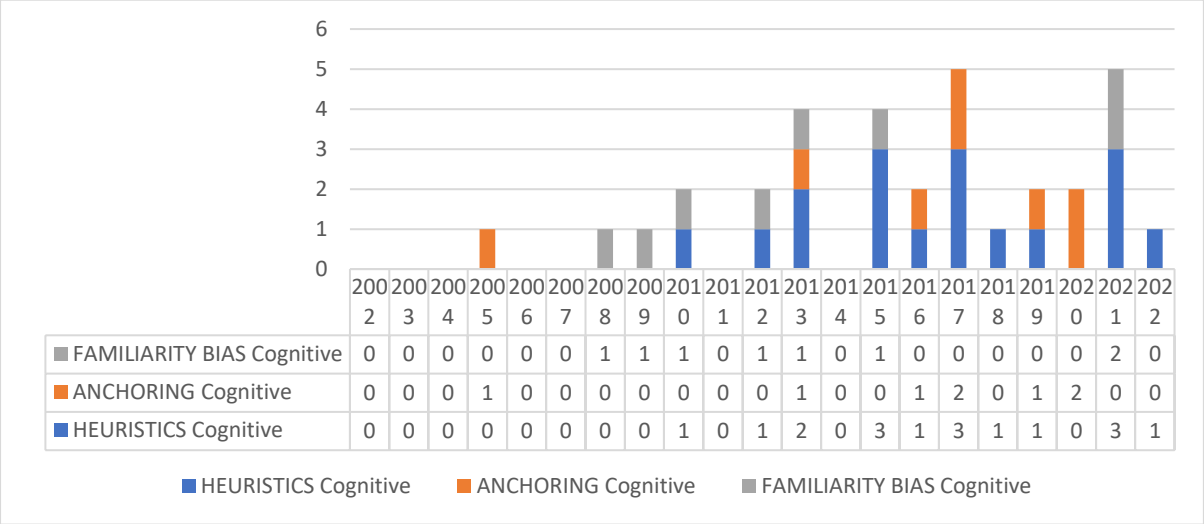


Figure 8. Aggregate Representation Of Top Three Cognitive And Emotional Biases

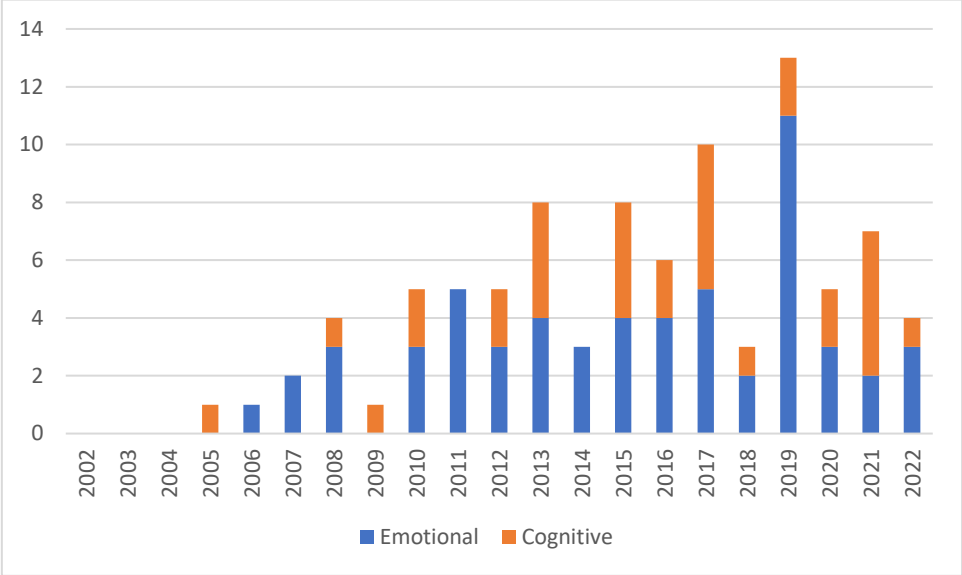


Table V. Major Studies Explaining Top Three Emotional Biases

Biases found in studies	Definition	Major studies discussing those biases
Emotional Biases	Emotional biases originate from instinct or intuition and are frequently caused by the influence of emotions on reasoning.	Ackert, Deaves, Miele, & Nguyen (2020)
Overconfidence	Tendency for individuals to overestimate their abilities, knowledge, and ideas.	Parveen, Satti, Subhan, & Jamil (2020)
Home Bias	Tendency to invest the majority of their portfolio in domestic equities, despite the diversification benefits of investing in foreign equities.	Dougal & Rettl (2021)
Loss Aversion	Phenomenon in which a investor is more	DeCaro, DeCaro, Hotaling, &

Biases found in studies	Definition	Major studies discussing those biases
	affected by a loss than a gain.	Johnson, (2020)

Table Vi. Major Studies Explaining The Top Three Emotional Biases

Biases found in studies	Definition	Major studies discussing those biases
Cognitive Biases	Cognitive biases are typically caused by simple statistical, information-processing, or memory flaws that lead to faulty reasoning.	Kienzler (2018)
Heuristics Bias	Investors employ mental shortcuts or rules of thumb when making decisions.	Gigerenzer (2018)
Anchoring Bias	When making decisions, investors rely excessively on pre-existing information or the first information they discover.	Zhang, Nazir, Farooqi, & Ishfaq (2022)
Familiarity Bias	Individuals' propensity to prefer the familiar, dislike ambiguity, and search for ways to avoid the unfamiliar.	Long, Fernbach, & De Langhe (2018)

Figure 9 shows the progression of the most popular themes over a two-dimensional space, with logarithmic frequency values plotted against publication years on the horizontal axis. It explains the trend topics year-wise, explaining how year-wise the key terms keep on changing. Reviewing the subjects turned up an intriguing pattern. Major topics in the initial years were emotional Bias (Home Bias), whereas cognitive Bias (Disposition effect) is the most common in recent years. Figure 10 explains the semantic network, graphical visualisation of the potential relationships between the common keywords, Factors risk perception and risk attitude were studied together with decision making. Trust is studied with disclosure. The biases were analysed together in research: self-attribution, Overconfidence, Herding, and the Disposition effect. Factors such as market efficiency, investor sentiments, momentum, and stock returns were studied together.

Figure 9. Trend Topics

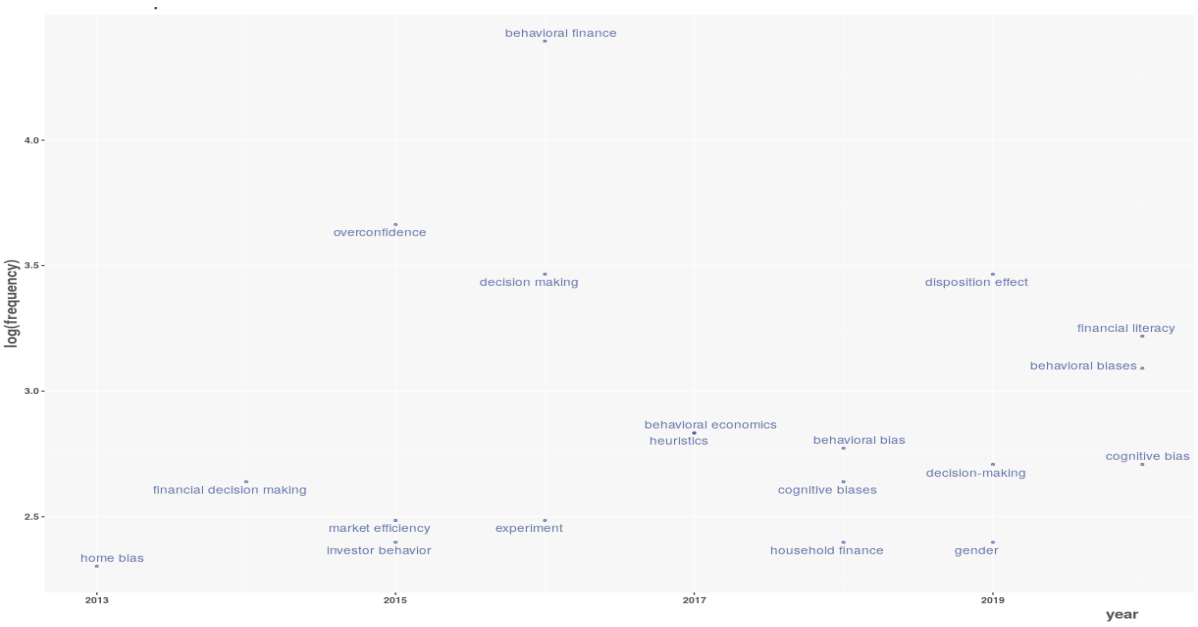


Figure 10. Co-Occurrence Network

A thematic map is a two-dimensional plot in which typological themes are plotted in the thematic map. The study domain's themes are created by identifying keyword clusters based on the co-word analysis. On the two-dimensional graph with centrality (how "central" a theme is to the whole field) and density (the internal cohesion of the theme) as the two dimensions, these themes can be grouped into four quadrants based on their density and centrality. A bubble on the map corresponds to each theme. 'Decision making', 'behavioural economics', 'heuristics decision making', 'overconfidence', 'disposition effect', 'behavioural finance', 'cognitive bias', 'financial literacy' can be seen plotted as bubbles on the graph (Figure 11). The themes' overconfidence', 'disposition effect', 'behavioural finance', and 'cognitive bias', which emerge in the lower right quadrant, are fundamental themes that point to a crucial but underdeveloped subject. A niche theme— 'decision making' and 'behavioural economics', which are well-developed with internal connections but weak exterior ties and are of minor importance—is indicated in the upper left quadrant' financial literacy' are the underdeveloped and less significant theme in the lower left quadrant. The theme in the upper right, 'heuristics decision

making' with high densities and centralities, is a motor theme at the centre of the discipline and the subject that receives the most attention.

Figure 11. Thematic Map

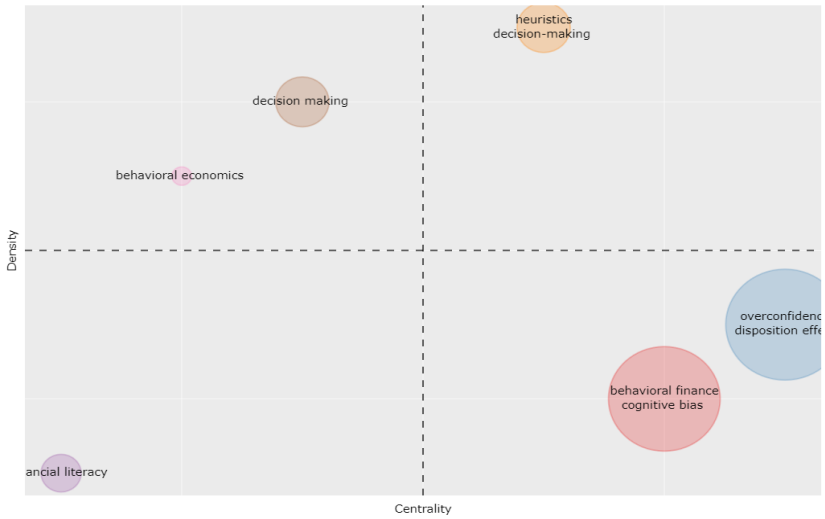


Figure 12. Bradford's Law

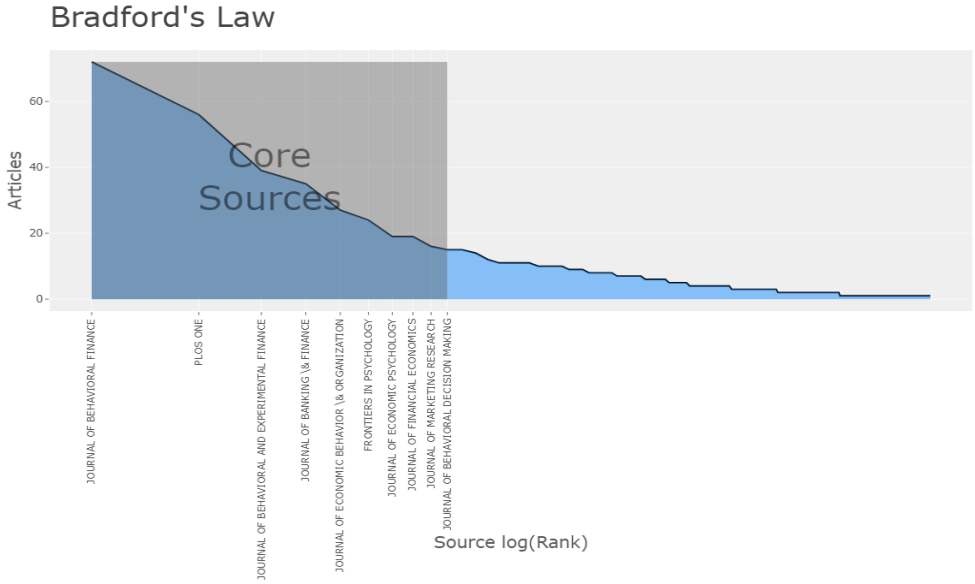


Figure 12 and Table VII explain Bradford's Law. It showcases the exponentially diminishing returns of searching for references in journals. The expression can be given as:

10: 10 x (4.25): 10 x $(4.25)^2$:: 1: n: n^2

10: 42.5: 180.6=233.1

% error = (233.1- 228)/228 * 100 = 2.23%. It is clear that the error percentage is not so high; hence, the data will fit in Bradford's Law (Kumar & Mohindra, 2015).

Table Vii. Zone-Wise Distribution Of Journals

Zone	Articles(n)	Article (%)	Journals(n)	Journals (%)	Multiplier
Z1	322	34.5	10	4.4	-
Z2	304	32.5	38	16.7	3.8
Z3	308	33.0	180	78.9	4.7

Total	934	100	228	100	4.25 (Mean Value)

DISCUSSION/CONCLUSION

Understanding common behavioural biases is essential for financial decision-making. These biases can lead to suboptimal investment decisions, which can lead to subpar returns. By understanding how these biases work, investors can avoid making costly mistakes. While some of these biases are difficult to avoid, awareness is the first step to mitigating their impact. Therefore, researchers conducted a bibliometric analysis to understand past research and develop a framework for the impact of behavioural biases in Investment decision-making. Articles for the study were collected from the Web of Science (WoS) database from 2002 through 2022. From the analysis, the publication pattern clearly shows that the topic is expanding and that researchers are paying more attention to it. The University of California, Berkeley (USA) was the highest affiliating university. As a result, the USA had maximum research production, with India's position at 15, highlighting a wide scope of research in the domain. The impact of behavioural biases on financial decision-making was studied, as seen in the plot. In addition, the influence of financial literacy, information availability, risks, return, and market performance were also considered in the previous researches.

The themes extracted from those top keywords were the factors impacting financial decision making, which were mainly market-related, firms-related, and individual investor related; followed by various emotional Bias and cognitive Bias were explained in which different types of cognitive biases were more prominent; trailed by various theories and domains studied in the published literature. These themes reflect the areas studied on the subject during the last two decades more prominently and help develop a framework for future research. When exploring the most frequent keywords, then Cognitive biases were more studied in the research. But when examined in aggregate of the top three most frequent biases, emotional biases were most leading over the other three most common cognitive biases, among all overconfidence bias was most commonly found just as found in the other researches such as Gügercin & Richter (2021); Abreu & Mendes (2020); and Costa, Melo Carvalho, de Melo Moreira, & do Prado (2017).

The bibliometric analysis, which can only collect citations, is also one of the crucial drawbacks of this research. Its results do not clearly define that whether they were employed positively or negatively. Although Web of Science is one of the world's largest databases, it does not include all papers on the topic of Behavioural Biases. Therefore, other international databases, such as PubMed or Scopus, may have been used. Based on the limits of bibliometric analysis, a more in-depth content study is recommended for future research. Relationships are seen in the bibliometric analysis, but a more comprehensive content analysis is suggested for ascertaining the positive or negative impact.

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